Corporate Governance, Emerging Technology, and Banks' Performance in G7 Countries: Three Essays.

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Statement of Declaration and Copyrights

Abstract

This thesis consists of three essays on corporate governance (CG) and performance of banks in G7 countries. The first essay empirically investigates the effect of CG practises on banks' financial performance using Return-On-Assets, Return-On-Equity, and Net-Interest-Margin. The essay concludes that all mechanisms are considered statistically significant to at least one of the aforementioned performance metrics.

Our findings indicate that reconsidering and reinforcing CEO duality practises, lowering board size, board meetings, and audit committee meetings, while increasing audit committee size, having more independent and female directors along with enhancing governance disclosures, improve financial performance. Although maintaining a diverse board is encouraged, banks must consider the drawbacks of having an excess number of female directors as they negatively impact net interest margin.

The second essay empirically examines the impact of CG mechanisms on market performance measured by Price-to-Earnings, Price-to-Book Value, Dividend Yield, and Price Risk. The findings suggest that all mechanisms significantly affect at least one of the market performance measures except for board gender diversity. The findings revealed that lowering board and audit committee meeting frequencies and separating leadership roles while increasing independent directors and enhancing transparency of governance disclosures increase stock performance synchronicity by market reactions.

The first two essays include additional empirical investigations that were conducted using a unique Two-Step algorithmic analysis to classify banks according to their CG behaviors. The results revealed behavioral insights and four banking groups were identified, whereby two groups were categorised as shareholders oriented and the remaining two were classified as market-oriented, as segregated by multiple CG mechanisms. Following the cluster analysis, CG practises within each group were examined to determine their impact on the market and financial performance metrics outlined in each essay. Three additional metrics were examined in essay two (Capital-Adequacy-Ratio, Cost-to-Income, and Asset Quality).

The regression analysis results for each banking cluster reveal statistically significant mixed relationships between financial performance and stability metrics, which vary based on the corporate governance practises of each banking cluster. The enhancement of the banking system's performance may necessitate the development of a hybrid model incorporating dynamic CG practises and utilising machine learning tools. However, in the next decade, the banking industry will increasingly rely on advanced digital technology to carry out important aspects of governance and risk management. This is due to the Fourth Industrial Revolution (4IR), which involves rapid technological advancements and increased global integration. It is important to have effective governance in place to address the complexities and potential risks associated with these developments. Failure to do so could pose threats and uncertainties for investors and innovators, ultimately jeopardising the global financial system at risk.

The third essay investigates the future of banking corporate governance by employing a combination of thematic analysis of existing literature and empirical examination of the influence of emerging technology and innovation on the financial performance and non-financial ESG disclosures quality (indicators of the fundamental basis of corporate governance) of banks in G7 countries from 2010-2021. This study aims to analyse the effects of technological innovation and growth on the financial sustainability of banks, taking into account the presence of CEO/chairperson roles and the potential conflicts between agency and stewardship. The findings of our study demonstrate that the progress in technology within the banking industry of G7 countries improves financial performance, stability, and transparency. Furthermore, this study provides empirical evidence that technological advancements mitigate agency issues by eliminating opportunistic behaviour and information asymmetry via enhanced transparency and reporting quality. Therefore, it is advisable for legislative and regulatory authorities, banks, investors, and other relevant parties to reassess the implementation of stewardship theory practises in the context of digitalisation and innovation in order to avoid any exacerbation in agency problems.

CHAPTER ONE

1. Introduction

Corporate governance has been defined as the utilisation of methods that ensure that firms are managed in a manner that leads to maximum value and the highest possible investment returns for their corporate financiers (Shleifer & Vishny, 1997). The notion of corporate governance involves much more than the administration of a company or corporation, however, and despite the fact that the term is commonly used, no broadly recognised conception of corporate governance has emerged (Rezaee, 2009). The main purpose of corporate governance is to allow investors to oversee managers' competencies, thereby resolving agency issues that may arise when control is separated from ownership (Shleifer & Vishny, 1997). The varying financing patterns in different countries result in significantly different ownership structures, thus leading to a number of corporate governance issues worldwide. Typically, previous studies have investigated such governance features as corporate ownership, agency conflicts, board of directors, board oversight, and executive remuneration.

Governments were alerted to the importance of corporate governance after a succession of financial scandals that occurred in Western economies in the 1990s due to improprieties on the part of management, auditors, and financial market participants. These scandals eroded shareholders' faith in institutions, which led to a need for stronger regulation. As such scandals have increased, corporate governance has become more crucial, as firms have been found to have lost shareholder value and investor trust, and, in some instances, declared bankruptcy (Klapper & Love, 2004). Effective corporate governance is required to ensure that organisations' resources are properly utilised through the provision of capital and fostering of investor trust (Denis & McConnell, 2003). Successful corporate governance has been attributed to an organisation's internal mechanisms and ideologies, and its response to external circumstances in the market, while governance efficacy is greatly reliant on a company's management structure and governance methods (Gregory & Simms, 1999).

Additionally, the reporting requirements of banks have transformed throughout the years. Banks now publish financial and non-financial information in their reports that is substantially focused on environmental, social, economic, and governance practises (ESEG) in the non-financial sections. As a result, these new disclosures (and the degree to which banks are reporting) are becoming frequently investigated, and researchers are attempting to find a correlation between ESEG disclosures and performance indicators. Some studies have revealed that while financial performance is the main indicator for institutions' financial health, it is also greatly impacted by the

latter's policies on disclosing information (Ioan Ban et al., 2020; Sabau-Popa et al., 2020). Research further proves that the use of integrated reporting practises (disclosing financial as well as non-financial information) is directly related to increasing profitability, as attributed to the growing preference for transparency within companies regardless of industry (Marjanova et al., 2017).

With the growing public interest in company transparency, the assessment of the influence of environmental, social, and governance information is becoming of growing interest to researchers. In this context, this thesis was initiated by a commitment to monitoring the disclosure behaviour of publicly listed banks in G7 and G20 countries and assessing how corporate governance practises that include non-financial information disclosure scores impact both market and financial performance.

However, for the last two decades, scholars and policymakers have acknowledged the critical significance of the issue of corporate governance in the banking system, as a proper banking system is critical to economic health and societal well-being. Since the banking industry affects liquidity and the flow of capital for infrastructure and commercial initiatives, it largely impacts the course of economic development. The occurrence of incidents involving the expropriation of company resources by managers at the expense of shareholders, fraudulent practises, overvaluation or undervaluation of financial accounts, and the high persistence of agency problems have been noted (Claessens & Yurtoglu, 2013). Additionally, the impact of the financial crisis on the different world economies has created a need for strict adjustments to corporate governance codes and regulations. Restrictive legislation, such as the law banning cross-appointments in banks in Italy and the Financial Services Act (2012) in the UK banking sector, has had significant effects worldwide, especially in the advanced economies (Jassaud, 2014; Tahtamouni & Alnahleh, 2015). The impact of deficient banking rules, along with resulting illiquidity, brought forth the 2007–08 global financial crisis (Kowalewski, 2016). Hence, an analysis of the evolution of the new CG codes as a result of the financial crisis, and their relations to investors' trust and overall financial management, will be useful to comprehend the degree to which the performance of markets affects management and stakeholder interests (Mertzanis, 2011).

This thesis's purpose is to provide a method for averting future crises by assessing current CG practises with respect to select market characteristics. Furthermore, due to the increasing development of financial and capital markets, along with high competition and the aggressive adoption of information technology, corporate governance has become a crucial notion focused on the protection of depositors' and shareholders' interests, and the effective monitoring of boards of directors' performance in the banking sector.

In the age of globalisation, the world has transformed into a small village. This research is based on solid convictions concerning how the performance of the banking system affects global economies. The focus of this thesis is to examine how corporate governance influences the market and financial performance of the banking sector, with specific attention to the performance of G7 banks. This research seeks to fill a void in the existing literature by examining areas that have not been investigated in previous studies conducted on the countries of the G7. Moreover, it is crucial to recognise that the countries of the G7 comprise the most sophisticated and industrialised economies globally. These countries play an important role as benchmarks and indicators in the development and implementation of corporate governance globally. Therefore, it is conceivable to utilise and analyse the corporate governance frameworks and practises of G7 countries as a valuable source of guidance and knowledge to enhance the efficiency of corporate governance procedures (Kanbur & Kanbur, 2018). Thus, the performance of banks is likely to show a significant positive correlation with the G7 countries' adoption of effective and suitable corporate governance policies concerning the creation of global reserve currencies.

In addition, the thesis tackles the future of corporate governance in banking while accounting for the rise of digitalisation and decentralised ledger technology. These areas of focus have been engaged to supplement the deficiencies in the literature in the interests of future research. In addition, by comparing the different codes of corporate governance models and their effect on banks' performance, the researcher aims to integrate optimal corporate governance mechanisms, leading to effective practises and/or the potential adoption of new governance models. The wealth and reliability of data relevant to the topic under discussion will also be of utmost importance for our conclusions.

The Group of Seven (G7) was chosen as it is composed of the world's largest developed economies: France; Germany; Italy; Japan; the US; the UK; and Canada. According to the International Monetary Fund (IMF) database, the G7 countries' GDP share of the world economy amounts to around 45%. Thus, the impact on and contribution of the G7 countries to the global economy, and consequently the influence of their banking sectors, are immense. In addition, banks are considered the backbone of any economy; in 2014, their asset share in respect of national GDP was as follows: the USA 58.8%; Germany 99.8%; France 113.5%; Italy 132%; and the UK 145% (Gugler & Peev, 2018). As of the end of December 2019, the total assets of Canadian banks amounted to $6.4 trillion, more than 277% of Canada's GDP (Korol, 2020). It is also noteworthy that the total assets of the banking sample used in the study comprise 122% of G7 GDP and 55.4% of world GDP in 2019.

In its aim of exploring the corporate governance of banking institutions in G7 countries while defining their impact and influence on different aspects of banking performance, this thesis addresses the research topic in a manner unexplored by previous researchers through an investigation of the impact of corporate governance in three fields: banks' market performance (shareholder perspective); financial performance (management perspective); and the impact of innovation with respect to Decentralised Ledger Technology (DLT) on the corporate governance of banks. This examination will include several mechanisms of banks' corporate governance, including the board of directors' (BOD) size, gender, and composition; audit committee size, and meeting frequency; governance disclosure; and CEO duality. Two independent essays will examine the effects of governance mechanisms in two distinct performance domains, namely market performance and financial performance, while the third essay will discuss the future of corporate governance in an era of continuing and rapid technological advances.

The first essay focuses on an examination of corporate governance mechanisms in connection with return on equity (ROE), return of assets (ROA), and net interest margin (NIM) as measures of banks' financial performance, in which a sample of governance characteristics and metrics of financial success is examined over a nine-year period (2011–2019).

In the second essay, by utilising a comprehensive dataset of market performance indicators and banking sector governance characteristics (2011–2019), the researcher explores the empirical relationship between market performance metrics, the price-to-earnings ratio (P/E), the price-to-book value ratio (P/BV), the dividend yield, and price risk in relation to selected corporate governance mechanisms of the G7 countries' banking sectors over a period of nine years.

In the third essay, the researcher explores the role of blockchain, emerging technologies, and digitilisation in relation to banking corporate governance in G7 countries using a mixed method approach, first by thematically analysing previous literature to evaluate the role of blockchain in banking corporate governance, business, and performance using a thematic analysis technique.

In the second approach, the researcher investigates the empirical impact of emerging technologies and digitalisation such as artificial intelligence (AI), big data analysis (Big.D), Internet of things (IoT), cloud computing, Internet banking, information and communication infrastructure and connectivity (ICT.IC) on G7 banking system corporate governance, stability and performance during a multi-time framework, in this case within the period 2010–2021; internal mechanisms of board and audit committee characteristics, duality of CEO/Chairperson roles, ESG disclosure quality (transparency) were utilised as proxies of corporate governance, and banking stability

measures include capital adequacy ratio, liquid liabilities share of GDP, and Z score (default/bankruptcy measure). Additionally, the performance indicators include Return on Equity and operating income relative to operating expenses as a proxy of management efficiency.

Chapter Two

2. Theoretical Framework of Corporate Governance

The following discussion presents a literature review of the corporate governance research generally and that which is devoted to banks' corporate governance specifically. The chapter also considers the regulations that govern banks, the rationale for these regulations, and the codes of G7 banking systems.

2.1. Origin of Corporate Governance

Corporate governance has been a topic of discussion since Queen Elizabeth I established the first royal charter for the East India Company to engage in commerce with the Far East in 1600 (Baskin & Miranti, 1997). The main issue at that time concerned who obtained the controlling power of the company and their degree of accountability. The court of directors were the shareholders in the corporation and chosen by the owners in the court of proprietors. The directors' court then assigned a CEO, who reported to them directly (Cadbury, 2002). The company's governance structure was similar to what presently exists in a capitalist economy (Warren, 2000). At the time, however, this conflict of interest did not pose a significant problem because shareholdings in companies were rather large, with a low level of passive investment, as Adam Smith remarked (Cadbury, 2002).

The issue of corporate governance has become much more widely discussed in light of recent financial scandals and collapses, such as the bankruptcies of Enron in 2001, Vivendi Universal in 2002, Ahold in 2003, and Parmalat in 2003. Existing corporate governance mechanisms were called into question by such reports, leading to the development of new laws and regulations that provoked multiple debates about suitable definitions for corporate governance and those models that best preserve the interests of shareholders (Trabelsi, 2010).

A study by the OECD in 2010 revealed that governments have been motivated to enact improved corporate governance due to global financial crisis, which has prompted reforms in their practises and policies, specifically in financial markets. The United Nations Conference on Trade and Development (UNCTAD) and the Orgnanisation for Economic Co-operation and Development (OECD) both outlined the limitations and deficiencies of existing corporate governance regarding risk management, compensation systems, board structure, disclosure, and transparency, thanks to which findings new worldwide corporate

governance norms and standards have been established (UNCTAD, 2010; OECD, 2010). However, most corporate governance components were absent in developing nations due to the weakness of legislation, perceptions of legal corruption, political intervention, and the lack of discipline in the capital markets (BCBS, 2015; 2010; OECD, 2010)

2.2. Definitions of Corporate Governance

The process of determining the direction and performance of a company from the relationship between its shareholders, BOD, and top management is defined as that of corporate governance (Wheelen & Hunger, 2006). Corporate governance is an evolving topic whose definition is context-dependent (Roche, 2005); as such, its definitions differ according to research and cultural perspective (Armstrong & Sweeney, 2002). Though corporate governance relates to questions of oversight, independence, and accountability, some scholars advocate that a firm's primary responsibility is to maximise shareholder wealth (Sundaram & Inkpen, 2004); others believe that a firm has an obligation to both shareholders and stakeholders (Freeman, 1984). The concept has also been characterised as concerned with resolving issues and disparities among investors, and reconciling the interests of corporate claim holders (Becht et al., 2002).

The concept of corporate governance has been defined both narrowly and broadly by researchers, depending on their backgrounds and areas of study (Salacuse, 2003). The narrow definition is geared towards the interests of shareholders and encompasses consumers, investors, workers, governments, unions, and society (Sternberg, 2004). However, this thesis will utilise the broad definition, which defines corporate governance more generally as the manner in which a bank is managed in terms of its systems, processes, procedures, and practises to allow for efficient implementation of its powers and managerial relationships (Uwuigbe, 2011). Within this broad definition, all stakeholders, including investors, managers, consumers, and workers, are able to advance their interests through increased accountability, greater monitoring, and more transparent administration (Baskin & Miranti, 1997). While the 'narrow' definition takes into consideration the interest of the shareholders only, this broader definition emphasises the laws, rules and regulations in capital markets that govern equity investments and publicly listed firms. These rules include such elements as the protection of minority shareholders' rights, listing requirements, disclosure and accounting rules, and insider dealing arrangements, whereas the narrow definition focuses on financial provision and the methods by which investors

protect themselves against expropriation by insiders. These elements also include collateral and bankruptcy laws, as they pertain to the protection of minority shareholders and creditor rights (Claessens, 2003).

The 'broader' definition, however, expands the scope of corporate governance beyond internal structures and their formal rules to include the external environment and the informal practises that evolve in the absence of proper regulations (Dyck, 2001). Cadbury (1992) defines corporate governance as the system or methodology that directs and controls companies, while the Organisation for Economic Cooperation and Development (OECD) construes it as a system where companies are directed and managed (OECD, 2004), a view with which the Basel Committee on Banking Supervision agrees in articulating that the means employed by management teams and BODs to organise and govern the affairs of banks are considered as falling within corporate governance (BCBS, 2006; 2015; 2010). For some, the concept involves an overly involved board of directors, while others emphasise corporate 'democracy' or broader shareholder participation (Federal Deposit Insurance Corporation (FDIC), 2005). In their study of corporate governance, Arun and Turner (2003) support the broader definition of corporate governance and go on to argue that the distinctiveness of banking operations requires direct regulatory supervision to ensure proper restraints are applied that will ultimately protect shareholders and depositors.

Regulators in the financial ecosystem also play a crucial role in the corporate governance of banks. The Federal Deposit Insurance Corporation (FDIC) differs in its view of corporate governance, asserting that corporate governance is generally defined as the process of managing an organisation's affairs or ensuring accountability, and it includes a variety of activities within the practise, such as developing internal policies and monitoring performance (Federal Deposit Insurance Corporation (FDIC), 2005).

2.3. Corporate Governance: Major Theories

This section explores the four primary schools of thought relating to corporate governance theories, which have been derived from a variety of disciplines, including accounting, economics, finance, and law (Solomon, 2007). Accordingly, previous studies have taken many theoretical views into consideration, among which agency, stewardship, stakeholder, and resource dependency theories are the most commonly utilised. This thesis investigates these perspectives in order to properly determine the effects of corporate governance on the market, financial, and non-financial performance of G7 banks, for which the administrative practises, governance structures, and procedures that control a bank's overall performance serve as the foundation (Solomon,

2007). In this thesis, corporate governance is investigated from a financial and market perspective, utilising a quantitative technique. However, since corporate governance is quite complex, and in accordance with calls by Van Ees et al. (2009) and other scholars, the adoption of a multi-theoretical approach is needed to research corporate governance that integrates all four theories. Hence, the approach taken here incorporates all four viewpoints.

2.3.1. Agency Theory

This theory has been widely adopted in a range of disciplines within corporate finance, most notably in corporate governance research and analysis (Dedman, 2004). The impacts and repercussions of agency theory have piqued the interest of a significant number of international scholars globally (Carrillo, 2007).

The concept of a separation of control between ownership and management is widely regarded as the most used practical approach to the examination of corporate governance, beginning with the work of Berle and Means (1932) who emphasized such a separation. The concept is primarily concerned with the alignment of the interests of both parties: the agents and the principals (Jensen & Meckling, 1976). As such, it denotes the connection between the principals, who are the business's shareholders or owners, and the managers, who operate as their agents to manage and control the business but may not always act in the best interests of the shareholders.

As cited by Cadbury (2002) this situation was documented by Adam Smith in the eighteenth century in his commentary on joint stock companies, who observed directors of such companies, being managers of other people's money rather than their own, cannot be expected to watch over it with the same anxious vigilance that partners in a private partnership frequently watch over their own. In addition, Jensen and Meckling (1976) have proposed that the agency issue occurs between principals and their agents since the latter are paid to operate the business and make choices on behalf of the owners. This relationship has been demonstrated to be plagued by two key interdependent problematic possibilities: (i) the agent having greater access to knowledge than the principal; and (ii) competing interests between the agent and the principal (Hills & Jones, 1992). The agency issue is based on three fundamental assumptions. In the first instance, Eisenhardt (1989) has remarked that when it comes to risk-taking, it is assumed that the agent and the principal do not possess the same outlook. Second, the agent and the principal may not have the same interests and purposes. Third, both

sides are believed to be utility maximisers (i.e., opportunistic), even if a rational agent would not always behave in the best interests of the principal. Thus, in operating as an agent, management performs fiduciary obligations on behalf of the principal in order to administer the company (Pratt & Zeckhauser, 1985).

There are three major ways in which self-interested managers might generate expenses that impair shareholder value. First, utility executives may use their position to take advantage of business resources and utilise their authority to grant themselves exorbitant salary packages. Second, they may opt to spend available funds on non-profitable ventures and less efficient opportunities rather than paying out dividends to shareholders. Finally, managers may choose to dedicate less time, effort, personal skill, and/or creativity to optimise the value of certain tasks, such as failing to explore new and lucrative investment projects (Jensen & Meckling, 1976). However, the theory argues that managers are self-interested, opportunistic, and individualistic in character, and hence seek to maximise their own wealth and position at the expense of shareholders. This view is based on the idea that there is an essential misalignment between the shareholders' and management's aims. Managers are unlikely to act in the best interests of shareholders, it is argued, in such a way that may lead to conflict between the two parties because managers have direct control over a company and direct access to accurate information, which is considered an advantage over shareholders. As a result, such conflict may lead to agents' failure to maximise shareholders' wealth and have an impact on performance (Morck et al., 1988). Therefore, it is in shareholders' best interests to implement monitoring and control measures over the management team to ensure that all interests are aligned (Garrillo, 2007). In order to safeguard shareholders' interests, therefore, a relevant and efficient corporate governance structure needs to be formed (Haniffa & Hudaib, 2006).

2.3.2. Stewardship Theory

According to this view, executives are naturally trustworthy (Nicholson & Kiel, 2003). Thus, managers should have complete authority and be empowered to govern businesses, as they are thought to be responsible stewards of the resources entrusted to them (Letza et al., 2004). Additionally, stewardship theory involves certain assumptions regarding senior managers' conduct. To begin with, it claims that since top managers often spend their whole careers with the firm they control, they have a greater understanding of the firm than outside directors as they have greater access to superior formal and informal information and hence can make better judgments (Donaldson & Davis, 1991). As a consequence,

proponents of stewardship theory argue that improved financial performance is likely to be related to internal corporate governance procedures that empower management, such as merging the roles of chairperson and CEO (Donaldson & Davis, 1991).

2.3.3. Stakeholder Theory

The stakeholder theory of organisations takes a pluralistic approach. According to Freeman (1984), a stakeholder is any group or person who can influence or is influenced by the achievement of a corporation's goal. According to stakeholder theory, a business is a nexus of both implicit and explicit contracts between a diverse variety of stakeholders, including workers, consumers, suppliers, investors, banks, environmentalists, governments, and other groups that might support or harm the firm (Freeman, 1984). According to this view, the goals of a business are met by balancing the interests of all groups. Corporations are also more likely to react to the interests of society as a whole if stakeholders are represented on boards. Compromises and bargaining are anticipated in the board's discussions under the stakeholder approach, which, according to Wang and Dewhirst (1992), is best characterised by how members of a board regard the interests of corporate constituents and hence how companies are governed.

In regard to the preceding debate, John and Senbet (1998) present a thorough examination of the stakeholder theory of corporate governance, highlighting the existence of several constituents with opposing commercial interests. They reiterate that the stakeholder theory seeks to harmonise the interests of management and other stakeholders and highlight the relevance of non-market factors, citing the necessity of selecting an appropriate size of board of directors as an example, particularly given the tendency of a bigger board size to have a negative association with business success. In their critique of stakeholder theory, Sundaram and Inkpen (2004) claim that the aim of shareholder value maximisation is important since this is the only goal that drives actions that improve outcomes for all stakeholders. According to Freeman et al. (2004), managers must cultivate connections, motivate stakeholders, and create communities in which everyone aspires to give their all-in order to provide the value that the business offers. As a result, the stakeholder approach is seen to better empower managers to express and develop their firm's common mission. Other important aspects to examine include the flow of information from top management to middle-level managers and others, interpersonal relationships, and the company's working environment (Jensen, 1993).

2.3.4. Resource Dependence Theory

This theory proposes that corporate governance mechanisms such as BODs are believed to not only facilitate effective management oversight but also to act as a vital connection that links the business to important resources that enhance profitability (Pfeffer, 1973). In the first instance, the board and non-executive directors in particular may embody vital resources, such as expertise, experience, and independence while also bolstering the managers with the ability to make wise decisions (Haniffa & Cooke, 2002). Furthermore, they may strengthen the reputation of the company and are considered valuable in terms of commercial connections (Haniffa & Cooke, 2005). Board membership serves as an important function by connecting a company to external stakeholders, such as creditors, consumers, and competitors. It has also been proposed that greater external connectivity is linked to a higher availability of resources in a way that might have a beneficial influence on the financial well-being of a company (Kiel & Nicholson, 2003).

2.4. Integration of Theoretical Corporate Governance Perspectives

In the preceding section, it has been seen how agency theory reflects the competing interests of principals and agents as well as the maximisation of shareholder wealth. Agency theory views outside directors, board leadership structure, and board committees as ideal monitory devices for the optimisation of firm value, while stewardship theory takes the view that shareholder wealth will be maximised when managers assume the role of stewards. Conversely, stakeholder theory states that the board should include members of all interested groups to safeguard stakeholder consensus. A board here serves as a forum for resolving issues and fostering the required cohesiveness. Resource dependence theory emphasises outside directors as key links to a firm's external surroundings and numerous opportunities for information-gathering and networking. According to agency theory, corporate governance mechanisms are critical for ensuring that the interests of owners and managers are aligned, thereby enhancing a firm's ability to maximise shareholder wealth and thus improve firm performance, whereas stewardship theory emphasises that the experience and full control over decision-making of managers has the greatest financial impact on a company. By contrast, stakeholder theory asserts that the involvement of all stakeholders in decision-making processes exerts a profound impact on a company's financial and social gains while resource dependency theory states that utilising external resources will have the greatest effect on financial performance.

The separation of management and boards has been one of the most contentious topics among scholars and researchers. Agency theory advocates that boards of corporations are composed of shareholders entrusted with the responsibility of overseeing and controlling executive decision-making in order to preserve shareholder interests. Specifically, it is assumed that independent directors successfully fulfil the duty of monitoring, and the roles of board chairperson and CEO should be held by different people (Cadbury, 1992). However, stewardship theory claims the converse, namely that dual CEO and independent director roles lead to superior performance.

In summary, scholars from several disciplines approach corporate governance challenges from a variety of theoretical viewpoints. However, this has resulted in the lack of a unifying theory by which to investigate the topic. According to Tricker (2009) and as previously stated, corporate governance does not yet have a single generally acknowledged theoretical foundation or broadly acknowledged paradigm, and so the topic lacks a conceptual framework that appropriately represents the reality of corporate governance. On this basis, each of the governance theories described has significant flaws, none of which alone can provide a comprehensive knowledge of corporate governance (Jackling & Johl, 2009).

Table 2:1 *Comparative Summary of Corporate Governance Major Theories*

Theory	Board of Directors' Role	Theoretical Basis	Implications for Board of Directors
Agency theory	Control and supervision (Managerial role)	Economics and Finance	- BOD enable shareholders to protect ownership, monitor performance, and control rights. - BOD includes outsiders. - No social or professional ties between BOD and executive management that causes conflict of interest. - Separation between CEO and chairperson.
Stewardship theory	Service and advice (Managerial empowerment)	Sociology and Psychology	- BODs must be controlled by management and manage corporate assets efficiently. - Insider-dominated board of directors. - CEO duality. - Strong Social and professional ties between BOD and CEO/management.
Stakeholder theory	Uphold interests of all stakeholders	Management	- Maximising shareholders' returns not sole objective. - Interests of all stakeholders should be upheld and equally respected.
Resource dependency theory	Connects firm to resources required to enhance performance (co-optation)	Sociology and Organisational Theory	- BODs to exhibit: - Large size. - Diversity of board members. - Strong external connection as co-optation mechanism for access to external resources.

- *Author's Own*

2.5. Systems of Corporate Governance

Corporate governance relies on the BOD as its most significant component (Filatotchev & Boyd, 2009). As such, the ownership structure of an organisation has a direct influence on the types of agency issues between agents and principals. Different challenges emerge when company ownership is scattered as opposed to concentrated. In developed countries such as the UK, the US, Australia, and Canada, dispersed ownership leads to a collision between the interests of management and stockholders, thus causing an organisational dilemma (Jensen & Meckling, 1976). In countries such as Germany, Japan, and certain developing nations where the largest shareholder has considerable influence and directly monitors the company, the main difficulty is that shareholders' interests diverge between major and minor shareholders.

Diluted ownership involves several stockholders, each of whom has a minor ownership portion of the company. These minor shareholders are referred to as 'outsiders' and have a lower incentive to work in a prominent position when it comes to monitoring the operations of the company, nor do they spend time on decisions that may potentially impact the management of the organisation. Since diluted ownership structures are outsider systems, this model is therefore considered and/or referred to as a diffused ownership structure. The proprietors in outsider systems tend to trust the independent board members to undertake critical monitoring functions such as assuring proper transparency, taking objective stockholder interests into consideration and providing minority shareholders with a means of defending their rights. However, it is necessary to create a regulatory framework and a sound legal structure for this system to operate.

An insider system is the model used in continental Europe, according to Mayer and Carlin (2000); under this system a limited number of owners have power, creating a conflict of interest since major and minority owners are competing with one another. Shareholders are required to exercise their voting and governance rights as well as their influence on the performance of the business. Findings by La Porta et al. (2000) have indicated that the top three shareholders hold a greater percentage of stock ownership in European continental nations, while Gorton and Schmid (2000) have demonstrated that enterprises may perform better when there is a correlation between the concentration of the bank's ownership and its control by shareholders who have a partly managerial influence on the business. This approach is based on two separate boards, one for management and one for supervision, whereas in Japan the model categorises assets based on different families, obligations, and agreements (Gorton & Schmid, 2000). Based on the above, researchers have identified two models/systems that companies may use for corporate

governance, referred to as the Anglo-Saxon shareholder-based model and the German-Japanese (market-based) system model. The primary characteristics of each model will be highlighted in the following section.

A limited number of persons, usually managers, families, corporations, boards, and lenders, have ultimate ownership and control of a company under concentrated ownership systems. Since concentrated ownership arrangements are viewed as insider systems, they are referred to as such and may operate via pyramidal and cross-ownership systems (Wiwattanakantang, 2001). In this context, an insider is an individual who has a significant impact on the management, control, or functioning of a company. In nations such as Japan and Germany, business structures are more centralised than in the US and the UK, and banks have far greater governing authority than in the US, while Prowse (1992) has observed that in Japan financial institutions are the most important major owners (Mayer & Franks, 2001; Prowse, 1992). In the UK, prior to the implementation of shareholder rights, ownership dispersion was widespread. According to Franks et al. (2009), the greatest contributor to this dispersion has been mergers and acquisitions.

2.5.1. Anglo-Saxon System of Corporate Governance

This style of corporate governance is characterised by a dominant number of independent persons and individual shareholders in a company. It emphasises the interests of shareholders as they select the individuals serving on the BOD and thereafter nominate individuals from the BOD for positions on committees of significant influence such as remuneration and audit committees. Shareholders are able to significantly influence key decisions in the organisation within the allowable limits set by corporate regulations, including those of central banks. Coupled with a broadly distributed ownership structure, countries that adopt this model (led by the UK and the US) are well developed with deep capital markets, have well-established corporate governance rules and regulations, and rely on markets to guide their companies. Although both the aforementioned nations are categorised in the same group, their corporate governance practises vary greatly. While CEOs in the UK are not normally also board chairpersons, it is common practise in the US, for example, for one person to hold both roles (La Porta et al., 2000).

One beneficial aspect of the Anglo-Saxon style of corporate governance is that it emphasises the interests of shareholders, who select independent (or non-executive) directors of single-tiered boards. In most cases, the latter hold positions of significant influence, for example on remuneration and audit committees, and typically outnumber executive directors. The markets will in

turn reward or penalise firms based on their performance (Shleifer & Vishny, 1997). However, although shareholders operating under this model are diverse and own a minority of shares, they tend to have low involvement in the business. In this context, the 'free-rider dilemma' arises because stockholders remain passive, even though they are in a position to make a difference, which provides management with greater freedom to take strategic decisions while knowing that shareholders will not intervene. Additionally, one of the major criticisms of this style of corporate governance is that executives tend to be very focused on quarterly performance targets and adopt a short-term perspective (Becht et al., 2002). This emphasis sometimes results in takeover threats unless managers focus on immediate results, leading some academics to call this model 'myopic' (Keasey et al., 1998). Critics of the model have cited the Enron financial scandals as prior to declaring bankruptcy Enron epitomised an exceptional Anglo-Saxon corporation. However, when stock prices for the firm were declining, executive compensation did not follow suit: even during the period of the last financial crisis, senior executives of failing or tainted institutions were handed substantial bonuses. Despite all these criticisms, however, countries adopting the Anglo-Saxon classification of corporate governance, especially the UK and the US, have experienced strong growth, and their systems have proven to be efficient. The emphasis on shareholder value maximisation thus appears to be one of the system's strong qualities in allowing these economies to develop.

2.5.2. German-Japanese System

This model's main characteristic is the presence of large investors, such as financial institutions and banks. In view of how these investors are able to commit significant capital, they tend to become interested in increasing their control and becoming more involved in the corporate governance of the firm they finance. This factor alone tackles the abovementioned 'free-rider' issue of the Anglo-Saxon paradigm. To address another of the issues of the Anglo-Saxon model, large investors are able to commit to and facilitate long-term investments while overseeing management.

The German-Japanese (stakeholder) model has been adopted in a number of European countries since the nineteenth century. It emphasises the maximisation of stakeholder benefits and interests and carries out investments on a long-term basis, as opposed to the short-term view in the US, UK, and Canada. The stakeholder approach is prevalent in Germany and Japan and is characterised as one engaging 'patient capital' invested on a long-term basis. As opposed to the principal-agent approach, this system also involves 'team production', meaning that a corporation consists of multiple stakeholders who empower the BOD with control over their resources (Aguilera & Jackson, 2010). Schilling (2001) has suggested that in the two-tiered board structure

favoured in Germany, the supervisory board makes appointments and has the authority to remove board members, whereas shareholders in the European system are mostly passive, the annual meetings they conduct are ineffective, and, in view of the fact that most stocks are owned by other companies, they become part of an integrated ownership system, while transparency is limited in the selection process of supervisory boards.

The Japanese corporate governance model embodies the characteristics of its corporate system: cross-shareholdings; the main bank; specific employment practises; and the Japanese-type firm. The main bank is considered the key supplier of funds to companies; thus, it has a monitoring role and is involved in managing firms during crisis situations. These characteristics differentiate the Japanese corporate governance system from that of other countries such as the US and the UK. Cross-shareholding and integrated relationships are established, creating a sense of shared interest. Additionally, Japanese corporate culture significantly shapes its corporate governance system. The monitoring of top management by the main bank is a disciplinary mechanism that is a form of contingent governance according to Miyajima et al. (2017), who explain that, when undertaking monitoring and disciplinary roles, banks rely on the fact that shareholders are passive and have low interference in firm management, thus mitigating agency problems that occur with dispersed ownership. This encourages long-term and growth-oriented behaviour. Supporters of this model suggest that the cultivation of strong relationships between equity holders and long-term debt allows access to finance at lower costs than in the US and UK, which indicates that projects that may be rejected by American or British investors may be approved by German or Japanese financiers (Keasey et al., 1998). The Japanese model also favours employees' interests, as reflected in its employment practises, which include seniority-based pay and promotion as well as life-long employment. According to Dore (2003), this model also facilitates career employment in contrast to the "job employment" of Anglo-Saxon firms (Anderson et al., 2004; Dore, 2003).

Most scholars believe that Japan's corporate governance structure has been greatly influenced by the country's culture and customs. Its corporate governance approach was commended in the 1980s for its long-term relationship-building with its stakeholders and the significant involvement of employees and suppliers (Becht et al., 2002). Although this model is fundamentally sound, one issue of concern is the position of its minority shareholders. Since the model depends on large shareholders, minority shareholders and small investors are in a disadvantaged position and vulnerable to expropriation by larger

stockholders. La Porta et al. (2000) have argued that this condition was brought about by the absence of legislative protection for small investors, resulting in the market being heavily dominated by major investors.

2.5.3. Comparison of Corporate Governance Systems

Some researchers consider the Anglo-Saxon corporate governance system superior to its continental counterpart (Hansmann & Kraakman, 2001). The relative ease and flexibility of entry and exit while maintaining cost efficiency is a reason behind this model's appeal and popularity. However, the legal and regulatory standards associated with the model are relatively high, making the Anglo-Saxon system more suitable for developed countries' financial markets and democratic political systems. On the other hand, the German-Japanese system of corporate governance successfully manages agency issues in firms located in both countries. This system, as pointed out by Keasey et al. (1998) encompasses the necessary institutions to provide excellent financial support in a timely and cost-efficient manner, although it is historically associated with weaker legal systems.

As the CG system is dependent on countries' culture and socio-economic principles, it may be said that the system that works best for a specific nation is contingent on that nation's economic and legal stage of development at that time. However, this may change over time, and so a nation for which the Germanic and Japanese system was optimal up to a particular point in its growth might move to the Anglo-Saxon system or vice-versa.

Table 2:2 *Characteristics of Insider and Outsider Governance Systems*

Insider System **German-Japanese System**	**Outsider System** **Anglo-Saxon System**
Control by small group of shareholders	Control by large range of shareholders
Owned by insiders who also wield control over management	Large firms controlled by management but predominantly owned by outside shareholders
Agency problems rare as little separation between ownership and control	Agency problems frequent as system characterised by separation of ownership and control
Hostile takeovers rare	Hostile takeovers frequent
Concentrated ownership	Dispersed ownership
Wealth transfer from minority to majority	No transfer of wealth from minority
Weak investor protection	Strong investor protection
Controls shareholder misuse of power	Potential for shareholder democracy
Japan, Germany, and emerging countries	US, UK, Australia, and Canada

- *Author's Own*

2.6. Mechanisms of Corporate Governance

The main purpose of corporate governance is to handle the issues that arise from the separation of control and ownership (Shleifer & Vishny, 1997). Agency theory proposes two distinct kinds of governance tools – 'internal' and 'external' – to protect against agency concerns (Jensen, 1993). Researchers suggest that internal control methods include the BOD structure, independence, size, committees, incentives and remuneration, ownership structure, and financial policies (debt and dividends) (Denis & McConnell, 2003; Hermalin & Weisbach, 1991). External control methods include the corporate control market, legal system, and product market; it is argued that these systems are capable of protecting and monitoring a firm's activities, thus limiting and controlling the power of management and shareholders (Bushman & Smith, 2001). Farinha (2003) has expanded on the preceding points by emphasising the importance of reputation, security analysis, dividend policy, and debt policy as additional processes for internal control. Globally, however, the influence of corporate governance frameworks on business performance has been variable and inconclusive. The following subsections provide an overview of internal corporate governance mechanisms relevant to this study, focusing on a particular collection of these mechanisms and their impact on the performance of banks and non-financial enterprises.

2.6.1. Board of Directors' Structure

The BOD's primary function is to supervise the management aspect of a business and to mitigate the issues inherent in the principal-agent relationship. In this view, owners are the principals, managers are the agents, and BODs serve as the monitoring mechanism. When the agents' and principals' interests are not aligned, an agency problem can develop. This is an ongoing possibility when agents pursue their own interests at the expense of the principals, which is why principals appoint members of the BODs in addition to agents to guarantee the business is operating in the owners' best interests. Due to this conflict of interests and the need for supervising agents, a business may incur agency expenses, which include monitoring and bonding fees costs, as well as residual losses (Jensen & Meckling, 1976). Because the principals ultimately bear these expenses, the reduction of agency charges forms part of the obligation to maximise shareholder value. The BOD is the pinnacle of hierarchical corporate control systems, whose major function is to supervise the administration of agents on behalf of the principals. The more authority and control a board exert over managers, the fewer opportunities managers

(agents) will have to engage in non-value-maximising activities (Liu & Fong, 2010). Thus, the BOD primarily serves as a monitoring tool to safeguard the interests of the principals.

In essence, the efficacy of a board is determined by how much value it brings to the firm. According to agency theory, the BOD's duty is to provide the most effective mechanism for ensuring corporate governance that protects the shareholders' interests; in other words, it is established largely to alleviate and mitigate against agency concerns (Fama, 1980). Solomon and Solomon (2004) outlined several principles to follow when establishing boards to ensure the optimal structure: frequent meetings; effective communication between board members and shareholders; a willingness to consider the suggestions of others; a high level of integrity; a concern for financial risks; and an awareness of and rationale for resolving financial problems. Walker et al. (2005) have remarked that one critical topic that should be addressed when establishing a board structure is the appointment of directors and their respective compensation. Previous research has summarised the primary roles of BODs in agency control as strategic decision-making and policy support (Mcnulty & Pettigrew, 1999), providing a network to support a firm's reputation and legitimacy (Finkelstein & Hambrick, 1997) and resource acquisition (Johnson et al., 1996). Their fiduciary obligations towards shareholders, such as monitoring managers' activities and evaluating senior executives' performance, reflect the critical nature of boards' governance roles, whose contribution to strategic decisions about the direction of companies increases their responsibilities. According to Brennan (2006), a corporate board must be efficient and successful in carrying out its responsibilities in order to defend shareholders' interests.

2.6.2. Board of Directors' Size and Meeting Frequency

Substantial research has investigated bank board sizes and compared them to those of non-financial organisations. In the US, banks have more board members than non-financial firms (Adams & Mehran, 2012; Booth et al., 2002). The same finding also holds for international banks with one-tier boards, spanning six OECD nations from 1995–2005, as shown by De Andres & Vallelado (2008). Due to the complexity of their operations and regulatory guidelines, banks have larger board sizes than non-financial companies because they require more committees, such as lending and credit-risk committees; the findings of Adams and Mehran (2012) reveal a substantial statistical link between board size and firm performance for large US banks during the period 1965–1999. Similar results have been published by Aebi et al. (2012)

with regard to banks during the credit crisis in the US during 2007–2008. It is possible that the value of larger boards offsets their associated costs, which is why research on banks shows a positive association between the former and bank performance (Aebi et al., 2012). However, De Andres and Vallelado (2008) have outlined that the costs associated with larger boards (coordination challenges, sluggish decision-making, and cost control) begin to outweigh the advantages for every additional director above 19 directors. According to the literature, the ideal board size is a trade-off: the benefits of a larger size include better monitoring and a greater ability to address challenges, while the disadvantages can include control and coordination issues.

A further issue that has gained attention in banking is risk-taking and its link to board size. Board members play a critical role in monitoring a bank's risks. Pathan (2009) has researched the connection between board structure and risk-taking in financial institutions, in which the data from a sample of 212 large US banks between 1997–2004 revealed that the smaller the bank's board, the higher its risk-taking. Fernandes and Fich (2013) reached almost the same conclusions in their study for the period 2003–2006. Wang and Hsu (2013) investigated a group of 1,500 financial firms belonging to S&P's Composite 1500 Index between 1996–2010 and found, in regard to operational risk occurrences, board size is inversely and non-linearly linked to risk whereby incremental increases in the number of board members enhance the chance of operational risk occurrences when the board size exceeds 14 members. One can infer from this finding that a board size above 14 directors will cause communication problems and conflicts, outweighing the benefits of knowledge development otherwise associated with a larger board. More recent evidence finds that the negative relationship between board size and bank risk-taking also held during financial crisis, while the link between the possibility of bank failure and the size of the boards of commercial banks in the US between 2007–2010 was reported as negative by Berger et al. (2016). On the other hand, board activities, measured by the number of meetings conducted during a year, are a key basis for the effectiveness of a board and may lead to enhancement of firm performance. According to the resource dependence theory, board meetings might be considered a resource for a firm, while the agency theory highlights that increased board activities could enhance the monitoring and control capability of the board of directors (Lipton & Lorsch, 1992).

The corporate governance codes of the UK and Germany outline those directors should allocate appropriate times for their own companies and utilise their responsibility effectively. Empirical evidence has also revealed a positive correlation between the frequency of board meetings and firm performance: the larger the number of meetings, the better the firm's performance (Brick

& Chidambaran, 2010). The same study also shows that board activities may increase due to pressure from investors and regulators in a way that generally has a positive impact on a company's performance. Other research efforts have also proved a positive correlation between meeting frequency and a firm's performance (Vafeas, 1999).

2.6.3. Board Composition of Independent Directors

Previous research on board independence has compared the board composition of banks to non-financial institutions with the aim of evaluating differences in governance structures, whose findings have indicated clear and consistent variations. The percentage of outsiders (independent directors) who serve on bank boards in the US was on average between 70% and 85% (Adams & Mehran, 2003; Belkhir, 2009), whereas that of outside directors on non-financial firms' boards is between 60% and 70% (Adams, 2012). Similar findings were generated by Andres and Vallelado (2008), who discovered that an average of 80% of the directors of commercial banks were not insiders, using a sample of 69 commercial banks from six OECD countries (the US, the UK, Spain, Italy, France, and Canada) from 1995–2005.

In contrast, the literature has also investigated whether board independence affects bank performance; for example, Adams and Mehran (2011) conducted a random sampling of the 35 largest publicly listed U.S. bank holding companies (BHCs), though these banks were concentrated in four US states. Surveying data from 1965 through 1999, the researchers determined that independent board roles had no impact on a bank's overall performance. Non-linear statistical correlations have been shown in other empirical studies that investigate the relationship between independent directors and bank performance. The BODs of a worldwide sample of banks were also analysed from 1995 to 2005 by De Andres and Vallelado (2008), who noted that all the sampled banks with a one-tier board structure exhibited an inverted U-shaped connection between the number of outside directors and bank performance. Further, Pathan and Skully (2010) analysed the relationship between independent directors and CEO-subordinate relationships. Banks gain from a larger number of independent directors when the cost of monitoring management is minimal, as shown by the research findings for a sample of 212 US bank-holding corporations from 1997–2004 (Bae & Skaggs, 2019).

Independent directors may be hired for the purpose of regulatory compliance or due to the need to utilise their high-performing expertise, according to Pathan and Faff (2013), whose study provided evidence to support the position that

companies should carefully implement corporate governance practises concerning the numbers of independent directors, as it has been shown that the association between board independence and poor financial performance held during the years of the 2007–2008 credit crisis, when the percentage of independent directors was inversely related to bank performance (Minton et al., 2014). Erkens et al. (2012) also found that throughout the 2007–2008 credit crisis, banks with highly independent boards performed worse than those with boards subservient to shareholders. Using a dataset that included 296 major financial institutions from 30 countries between 2007 and 2008, the authors state that independent directors were crucial in compelling management to increase equity capital in the aftermath of the crisis because of their concern for capital sufficiency. In order to finance their short-term loans and obligations during this period, financial institutions no longer had any choice but to obtain more capital since they could no longer depend on rolling over short-term loans against their assets. This prompted a wealth shift from current equity holders to debtholders since generating equity capital was exceedingly expensive during this period. The findings show that conventional equity governance (i.e., board independence) created wealth transfers between shareholders and debtholders throughout the crisis.

2.6.4. Audit Committee Size and Meeting Frequency

A board's effectiveness is impacted by board committees. Because of the great volume of regulatory advice and the complexity of bank operations, the need for board committees has become an important concept for monitoring purposes. In recent decades, audit committees have been globally identified as a common mechanism for corporate governance. The role of an audit committee is considered specifically essential to the overall performance of a board and is significantly responsible for monitoring and evaluation on its behalf. Reinstein and Weirich (1996) have stated that most large corporations utilise audit committees as a means of protection against financial liability, corporate fraud, and overall mismanagement by ensuring accurate financial reporting. The SEC and OECD, among many other major international institutions, have advocated the creation of audit committees and suggested that they be composed of non-executive directors (Hermes et al., 2007; ICGN, 1999). This, however, has not prevented corporate and financial fraud. Corporate governance scandals suggest the operation of under-performing (or inefficient) audit committees, highlighting the importance of their responsibilities (Levitt, 1999). Such scandals have also prompted the issuance of much-needed amendments by regulatory institutions globally to boost the effectiveness and efficiency of audit committees beyond the

manipulation and control of CEOs. The multiple scandals that have occurred in the financial system have specifically led to the passing of the Sarbanes-Oxley Act (2002) in the US as a federal law. Similar efforts had previously been made internationally to enhance the performance of audit committees and corporate governance, such as the Bosch Report (1995), the Business Sector Advisory Group on Corporate Governance (1998), the Hampel Report (1997) and the Peters Report (1997).

Independence and board efficiency are the two key monitoring advantages gained from audit committees. The former occurs due to the presence of internal and external auditors reporting to the audit committee. This method of reporting ensures that internal and external auditors remain uninfluenced by management and hence become more credible in the proper discharge of their duties. Sun and Liu (2014) investigated the association between audit committee effectiveness and bank risk-taking in the United States from 2008 to 2010, discovering that banks with extended board-tenure audit committees have lower total risk and idiosyncratic risk, while banks with busy audit committee directors have greater total risk and idiosyncratic risk. Barakat and Hussainey (2013) investigated audit committee and operational risk-disclosure quality in European banks by using a sample of 85 banks from 20 EU countries from 2008 to 2010, who discovered that banks with more active audit committees provide higher quality operational risk disclosure and whose findings imply that strong audit committee effectiveness may limit bank risk-taking actions.

Lingel and Sheedy (2012) investigated the quality of supervision provided by board risk committees on a global scale. They provided evidence that the ratio of experienced bankers on risk committees rose considerably between 2004 and 2010, demonstrating that improved risk governance decreased risk and enhanced return on assets (ROA) across a sample of 60 banks from 17 countries in varying regulatory and commercial environments. Implying that risk governance choices are important regardless of unique local situations, they concluded that during the financial crisis this relationship did not hold. On a global scale between 2007 and 2008, enhanced risk governance had no significant impact on risk outcomes. These findings indicate that stronger audit and risk committees have a beneficial impact on bank performance and may limit bank risk-taking. More efficient and precise risk governance minimises larger risks, whose consequences might jeopardise a financial system and a society’s overall stability. As such, these results might also have policy consequences for optimal bank regulation.

2.6.5. CEO Duality

The practise of a single person acting as both CEO and board chair is referred to as CEO duality (Krause et al., 2013). CEO discipline may be weakened due to the opacity of banks, lack of market oversight, and the complexity of agency expenses, making the separation of leadership responsibilities in banks essential. Bank CEOs, who tend to be risk-averse, are typically less incentivised to take risks. From 1997–2004, Pathan (2009) indicated that the presence of CEO duality had an impact on bank risk-taking. CEO duality also lessens the chance of financial crises, according to a study by Simpson and Gleason (1999) based on their sample of US banks from 1989 to 1993, who state that it is possible for a CEO to also serve as the chairperson of the board, as a CEO is empowered to pursue his own interests and profit for private gains. Berger et al. (2016) demonstrated that CEO duality decreases the likelihood of a bank failing one year and two years prior to default and does not negatively impact corporate governance, whose findings also revealed that CEO duality lowers bank equity performance. CEO duality may have a beneficial effect on the likelihood of a bank default and/or risk taking by lowering the possibility of a bank's failure.

2.6.6. Board Diversity and Competency

Diversity is a key factor used to evaluate a board's performance. According to some studies, a diverse board leads to a strong competitive advantage and improved decision-making, as it is based on a wide knowledge base and differing experience levels (Bilimoria & Wheeler, 2000; Prieto et al., 2011). Diversity is characterised as either observable (concentrated on gender, age, race) or non-observable (concentrated on knowledge, education, values). Most research on the correlation of board diversity and performance focuses on demographic diversity.

Researchers have clarified that one of the main tasks of a board is to support and advise the CEO in a manner that is otherwise unavailable from other managers (Dalton et al., 1999; Hillman & Dalziel, 2003; Lorsch, 1989; Zahra & Pearce, 1989). Therefore, the effectiveness and strength of this advisory role is highly dependent on certain characteristics of a board, such as experience level, tenure, and professional diversity, among others. A diverse board in regard to its experience and professional level leads to greater effectiveness and enhanced decision-making; indeed, some studies have found that professional diversity ultimately leads to better performance of firms (Baysinger & Butler, 1985; Carpenter & Sanders, 2004; Gulati & Westphal, 1999; Kaplan & Reishus, 1990).

Gender diversity is a key element of board composition. Women are considered valuable resources and crucial to a firm's survival and success (Chen et al., 2019; J. Huang et al., 2020). It is worth mentioning, however, that harnessing female talent and properly utilising women's expertise greatly depends on the social interactions between board members (Bae & Skaggs, 2019; Richard et al., 2004). Some studies also show that excluding women from social and professional activities may lead to poor cooperation, slower decision-making, rising conflicts of interest, and weaker firm performance (Ferreira et al., 2011; Huang et al., 2020; I. Ullah et al., 2019).

The capacity and readiness of boards to question management and enter into meaningful dialogue is a further component of successful management that ensures corporate choices take account of the many factors that may influence the interests of stakeholders (Mehran & Mollineaux, 2012). In this regard, and to carry out this work, a management board must be competent and knowledgeable in order to understand the complexity of a bank's assets and the related risks. Research has also proven the impact of managers' experience on bank performance. For example, Aebi et al. (2012) examined whether US banking performance during the crisis was affected by experience and financial competence. Their findings suggest that the inclusion of a CRO (chief risk officer) on a bank's board favourably affected the performance of banks during the financial crisis of 2007–2008. However, they reported that the connection between the presence and financial background of non-executive directors and the performance of the bank in the crisis was unfavourable.

These results also correspond to the results of Minton et al. (2014) who demonstrated that the financial knowledge of independent directors was adversely linked to banking performance during the 2007–2008 credit crisis and favourably linked to risk-taking in a sample of US banks. These outcomes were a result of the closeness of independent directors to management where financial skills were utilised to enhance the value of shareholders. It should also be noted that banks with high leverage may lead to more risk-taking that might harm overall bank performance. It is further evident that foreign financial specialists are more willing to allow their banks to take on more risk because they are familiar with and understand complex financial products (Minton et al., 2014).

Hau and Thum (2009) found that those board members without the financial expertise of the major German banks had a negative impact on performance during the subprime crisis. Similarly, Cuñat and Garicano (2009) indicated that

Spanish bank presidents without prior banking or post-graduate training experience from 2007–2009 were even worse off. Appropriate indicators employed as a proxy for financing knowledge or networks of directors might influence the association between board competence and banking success.

2.6.7. Environmental, Social, and Governance Disclosures

With the growing public interest in the transparency of institutions, the assessment of the influence of environmental, social, and governance information is becoming of growing interest among researchers. Multiple studies have shown a positive correlation between ESG disclosures and the financial performance of companies across varying sectors. Kuo and Fu (2021) backtracked the financial performance of airline companies and concluded that setting Key Performance Indices (KPIs) in support of sustainability should be prioritised. Boakye et al. (2021) examined the relationship between the environmental practises and performance of SMEs and found a positive correlation by studying the inverted U-relationship. Siddique et al. (2021) also stated that, as evidenced by the signalling theory, environmental activities positively affect the long-term financial performance of companies.

With regards to the level of transparency of institutions as represented by ESG disclosures and in relation to corporate performance, some studies have revealed mixed or neutral results in respect of the relationship between disclosures and performance. Petitjean (2019) for example, compared the nature of the relationship between environmental and financial performance during the subprime crisis, concluding that changes in environmental policies in large US companies do not necessarily yield better performance, while Bătae et al. (2021) found a significant positive relationship between emission reductions and the ROA of banks but a negative relationship between product responsibility and ROA. In a study based on stakeholder and legitimacy theories, it was found that a negative correlation exists between disclosures and performance, while in a study based on voluntary disclosure and signaling theory a positive correlation was found between disclosures and performance (Cho & Patten, 2007; Clarkson et al., 2011; Farag et al., 2014; Hummel & Schlick, 2016; Luo, 2019; O'Donovan, 2002; Xie, 2019).

Borodin et al. (2020) argued that non-financial statements in sectors such as commodities and utilities had a significant positive effect on Q-Tobin growth, while on the other hand Horváthová (2010) has contended that

environmental regulations require some time before materialising in performance, and time coverage is important before establishing a positive link between disclosures and financial performance.

2.7. Corporate Governance of Banks

Like any other organisation, a bank is influenced by governance issues that are usually linked to ownership and power-splitting. Nevertheless, banks have specific characteristics that can increase management issues and impair the efficiency of traditional governance procedures (Levine, 2004; Levine & Caprio, 2002). Extensive research has addressed corporate governance in banks and shown the variations from corporate governance in non-financial companies (Hopt, 2013; Macey & O'Hara, 2003; Mehran & Mollineaux, 2012). The first feature concerns the large leverage of banks, which may exceed 90% (Berger & Bouwman, 2013; DeAngelo & Stulz, 2015). As opposed to non-financial enterprises, depositors and other debtors are the main sources of capital for banks. As explained by Gornall and Strebulaev (2018) banks' average leverage, as indicated by the debt-to-asset ratio, is between 87% and 95%, whereas that of non-financial enterprises is on average of between 20% and 30%. This high leverage in turn makes bank collapses more probable (Gornall & Strebulaev, 2018).

A further important concern is the rise in how conflicts of interest between debtholders and shareholders in the presence of high leverage correlate to a bank's equity. As claimed by Macey and O'Hara (2003) banks are more likely than industrial enterprises to experience moral hazards. Laeven (2013) contends that due to the nature of banks' operations, the agency costs in these financial organisations are more prominent than in other types of firms. Moreover, the major claimholders of banks are the depositors (debtholders), who have considerably different interests from those of owners (John & Qian, 2003). While owners work towards maximising their wealth, depositors receive a set payment. If the project fails, the value of collateral to depositors is reduced and the value of the outstanding debt declines. When a firm announces bankruptcy, limited liability enables stockholders to walk away risk-free while transferring all the risk to creditors (John & Senbet, 1998). This risk-shifting incentive for managers who act on shareholders' behalf impacts governance in terms of agency debt costs, effective control, and monitoring, as well as the incentives of management. John and Qian (2003) discuss how, in companies that are highly leveraged, there will be a greater incentive for top management to undertake high-risk investments if their interests are aligned with equity interests, even if such investments lack a positive net present value. Accordingly, the managerial incentives that align shareholders' interests with

managers' interests may increase the debtholder-shareholder conflict in leveraged firms. Thus, improving equity governance might raise agency costs of debt, leading to declining firm value. Regulation might also limit the efficiency of fair governance in this context.

Banks' governance has also been explored from the perspective of society and the financial system, in which they play a major role. Economic agents with no possession of bank ownership equity or debt claims are still able to profit from a secure and solid financial system. For the stability of the whole financial system, a competently controlled bank is vital (Adams, 2012). The social planner might in this scenario control the banking industry in two ways. On the one hand, the regulator might limit banks' investment options and enforce capital requirements; on the other, the regulator might also enforce elements of governance, which in turn impacts management incentives and risk decisions. The connection between banking regulation and governance is examined in the next subsection.

The opacity and complexity of banking assets is a further feature that makes banking governance vital. While some experts question banks' opacity, others believe that information asymmetries are more relevant to the banking business than manufacturing industries (Furfine, 2001; Laeven, 2013). Some scholars further claim that credit quality might not be easily observable and may be obscured for lengthy periods since it is difficult to evaluate and verify risks due to the complexity of numerous financial products (Ferrarini, 2015). During the subprime mortgage crisis, for example, it came to light that many of the financial innovations made via special-use vehicles, such as securitised products generated by the bundling and cutting of initial loans and offsetting operations, increased a firm's risks. However, these hazards have not been completely recognised or correctly addressed (Dell'Ariccia et al., 2012).

In addition, the risk structure of banks' assets may be adjusted faster than in any other company. This shift in the mix of risk may not be immediately obvious to directors or external investors, however. The opacity of banks also has major management consequences, according to Levine (2004). To begin with, the imbalance of information in the banking sector causes more difficulty in management control of diffused stock investors and debtholders in preventing banks from transferring risk from shareholders to debtholders, which in turn exacerbates agency costs. Second, opacity makes it harder for effective incentive agreements to be designed. If results are difficult to assess and easy to adjust in the short term, it will be simple for managers to

modify compensation packages (Levine, 2004). Remuneration packages are also frequently developed that enable managers to gain wealth to the detriment of a bank's long-term viability. However, some research indicates that opacity might not severely harm banks, which are more open than non-financial corporations by being subject to strict disclosure standards and balancing mechanisms (Hopt, 2013; John et al., 2010). Special bank auditors are also obliged to perform special investigations to promote the transparency of banking operations and to have unique information responsibilities concerning the supervisory bodies of banks. In addition, a large number of banks are followed by analysts, who may potentially raise transparency levels.

Moreover, country management factors may potentially raise crucial problems for banks (Aggarwal et al., 2011). For example, research into non-financial companies reveals that corporate governance is impacted by a number of factors at a national level, such as domestic financial growth, domestic institutions and the structures of domestic financial systems (Chen et al., 2011; Kumar & Zattoni, 2015; Renders et al., 2010). Berglof (2011) provides an outstanding debate on the interconnectedness of the macro-government (country-level) system with micro-government mechanisms (company-level management) as well as the significance of a strong relationship, stressing the disparities between systems of corporate governance and contending that the same principles might influence nations quite differently. Empirical studies on the relationships between corporate and national governments in the context of banks were undertaken by Caprio et al. (2007) who examined the protection of shareholders' (country-variable) legislation which prevented the expropriation of minority owners in 44 nations in 2001. In particular, they analysed whether governance regulations, like the legislation governing investors' protection, decrease insiders' capacity to expropriate bank resources and increase the market value of banks, a metric that contains an indirect evaluation of banks' management by the market, and discovered that minority shareholder expropriation is common in many nations, though investor protection legislation may limit this.

2.8. Bank Regulations

In general terms, regulation refers to the issuance of authoritative norms together with a promoting and monitoring system such as a governmental agency (Baldwin et al., 1998). In its purest definition, banking regulation is defined as the system of laws and norms that governs banks' operations. According to a very broad definition, supervision includes both the monitoring of banking institutions' financial conditions as well as the continuing implementation of banking laws and policies (Spong, 2000).

In order to ensure financial stability, three key ideas underlie financial regulation: (i) to avoid systemic risk, and to safeguard the integrity of the financial sector, banks are monitored to assure their safety and soundness; (ii) financial regulation gives assurance to depositors and borrowers, thus encouraging banks to provide sound lending and depositing practises while helping to fund economic growth; and (iii) minority depositors who are unable to monitor their banks or have no incentive to do so are protected. There is a need for depositors to have a regulator since banks play a significant role in capital accumulation and distribution. The justification for financial regulation is that it is essential to avoid price and production volatility that might lead to financial crises. According to the IMF (2009), financial regulation reduces systemic risk and safeguarding of customers. Stigler (1971) first recognised the key component of the theory of regulation in 1971, which entails the fusion of political behaviour analysis and economic analysis. The development of the theory is centred on two basic approaches: positive and normative regulation theories (Joskow & Noll, 1981).

Financial regulation has an economic consequence since the activities of financial markets produce externalities that cannot be effectively handled by private agents. The problem is that such externalities, which include the costs borne by individuals due to external factors beyond their control, lead to social costs in the event of failure, which are particularly high when compared to private costs. Moreover, this is accentuated when social costs are not included in the decision-making functions of financial institutions, and particularly banks.

There are two major rationales for regulating the financial markets: the prevention or minimisation of systemic risk; and the regulation of the behaviour of the financial markets. Financial regulation also seeks to safeguard the customer while achieving high levels of economic efficiency in the market, as argued by Falkena et al. (2001). The need to safeguard the customer arises when an institution fails to meet the needs of the customer or acts in an undesirable manner in doing its business (Falkena et al., 2001). Llewellyn (1999) suggests that the three key goals of financial regulation are to safeguard the long-term systemic stability of the economy, to ensure financial institutions' safety and soundness, and to shield the public from financial mishaps. Goodhart et al. (1998) have suggested the primary justification for financial sector regulation have been suggested by as required in order to guarantee that consumers are protected against monopolistic abuse.

Key determinants should be taken into consideration when defining the rationale for regulating financial institutions. In the first instance, there are clear distinctions between regulation, supervision, and monitoring. Regulators supply all three services to multiple stakeholders, all of whom have varying interests. Regulation imposes a wide range of costs, and regulators are typically risk-averse. Finally, regulators may impact and influence the actions of financial firms by incentivising certain behaviours, for example.

Chapter Three

3. First Essay: The Impact of Corporate Governance Practises on Financial Performance of Banks in G7 Countries

3.1. Introduction

The rapid increase of globalisation, the deregulation of capital markets, and the financial scandals followed by corporate downfall have all brought to the forefront the debate about the importance of corporate governance as a tool to regulate the relation between shareholders and managers. Regulatory organisations' attention has shifted to corporate governance legislation and the significance of establishing systems that allow shareholders to control managers and safeguard their interests.

The divergence of interests between shareholders and managers and the need to separate control and ownership have been the premises behind modern corporate finance. As managers have control over and inside information about firms, they can prioritise their own interests and goals over those of shareholders. Managers' interests may take the form of overstaffing, investing in projects that deem managers indispensable, showing resistance to takeovers, investing excessively, and self-dealing, all of which might be undertaken to increase the private wealth of managers at the expense of shareholders (Shleifer & Vishny, 1997; Tirole, 2001).

International banking and finance, with its pioneering implementation of corporate governance, has provided vast material for research in countries such as the United States, Nigeria, and Ghana. Region-specific analyses have looked at the Gulf region and Europe, but none have explored the G7 banks' corporate governance impact on its performance. This research will therefore attempt to explore this uncharted area and analyse the effect of corporate governance on the banking sector in G7 countries. It specifically aims to evaluate how banks' financial performance is related to corporate governance. The researcher's attention was drawn specifically to the banking industry on account of the crucial role that banks play in economies through their provision of finance to other sectors, hence directly impacting GDP growth, job generation, and the circulation of capital. Banks not only affect the monetisation of an economy but also have a wide social responsibility in the allocation of funds for economic benefit and thereby affect corporate governance structures across industries (Avgouleas & Cullen, 2014).

This research was also initiated by of a desire to monitor the disclosure behaviour of publicly listed banks in G7 and G20 countries and to assess how corporate governance practises that include non-financial information disclosure scores impact financial performance. It has been conducted through an examination of the importance of environmental, social, and governance reporting practises by banks in G7 and G20 countries in the last decade with the aim of investigating governance behaviours relative to ESG disclosures from a multi-perspective view. This research also focuses on the G7 nations (the US, UK, Canada, France, Italy, Germany, and Japan) due to their impact on the global economy. Banks in the G7 countries adhere to regulated corporate governance frameworks that are enforced by codes that control any transgressions by shareholders and stakeholders, although such mechanisms vary among the countries being studied, so that the scope and focus of corporate governance regulations in this study diverge.

As previously quantified, the ripple effect of the financial crisis throughout the world's economies is living evidence of G7 banks' significant contributions to local, regional, and national economies. The researcher's main focus is to explore the relationship between corporate governance mechanisms and the financial performance of banks – namely, the return on assets (ROA), return on equity (ROE), and net interest margin (NIM) – and by doing so draw conclusions about the effectiveness of such mechanisms on the overall banking sector.

Numerous studies have addressed the influence of corporate governance on the performance, risk, ownership, and control of companies. Using econometric models, this essay examines the impact of corporate governance on financial performance while also identifying the improvements that must be made to the regulatory environment in order to reach efficient implementation of corporate governance. In investigating strategies for improving banks' financial performance through enhanced mechanisms to strengthen governance, it uses efficient and knowledge-based resources based on verifiable data and offers critical insights on how to improve banks' overall administrative skills and financial performance by applying effective corporate governance mechanisms. Statistical regression models are used to examine the relationship between corporate governance mechanisms and banks' financial performance metrics from a management perspective. In summary, the primary objectives of this essay are to determine:

- The relationship between corporate governance and G7 banks' financial performance in relation to return on assets (ROA).
- The effect of corporate governance on the financial performance of G7 banks in the context of return on equity (ROE); and;

- The relationship between corporate governance and the financial performance of banks in G7 countries in relation to net interest margin (NIM).

The essay examines the link between corporate governance characteristics in relation to CEO duality, board size, board composition of independent directors, board meeting frequency, the gender diversity of board members, audit committee size and meeting frequency, and disclosure flow of information, as judged by a credible and specified disclosure quality score, all in relation to the financial performance ratios of the ROA, ROE and NIM. Within the framework of the selected financial performance metrics, the following research questions (RQ) attempt to address the influence of corporate governance:

- RQ1: To what extent do corporate governance mechanisms have an influence on (ROA) of banks in G7 countries?
- RQ2: What is the impact of corporate governance (ROE) of banks in G7 countries?
- RQ3: To what extent does corporate governance have an impact on (NIM) of banks in G7 countries?

Based on the information provided, it was necessary to analyze the data in relation to the general topic of this research. This analysis included important additional measures related to corporate governance and banking stability. Additionally, there was an unintentional sampling bias issue in the G7 banking sample population. This bias was induced by the inclusion of regional banks in the United States, which made up about half of the observations. As a result, the estimates obtained from the analysis were biased. This issue was identified through an empirical analysis conducted by the researcher in section 3.4.4.9. To address these issues, it was deemed necessary to analyse the data in relation to the general topic of this research and in line with its aim and objectives while introducing a modern advanced analytics tool supported by machine learning, artificial intelligence and pattern-matching and based on a combination of computer science, statistics, and the understanding of the research problem. In this way, this essay endeavours to draw hidden insights from the process of transforming the dataset into a body of useful and applicable knowledge.

Accordingly, the researcher has utilised unsupervised machine-learning techniques (clustering/segmentation analysis) followed by (supervised) regression modelling, thus, introducing advanced big data analytics techniques into the field of corporate governance which further contributes to the uniqueness of this study; sampling bias is resolved by the clustering analysis via segmenting homogenous banking groups based on their corporate governance practises which resulted in hidden insights. (Note

that additional investigations also included clustering analysis of a larger sample representing corporate governance practises of G20 banks in order to validate the clustering results of G7). Therefore, the following research questions are related to the additional investigations conducted by the researcher using machine learning and AI analytical tools:

- RQ4: How can G7 banks be classified by their corporate governance practises and ESG reporting behaviour?
- RQ5: How can G20 banks be classified by their corporate governance practises and ESG reporting behaviour?
- RQ6: To what extent corporate governance practises impact different banking groups' financial performance in G7countries?

The above additional research questions 4 and 5 aim to group G7 and G20 banks respectively with similar corporate governance practises and separate each banking group with different corporate governance practises. These are followed by research question 6, which aims to explore the influence of each G7 banking groups' corporate governance practises on each banking group's financial performance. By answering the above-mentioned research questions via offering empirical evidences using the cluster algorithmic analysis followed by regression modelling, this research will potentially contribute to the existing body of literature hidden insights that emphasize the importance of corporate governance in financial institutions, insights that will ultimately assist regulators, market practitioners, and professionals to evaluate the effects of properly implemented frameworks and practises on the financial performance and stability of the banking sector in the G7 countries.

3.2. Literature Review

3.2.1. Introduction

The origins of corporate governance are largely based on the understanding that the creation of modern corporations has led to complications associated with the separation of ownership and control. Corporate governance's main responsibility is to align the interests of shareholders and managers of those of the company. The last two decades have seen a substantial evolution in corporate governance practises and methods. The aim of this section is to evaluate the empirical research on internal corporate governance mechanisms, especially in banks and non-financial firms, with an emphasis on performance and profitability.

The literature addressing the relationship between corporate governance and financial performance is described in Section 3.2.2, which presents the theoretical and empirical scholarship in seven subsections. We discuss published studies on aspects of board structure such as size, composition, gender diversity, and meeting frequency, and their association with financial performance. Section 3.2.3 provides a holistic definition of corporate governance from different aspects. Section 3.2.4 contains the summary.

3.2.2. Effect of Corporate Governance Mechanisms on Banks' Financial Performance

Corporate governance mechanisms are essential in reducing agency costs and conflicts of interest between shareholders and managers. Board of Directors (BOD) plays a crucial role in implementing proper ownership, debt structure, and compensation plans (Denis & McConnell, 2003; Jensen, 1993) Their tasks have evolved from traditional CEO hiring and evaluation to monitoring and evaluating a firm as a whole (Jensen, 1993) Corporate governance theories of agency, stewardship, and dependency impact performance by controlling, monitoring, servicing, and strategising. Stakeholder theory acknowledges that addressing stakeholders' interests improves relationships between stakeholders within and outside the institution. Board performance is influenced by size, diversity, and structure, which ultimately affects overall corporate performance (Yermack, 1996; Zahra & Pearce, 1989). A board's main responsibility is to oversee and supervise management to preserve the interests of the business and its stakeholders. However, stakeholders and shareholders may have contradictory objectives, with shareholders focusing on short-term profits rather than long-term strategic growth. Ethical/socially conscious investment, corporate sustainability, and corporate social responsibility all consider these expectations (Dermine, 2013; Gali et al., 2016).

Corporate governance practises are influenced by institutional and regulatory settings, past patterns, and culture-specific factors. Research shows that businesses in countries with greater minority shareholder protection are valued more by society (La Porta et al., 2002). Klapper and Love (2004) claim that corporate governance is crucial in nations with weak legislative frameworks, as strengthening it can positively correlate companies' performance and market value. However, it can discourage CEOs from pursuing their own interests that may conflict with the business's broader interests (Fama & Jensen, 1983). Corporate governance is essential both during economic prosperity and downturns, as companies that do not follow proper governance risk exposure to external risks (Choi & Wang, 2009).

A study by Hau and Thum (2009) on state-owned German banks during the 2008–2009 financial crisis highlighted the underperformance of these banks due to weaker monitoring of bank managers and higher risk exposure. They suggested that instead of installing politically connected board members, the state should delegate financial experts to supervisory boards. Private institutions could also benefit from a more competent supervisory board. Enhanced shareholder rights and better representation can improve bank board quality and effective monitoring. Market signals can be considered as indicators of bank risk, and increased market transparency can improve regulatory supervision. The authors suggest exploring prudent bank regulations that explicitly include criteria for board competence and quality to improve financial stability, as large bank losses are at the heart of any financial crisis.

Corporate governance frameworks can improve stakeholder relations, increase financial transparency, and enhance financial disclosure integrity, ultimately impacting the banking sector's financial performance. Robust governance mechanisms deter agency issues and create a disciplined environment for effective decision-making. Empirical literature discusses the influence of internal board-structure mechanisms, board size, composition, diversity, frequency of board meetings, audit committee size and meeting frequency, and disclosure scores on corporate financial performance. These mechanisms are crucial in ensuring a disciplined and effective corporate governance environment.

3.2.2.1. Board Size

Boards of directors (BODs) are essential for optimizing the availability of critical resources for a company (Hillman & Dalziel, 2003) As a firm's reliance on external resources increases, the CEO's need for advice increases, leading to the pressure to increase the size of the board and create one with directors from different backgrounds (Klein, 1998). Board

size is crucial for decision-making, as per the UK Corporate Governance Code (2010). A board that is too small or too large is ineffective, and it should not include more than eight or nine directors (Klein, 1998). Over seven or eight individuals can reduce supervision effectiveness and increase bureaucracy (Jensen, 1993). A negative link between board size and bank profitability was found in a sample of 68 US banks between 2005 and 2007 (Sheikh & Wang, 2012). As board size increases, agency issues emerge, leading to a decrease in board effectiveness due to lack of communication and disorganisation. This results in inferior financial reporting supervision and reduced company performance (Eisenberg et al., 1998; Mak & Kusnadi, 2005).

Guest's (2009) study found a negative relationship between board size and firm profitability and valuation in 2,746 UK companies. These findings align with previous studies by Eisenberg et al., (1998) and Yermack (1996).

Research indicates a positive relationship between board size and firm performance, particularly in Australian and Swiss firms. Large boards establish an external environmental link, adding value to the organisation (Beiner et al., 2006; Kiel & Nicholson, 2003). However, larger boards accommodate a wider range of experiences from different stakeholder perspectives, especially directors from outside the company. A study of UK businesses listed on the London Stock Exchange found a negative correlation between board size and executive turnover (Dahya et al., 2008). Additionally, a negative correlation was found between board size and financial performance. As board size increases, communication becomes difficult, leading to less effective decision-making and reduced overall company performance (Staikouras et al., 2008). Overall, the relationship between board size and firm performance remains a topic of debate.

Research has shown a positive correlation between board size and a company’s financial performance (Coles et al., 2008; Kajola, 2008; Sanda et al., 2010; Sheikh & Wang, 2012). Larger boards attract directors with relevant and complementary business expertise, increasing the depth of their knowledge and experience. However, increasing board size can negatively impact banks’ financial performance, as it can cause communication, organisation, and participation issues. A study by Pathan (2009) found that a larger board minimizes risk-taking, while Minton et al. (2010) found that board size has a detrimental impact on bank performance during non-crisis periods. Vafeas (2000) and Yermack (1996) suggested that increasing board size promotes meaningful, critical debate, enhancing decision-making and ultimately,

business performance. Grove et al. (2011) found an inverse U-shaped relationship between board size and ROA, but in a sample of 328 US commercial banks, there was a statistically insignificant negative association between board size and the risk of default. Overall, the relationship between board size and financial performance is complex and requires further research.

The above discussion has focused on the discoveries of various studies concerning the relationship between board size and firm performance. However, it is evident that researchers have not reached a definitive consensus, and further investigation is required.

Based on the above, the following hypothesis has been developed:

H01a: *Larger board size has a significant and positive impact on banks' financial performance measures within G7 countries.*

3.2.2.2. Board Meeting Frequency

The frequency of board meetings is a crucial internal corporate governance mechanism that directly impacts a firm's value (Vafeas, 1999). The Corporate Governance Code, mainly in Anglo-Saxon countries, restricts executive directors from holding non-executive directorships in other companies to allocate sufficient time to their own companies. The time allocated by the board of directors to a firm is a resource provided to the organisation, and it is the duty of directors to act in the best interests of shareholders (Lipton & Lorsch, 1992). This foregrounds the stewardship theory, which asserts that directors should allocate their time to monitor and control organisations to ensure alignment between shareholders and management (Jensen, 1993). The commitment of a board's membership has often been gauged by the meetings attended by them (Ghosh et al., 2007; Ilaboya & Obaretin, 2015; Johl et al., 2015). However, the authors state that there are no governing laws that dictate how many meetings a board member should attend. The responsibility for monitoring an individual board member's diligence thus falls on the chairperson and as such has a subjective component. An increase in board activities as measured by the number of their meetings will improve internal control mechanisms and might prove less costly than changing the board composition and ownership structure. Vafeas (1999) argues for an inverse relation between market valuation and board-meeting frequency, adding that as the latter increases, an organisation's

performance begins to decline. Xie et al. (2003) claim that a board that meets infrequently only has time to focus on management plans, and as a result the focus on performance issues will be negligible. This demonstrates that board engagement has an impact on performance and is therefore a significant corporate governance factor in performance management. Ntim and Osei (2011) set out to more comprehensively test the theory that board meetings have a significant impact on the overall success of a company through in-depth study of the African economy that focused on Nigeria, concluding that the higher the board-meeting frequency, the greater the level of performance.

Research has shown a negative relationship between the number of board meetings and the return on assets of Forbes 500 firms from 1989 to 1995. This is supported by studies by Conger et al. (1998), Fich and Shivdasani (2006), Ilaboya and Osasu (2015), Johl et al. (2015), and Useem and Zelleke (2006). Board meetings are crucial for business operations and are a good gauge of directors' dedication (Ronen & Yaari, 2008). More frequent meetings are considered more effective (Conger et al., 1998).

However, the frequency of board meetings can interfere with corporate governance rules, leading to coordination and communication issues (Conger et al., 1998). This highlights the importance of board committee meetings in reporting board issues and directing management to align with shareholders' interests. The Malaysian code, which encourages regular board meetings, disclosures, and member attendance, has been found to positively affect board effectiveness (Johl et al., 2015). Francis et al. (2012) confirmed these results, revealing that low-frequency board meetings resulted in lower financial performance compared to high-frequency meetings. The board's obligation to direct and advise management aligns with shareholders' interests.

Taghizadeh and Saremi (2013) found that frequent board meetings lower the ROE and deter agency issues in publicly listed Malaysian firms. The study suggests that a disciplined atmosphere, where corporate decision-making is effectively monitored and the board's expertise is utilized, enhances communication and discipline within the organisation.

Based on the above, the following hypothesis has been developed:

H02a: *Higher board meeting frequency has a significant and positive effect on banks' financial performance within G7 countries.*

3.2.2.3. Board Composition of Independent Directors

Board composition is a contentious corporate governance issue due to its potential to influence top management's decisions and performance. The focus has shifted to the independence of boards, with the main question being the acceptable number of independent board members. The greater the proportion of outside members, the lower the agency costs between management and shareholders (Chizema & Kim, 2010).

The separation between ownership and management control can lead to agency costs, which can be mitigated by having a higher percentage of independent directors on a board (Chizema & Kim, 2010). Independent directors are seen as a tool for supervision and control of management, and the UK Corporate Governance Code (2011) emphasizes their responsibility for maintaining the integrity of financial controls, procedures, systems, and risks in companies (Brennan & McDermott, 2004). By performing their tasks efficiently, independent directors can develop a reputation as experts in decision-making and non-partisan observers of the company's conduct, ultimately leading to more reliable financial performance (Fama & Jensen, 1983; Vance, 1983).

Agency theory suggests that independent directors on a board can led to more independent decisions due to their supplementary skills, experience, expertise, and network (Baranchuk & Dybvig, 2009). This independence allows non-executive directors to carry out their monitoring function more professionally and efficiently, as they are conscious of their reputation and maintain a professional attitude to preserve it (Fama, 1980; Fama & Jensen, 1983). Therefore, independent directors play a crucial role in supervising and controlling managers.

Resource dependency theory suggests that non-executive directors enhance a firm's profitability by providing strategic planning and investment consultancy and fostering community and stakeholder networks. On the other hand, stewardship theory suggests that executive directors are more efficient in monitoring organisations due to their specialized knowledge and decision-making abilities (Baysinger & Hoskisson, 1990). A unified leadership structure with executives can improve a firm's performance by enhancing its overall performance.

Scholars argue that the independence of board directors allows them to express their opinions without fear of repercussions and signals a company's intention to apply good corporate governance practises (Black et al., 2006; Jensen,

1993). A high proportion of independent directors can improve performance, signaling an efficient control system (Fama & Jensen, 1983). Empirical literature shows that boards composed mostly of independent or outside directors have a positive impact on business performance (Cho & Kim, 2007; Yasser, 2011). Independent directors' presence is positively correlated with a firm's performance due to their talents, experiences, and associations with external resources (Gordini, 2012). As the ratio of outside directors increases, the overall performance of the company tends to improve, adding value to the organisation. Agency and resource dependency theories are both efficient, with non-executive directors being effective monitors of management performance and enforcers of corrective action. Studies have found that greater representation of non-executive directors on the board can improve corporate performance. In Ireland, independent board members have a positive impact on a company's overall performance (O'Connell & Cramer, 2010).

Trabelsi (2010) found that Tunisian commercial banks with a higher number of non-executive directorships reported better performance, as assessed by Tobin's Q and the ROA. Studies found a positive correlation between the number of independent directors and a bank's performance, a strong correlation between outside directors' engagement and company performance, and a significant correlation with financial performance (Alonso & Gonzalez, 2006; Cho & Kim, 2007; Cornett et al., 2011). Staikouras et al. (2008) found that board composition has a favourable but statistically insignificant influence on both the ROA and ROE. Fama and Jensen (1983) argue that the independence of non-executive directors makes it easier for them to provide constructive criticism and help reduce information asymmetry between shareholders and executives. These studies show that boards with a high number of external directors provide better performance. The value of an independent board is evident in times of crisis as independent members have access to information and external resources. Outsiders function as competent, independent decision-makers because they value the preservation of their reputations as independent decision-makers. The value of an independent board is evident in times of crisis as independent members have access to information and external resources (Daily & Dalton, 1994).

In contrast, research indicates that a higher percentage of non-executive directors on a board negatively impacts a firm's financial performance. Studies have shown a negative correlation between performance and the number of outside directors (Yermack, 1996), with a negative correlation found in Canadian businesses between 1976 and 2000 (Bozec, 2005). Cheng's (2008) study of 2,980 US enterprises from 1996 to 2004 also found a negative relationship between

business performance and board composition. De Andres and Vallelado (2008) argue that non-executive directors may not devote enough time to the company and lack the necessary knowledge and expertise to make crucial decisions, leading to a negative relationship between non-executive directors and bank performance. Bhagat and Bolton (2008) confirmed a negative relationship between board independence and firm performance.

Further, empirical studies have shown that independent directors do not significantly impact company performance, as per studies by Bonn et al. (2004), Llewellyn and Muller-Kahle (2012), and Minton et al. (2010). Fernandes et al. (2016) examined the banking data of 298 US banks and concluded that independent directors had no impact on the institutions' stock performance. Furthermore, claims of extra skill sets and knowledge brought by independent directors have been refuted, and no empirical evidence supports the propositions of stewardship and agency theory regarding the impact of board composition on firm financial performance (Belkhir, 2009; Ehikioya, 2009).

Studies on the impact of outside directors on non-financial firms' performance have yielded mixed results. Some studies suggest a positive relationship between board composition and a bank's profitability, with banks with more independent directors outperforming those with fewer (Al-Hawary, 2011; Al-Sahafi et al., 2015; P. Staikouras et al., 2007). To support the execution of effective corporate governance that improves decision-making, the appointment of an independent director is crucial (BCBS, 2006; 2010; 2015). However, others argue that board composition is negatively linked to bank performance, as non-executive directors often lack knowledge of the banking business and face challenges due to its complex operations (Adusei, 2012; Al Manaseer et al., 2012; De Andres & Vallelado, 2008). The additional responsibilities and part-time status of these directors add to their inefficiency and lack of focus (Jiraporn, et al., 2009). Some studies show no significant relationship between board composition and performance (Adams & Mehran, 2012; Romano et al., 2012; Zulkafli & Samad, 2007).

Regulatory financial bodies in the G7 countries have issued codes of efficient corporate governance best practises, aiming to balance authority between executive and non-executive directors, ensuring no individual or group dominates the decision-making process in a firm.

Based on the above, the following hypothesis has been developed:

H03a: *Larger board composition of independent directors (outsiders) is an important banking governance mechanism and significantly positively impacts financial performance in G7 countries.*

3.2.2.4. Board Gender Diversity

The issue of gender diversity in boards of directors (BODs) and top management is a contentious topic, with both researchers and regulators scrutinizing it. Stakeholder theory suggests that placing women in authority positions can offer social benefits, such as enhancing decision-making and addressing difficult managerial issues (Cabrera Fernández et al., 2016).

Representation of minority groups, such as women and ethnic minorities, can also improve governance and the quality of management as it is valuable in offering a different and unique perspective that is useful in enhancing decision-making (Westphal & Milton, 2000). Kramer et al. (2007) have argued that when a company board includes three or more women, the perspective of stakeholder groups such as employees, customers, and the community will be represented, and thus governance improved. In addition, women tend to confront difficult managerial issues, which enhances a board's decision-making process.

Studies have shown that having female representation on corporate boards and senior management positions has a positive impact on financial performance and success. Prihattiningtyas (2012) confirmed this conclusion by studying the positive impact of gender diversity on profitability and financial position on the ROA, ROE, and return on sales (ROS) indices, in addition to Tobin's Q. Willows and Van der Linde, (2016) have asserted that women directors in South Africa have a positive influence on return on assets and return on equity. The positive correlation between financial performance and the participation of women is also confirmed by studies by Carter et al. (2003) and Smith et al. (2006). Investors typically respond favourably to the participation of women directors in Singaporean businesses (Kang et al., 2010). Greater gender diversity on a board of directors is directly connected to increasing the value of shareholders' holdings (Carter et al., 2003).

Above propositions contradict those advanced by Darmadi(2011) who discovered that female executives had a detrimental impact on the performance of the firm as measured by the ROA, while a study conducted by Prihattiningtyas

(2012) arrived at a more equivocal view, showing that greater gender diversity in the workplace has both a positive and negative impact on a company's success and may or may not have a detrimental influence on overall performance.

It can therefore be concluded that there is no consensus on the effect of a board of directors' gender diversity on financial performance. However, most studies confirm that the presence of women on boards has an evident positive impact on the management and strategic and financial direction of firms.

Based on the above, the following hypothesis has been developed:

H04a: *Higher board gender diversity (outsiders) is an important banking governance mechanism and significantly positively impacts financial performance in G7 countries.*

3.2.2.5. Audit Committee Size and Meeting Frequency

Kesner (1988) and Romano et al. (2012) argue that board members (BODs) should form committees to oversee a company's operations, including audit, risk, nomination, remuneration, and compliance. These committees have a positive impact on banks' risk mitigation and performance (Bussoli et al., 2012). Board committees are an efficient system to objectively monitor the operations, activities, and functions of banks (BCBS, 2015; 2010). An audit committee evaluates a company's internal controls and risks, ensuring executive management adheres to company policies, procedures, rules, regulations, transparency requirements, and financial reporting standards. The committee's independence is crucial for its integrity in its supervisory role. It also coordinates and reviews work related to the bank's audit function, performing frequent checks and organising audit-related deliverables. This ensures the protection of shareholders' wealth and investments.

An audit committee is crucial for financial reporting and has been the subject of numerous studies focusing on its optimal size, composition, expertise, and meeting frequency (Walker et al., 2005). The size of an audit committee can significantly impact its performance, as an insufficient number of directors can lead to ineffective monitoring and control issues (Vafeas, 2005). A workload spread between too small a number of directors may cause problems of coordination and the committee may fall short of performing its significant task (Jensen, 1993) A general rule of thumb is for a committee to be around three to four people (Abbott et al., 2004; Xie et al., 2003).

A larger audit committee is more efficient in monitoring management, as evidenced by an analysis of audit committee size and quarterly earnings management in 896 US corporations between 1996 and 2000 (Krishnan, 2005). This suggests that a suitable number of audit committee members significantly impacts the monitoring and integrity of financial reporting. Firms concerned with their auditor's reputation are more likely to assign one of the Big Four auditors and have a larger size audit committee to ensure effective and monitored financial reporting (Chen & Zhou, 2007).

Frequent meetings of an audit committee lead to more efficient and diligent monitoring, leading to more efficient accounting practises. It is argued that frequent meetings of an audit committee will lead to more efficient and diligent monitoring and thus more efficient accounting practises (Abbott et al., 2004; Beasley, 1996; Xie et al., 2003).

Chen et al. (2015) found that while the presence of an audit committee does not directly improve earnings quality, a committee with a substantial role can significantly enhance a company's overall performance. Durgavanshi (2014) found no correlation between audit committees and return on equity (ROE) and operational self-sufficiency (OSS), while Fanta et al. (2013) found a negative impact on bank financial performance. Klein (2002) confirmed a negative correlation between audit committee independence and earnings.

The independence of an audit committee can lower a company's financing debt cost, while its size and number of meetings directly impact its yield spreads (Anderson et al., 2004; Kajola, 2008). The presence of a majority of outside members on an audit committee has no statistical significance for a company's performance (Kajola, 2008). However, experienced accounting or finance independent directors have a significant negative effect on returns and earnings (Agrawal & Chadha, 2005), while non-experienced independent members in finance or risk have a positive effect on financial errors (Abbott et al., 2002). An experienced audit and accounting member on the committee has been reported to have a positive market response (Davidson et al., 2004; Defond et al., 2005).

The number of non-executives on an audit committee has no impact on performance. The structure of an audit committee is not specifically correlated to the number of fraud events in a company (Beasley, 1996), and there is no correlation between improvements in financial performance and the presence of an audit committee (Carcello & Neal, 2000).

The failure of a firm is often attributed to the inability of board committees to take corrective action. However, audit committees can enhance corporate image, accountability, legitimacy, credibility, and performance (Weir et al., 2002). Businesses with more audit committee meetings pay higher audit fees, indicating a higher level of assurance and quality auditing (Krishnan & Visvanathan, 2009).

The agency theory addresses the separation between ownership and management, highlighting the importance of functions monitoring risk, remuneration, auditing, and nomination (Roche, 2005). The adoption of audit and risk committees has been a focus for regulators and shareholders. (BCBS, 2006; 2010; 2015) recommends that board committees be composed of independent and non-executive directors to ensure proper supervision of banks' functions and internal control systems. This ensures shareholders' confidence and guarantees the integrity of board committees in audit, risk management, compensation, nomination, and compliance.

Based on the above, the following hypotheses has been developed:

H05a: *Larger audit committee size has a significant and positive relationship with financial performance measures of banks listed on the 7 major advanced markets.*

H06a*: Higher audit committee meeting frequency has a significant and negative effect on banks' financial performance in G7 countries.*

3.2.2.6. CEO Duality

Duality is a leadership style where one person holds both the CEO and chairperson positions, concentrating their power. The chairperson manages the board, schedules meetings, sets strategic plans, monitors managers, reviews performance, and resolves issues, while the CEO oversees daily operations and complies with the board's guidelines (Laing & Weir, 1999). Supporters argue that CEOs' quick reactions and knowledge of bank operations make them skilled and effective leaders, as chairpersons they will be better aware about bank operations and will make clever and smart judgments (Brickley et al., 1997).

The stewardship theory posits that CEO duality can enhance knowledge and facilitate more effective decision-making processes, ultimately leading to enhanced performance (Weir et al., 2002). Nevertheless, research conducted by

Durgavanshi (2014) has revealed that CEO duality does not have a substantial influence on a company's financial performance. Mollah and Zaman (2015) found that in Islamic banks, there is a detrimental correlation between role duality and performance.

Jensen (1993) argues that the CEO's position must be independent of the chairperson for the board to be effective, and that CEO duality generates information flow difficulties. The CEO's role must be independent of the chairperson, as they are responsible for the agenda, declaration of information, and decision-making.

Since CEO and chairperson are the same, CEO duality eliminates agency costs (Alexander et al., 1993) (Alexander et al., 1993). However, some literature suggests that combining the roles of CEO and chair negatively affects performance (Jensen, 1993; Lipton & Lorsch, 1992) because the board remunerates the CEO, increasing agency costs. Duality lowers return on equity, return on investment, and profit margin, according to Rechner and Dalton (1991)'s 1978–1983 study of 141 large US companies.

Agency theory suggests that separating the chairpersonship and CEO position can improve a board's effectiveness and monitoring function (Finkelstein & D'aveni, 1994). This separation allows the board to efficiently monitor and evaluate the CEO's performance, limiting corrupt behaviour (Haniffa & Cooke, 2002; Lipton & Lorsch, 1992). Dahya et al. (1996) examined the stock prices of 124 UK companies from 1989 to 1992 market reacts positively to the separation of roles, suggesting that the board's independence is crucial for efficient performance evaluation.

Banks face challenges in implementing CEO discipline due to opacity and agency costs, making it essential to separate leadership roles. Studies have shown that appointing risk-averse CEOs with dual roles does not incentivize banks to take risks. Pathan (2009) found that CEO duality negatively impacts bank risk-taking, while Simpson and Gleason (1999) in their study of 287 US banks between 1989 and 1993 found that CEO duality reduces the likelihood of financial distress by protecting personal interests. Berger et al. (2016) found that CEO duality decreases bank default risks for up to two years before default, based on factors such as market competitiveness, state economy indicators, regulatory bodies, and government fund allocation policies. They also found that a bank's performance is more dependent on managerial

incentives than board structure. Therefore, it is crucial to separate leadership roles in banks to ensure effective risk-taking measures.

The findings above challenge the notion that CEO duality undermines corporate governance. While it may negatively impact equity governance in banks, it can enhance performance by reducing bank default and risk-taking. This suggests that CEO duality could strengthen bank governance from the perspective of stakeholders and the community. The issue is addressed by regulators and corporate governance code regulations, which emphasize the importance of a separation between CEO and chairperson, assigning clear responsibilities to prevent individual decision-making authority. Some codes have also extended the criteria for assigning an independent chairperson.

Based on the above, the following hypothesis has been developed:

H07a: *There is a significant and negative relationship between CEO duality and banks' financial performance.*

3.2.2.7. Environmental, Social, and Governance (ESG) Disclosures' Quality (Transparency)

The financial crisis has been attributed to a lack of financial disclosure and poor oversight of directors, leading to increased regulatory demands and stringent disclosure requirements. This has complicated accounting rules, and shareholders and the public now believe corporations must provide accurate information about financial performance, liabilities, ownership, and corporate governance to help investors make informed decisions (Kosack & Fung, 2014; Organisation for Economic Cooperation and Development (OECD, 2004). Disclosure is connected to corporate governance in two ways: first, it is necessary for the efficient operation of internal and external governance systems, second it is a sign of proper functioning of these mechanisms (Chen & Lu, 2009). Beekes and Brown (2006) found a direct positive association between the level of disclosure in firms and the quality of governance. Open and accurate information is in the best interest of all investors, allowing them to evaluate a company's governance and respond to managerial actions. Transparency exposes hidden risk and provides a clear understanding of the firm's future and finances (UNCTAD, 2011).

Research on corporate governance practises in Indonesian, Nigerian, Japanese, and Canadian banking sectors has shown that larger, established banks release more information than newer, smaller ones, despite the latter having more disclosures about board members (Boolaky & Thomas, 2010; Darmadi, 2013; Feldioreanu & Seria, 2015; Maingot &

Zeghal, 2008; Nwakama et al., 2011). This lack of disclosure is attributed to bank managers' ignorance of the advantages of disclosures (Darmadi, 2013). Maingot and Zeghal (2008) argue that disclosures are influenced by managers' strategic concerns and that small banks often publish the same corporate governance disclosures due to their tendency to emulate one another.

Boolaky and Thomas (2010) found that non-executive directors on boards, cross-ownership, capital adequacy ratio, and auditor quality influence corporate governance disclosure in Japanese banks. Feldioreanu and Seria(2015) found that culture influences corporate governance transparency, with banks that disclose more information typically performing better. The size of the bank does not seem to impact this relationship (Boolaky & Thomas, 2010; Feldioreanu & Seria, 2015).

The Basel I Accord in 1999 emphasized market discipline, leading to the regulation of bank capital and disclosure as a means of achieving this (Baumann & Nier, 2004, 2006; Hirtle, 2007). However, finding a negative correlation between the cost of capital and disclosures is challenging (Botosan, 1997). While Botosan and Plumlee (2002) found a positive correlation between cost of equity and timely disclosures, no correlation was found between the cost of equity and disclosures in general. Al-Tuwaijri et al. (2005) suggested that disclosure positively impacts performance, as it lowers stock volatility, lowers capital costs, and enhances stock compensations. Hirtle (2007) found that efficient risk-taking and better risk return are positively associated with disclosures. Lu et al. (2007) found a positive relationship between ownership structure, disclosure, and performance, while Hassan (2011) found a negative relationship. Nurul and Raudah, (2012) found a positive link between disclosure and performance in Malaysian Islamic banks. Huang et al. (2021) argued for a modest positive relationship between disclosures and performance.

Various studies have come to different conclusions concerning the connection between the level of disclosure and financial performance in the financial sector. Since information is an important component in assessing investment opportunities, this essay assesses what relationship there might be between disclosure and banks' performance, particularly in the context of regional and diversified banks in the G7 countries.

Based on the above, the following hypotheses has been developed:

H08a: *Higher governance disclosure quality (transparency) has a significant and positive relationship with financial performance measures of banks listed on the 7 major advanced markets.*

Table 3:1 *Literature Review Summary*

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
1	Pathan and Faff (2013)	USA	212 National and State Bank Holding Companies	1997–2011	Board Size, Independent Directors, and Board Gender Diversity	Pre-Tax Operating Income to Assets Ratio, Return on Assets (ROA), Return on Equity (ROE), Net Interest Margin (NIM), Tobin's Q, and Stock Returns	Total Assets, Equity to Assets Ratio, Stock Price Risk, Merger & Acquisition as Dummy Variable, and Year	Two-Step System Generalised Method of Moment	Board size and independent directors decrease bank performance Board gender diversity positively impacts performance
2	De Andres et al. (2005)	OECD Countries	450 Non-Financial Firms	1990–1996	Board Size, Proportion of Independent Directors, Proportion of Inside Directors, and Board Meetings	Price to Book Value (P/BV), Tobin's Q, and Return on Assets (ROA)	Director Compensation, Total Assets, Long-term Debt to Assets Ratio, Sales, and Corporate Governance System as Dummy Variable	Uniequational Ordinary Least Squares (OLS) and Three Stage Least Squares	A negative relationship between firm value and board size, No consistent relationship between the proportion of outsider directors and firm value
3	Haniffa and Hudaib (2006)	Malaysia	347 Firms Listed on The Kuala Lumpur Stock Exchange	1996–2000	Board Size, Proportion of Independent Directors, CEO Duality, Multiple Directorships, Block Shareholding, Directors Ownership	Tobin's Q and Return on Assets (ROA)	Tobin's Q 1-Year Lag, Return on Assets 1-Year Lag, Sales, Capital Expenditures, Industry Classification	Ordinary Least Square (OLS)	Board size and top five substantial shareholdings are significantly associated with both market and accounting performance measures A significant relationship between multiple directorships and market performance The role of duality and managerial shareholdings are significantly associated with accounting performance
4	Mandiri et al. (2023)	Indonesia	23 Banks Listed on the Indonesia Stock Exchange	2015–2019	Board Size and Board Meetings	Debt to Equity Ratio (DER), Capital Adequacy Ratio (CAR), Return on Assets (ROA), Return on Equity (ROE), and Non-	N.A.	Partial Least Square (PLS)	The existence of the board of directors and the frequency of meetings, indicators of the corporate governance variable, have positive effect on capital structure as reflected by DER and CAR. The existence of the board of directors and the frequency of meetings, indicators of the

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
						Performing Loans (NPL)			corporate governance variable, have negative and significant effect on corporate performance as reflected by ROA, ROE, and NPL.
5	Rashid et al. (2020)	Nigeria	15 Banks Listed on the Nigeria Stock Exchange	2013–2015	Board Independence, Board Meetings and Board Gender	Return on Assets (ROA)	N.A.	Random Effects	Board independence, board genders, and board size are negatively insignificantly linked to ROA. Board meetings are negatively significant in relation to ROA.
6	Sobhan (2021)	Bangladesh	20 Financial Institutions (Non-Banking) Listed on Dhaka Stock Exchange	2012–2018	Board Size, Proportion of Independent Directors, Proportion of Female Directors, Number of Board Meetings and Percentage of Directors' Ownership	Return on Assets (ROA)	N.A.	Ordinary Least Square (OLS)	Board size and female directors are positively and significantly related to firm performance. The proportion of independent directors, number of board meetings and percentage of directors' ownership have no significant impact on firm performance.
7	Zhang et al. (2020)	USA	244 Public-Shareholding Banks	2007–2015	Bloomberg's Governance Disclosure Score and Social Responsibility Disclosure Score (Measures of Transparency)	Return on Assets (ROA) and Return on Equity (ROE)	Total Assets, Leverage, Operating Cash Flow and Provision for Loan Loss Tier 1 Capital Ratio and Operating Profit Margin	Ordinary Least Square Regressions (OLS)	Banks with a higher social responsibility disclosure score and stronger corporate governance tend to have lower percentages of Level 3 fair-value assets.
8	Musah and Adutwumwaa (2021)	Ghana	30 Rural Banks	2010–2018	Board Size, Board Independence, Board Gender Diversity and CEO Duality	Return on Assets (ROA) and Return on Equity (ROE)	Total Assets	Ordinary least square regressions (OLS)	A positive but statistically insignificant association between CEO duality and ROA and ROE. Board independence was found to be a significant determinant of rural bank financial performance. A negative statistically significant association exists between gender diversity on the boards of the rural banks and ROA and ROE.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
9	El Idrissi and Alamia (2021)	Morocco	6 Banks Listed on Casablanca Stock Exchange	2014–2019	Board Size, CEO Duality, Board Independence, Foreign Directors, Board Meeting Frequency, Audit Committee Size, Independence of Audit Committee, Nomination & Renumeration Committee Size, Independence of Nomination & Renumeration Committee, Audit Committee Meetings, Nomination & Renumeration Committee Meetings	Return on Assets (ROA), Return on Equity (ROE), and Tobin's Q	Total Assets, Equity to Assets, and Market Capitalisation	Generalised Method of Moments (GMM) EGLS	Most board mechanisms have a negative impact on financial performance. The audit committee and nomination & remuneration committee have a positive effect on financial performance. The negative impact of size, meetings, and director's independence is consistent with the agency theory's aims. The high number of meetings is the direct result of board missions' multiplicity, passing from negotiating and issuing all loans with or without mortgages or other guarantees on corporate assets to establishing the bank's vision.
10	Hashed and Almaqtari (2021)	Saudi Arabia	102 Public-Shareholding Firms	2014–2019	Board Size, Board Independence, Board Meetings, Audit Committee Size, Audit Committee Meetings, Audit Committee Independence, Audit Quality, Family Ownership, Board/Managerial Ownership, Foreign Ownership	IFRS Compliance, Earning Management, and Financial Reporting Quality	IFRS Adoption Period as a dummy variable (Pre/Post IFRS)	Ordinary Least Square Regressions (OLS)	Board size, board meeting and foreign ownership had negative effects on compliance with IFRS, board and audit committee independence exhibited a positive effect. Board and audit committee size, audit committee meeting and managerial ownership had significant negative effects on financial reporting quality. Board and audit committee independence showed a significant positive effect on financial reporting quality.
11	Warrad and Khaddam (2020)	Jordan	11 Banks Listed on the Amman Stock Exchange	2015–2018	Board Size, Board Meetings, Audit Committee Size, Audit Committee Meetings	Return on Equity (ROE)	Total Assets and Return on Assets (ROA)	ANOVA & Ordinary Least Squares (OLS)	Characteristics of the corporate governance, whether combined or individually, have a positive impact on the performance of the companies.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
12	Boshnak (2021)	Saudi Arabia	70 Leading (Excluding Financial and Insurance) Firms Listed on Saudi Stock Exchange	2017–2019	Board Size, Independence, and Meeting Frequency, Audit Committee Size and Meeting Frequency, CEO Duality and Ownership Concentration	Return on Assets (ROA), Return on Equity (ROE), and Tobin's Q	Total Assets, Debt to Assets Ratio, and Firm Age	Ordinary Least Square Regressions (OLS)	The results show that firm performance deteriorates with board size and independence, audit committee and meeting frequency, and the presence of CEO role duality, while performance improves with board meeting frequency and ownership concentration. Stakeholders should apply pressure on investee firms to maintain smaller boards, engage genuinely independent directors, separate the role of chairman and CEO, and maintain smaller audit committees with fewer and more effective meetings.
13	Sormin and Manona (2022)	Indonesia	28 Manufacturing Firms Listed on Indonesia Stock Exchange	2015–2019	Value-Added Intellectual Capital Efficiency, Managerial Ownership, Percentage of Independent Directors on BOD, and Percentage of Independent Directors on Audit Committee	Return on Assets (ROA)	N.A.	Ordinary Least Square Regressions (OLS)	Intellectual capital and independent commissioner proportions positively impact a company's financial performance, while managerial ownership negatively affects it, and independent audit committee proportions positively affect it.
14	Abdullah and Tursoy (2019)	Germany	364 Non-Financial Firms Listed on Frankfurt Stock Exchange	2002–2018	Audit Committee Independence, Board Size, and CEO Duality	Return on Assets (ROA) and Return on Equity (ROE)	Long-Term Debt to Equity and IFRS Adoption as Dummy Variable (Pre and Post Adoption)	Fixed Effects	The audit committee and board negatively impact firm financial performance, while CEO duality is not significant. Large board sizes may cause decision-making issues.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
15	Hunjra, et al. (2020)	10 Asian Countries / Emerging Economies (China, India, Indonesia Lebanon, Malaysia, Pakistan, Philippines, Thailand, Turkey, and Vietnam)	116 Banks Listed on 10 Asian Stock Exchanges	2010–2018	Board Size, CEO Duality, Board Independence, Block Holders, and Capital Regulations, Income Diversification, Asset Diversification	Z-Score and Non-Performing Loans (NPLs) Ratio	Equity to Assets Ratio, Deposits to Assets Ratio, and Total Assets	Generalised Method of Moments (GMM)	Income diversification, asset diversification, board size, CEO duality, board independence, block holders, and capital regulation all play a role in bank risk-taking. Noninterest incomes increase credit risk, while asset diversification decreases insolvency risk. Larger boards tend to undertake less risk, while CEO duality increases risk-taking. Board independence increases risk, while block holders help align interests between managers and shareholders. Capital regulation, measured by the capital adequacy ratio, positively affects bank risk-taking, while increasing it leads to lower solvency risk as banks meet regulatory requirements.
16	Khan and Zahid (2020)	19 Asian Countries	79 Islamic Banks	2011–2016	Islamic Corporate Governance Index, Shariah Board Size, Proportion of Shariah Board Having University Degree of Accounting, Finance Economics, Board Size, Proportion of Independent Directors on Board, Board Meetings, Percentage of Institutional Block Holdings	Return on Assets (ROA), Return on Equity (ROE), and Tobin's Q	Z-Score, Equity to Assets Ratio, and Non-Performing Loans Ratio	Random Effects	Islamic Corporate Governance Index (ICG) was found insignificant with ROA. University education and knowledge of Shari'ah of the members of the shariah board have a positive impact on banks' performance. Shariah board expertise was not found significant in case of two other performance variables, i.e., ROA and Tobin's Q, which is consistent with the work. Board size and independence individually were not found significant and ineffective to influence performance. The results of the control variables of equity to assets ratio was found significant only in case of ROE; the non-performing loans ratio was significant in case of Tobin's

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
									Q. Z-score was consistently found significant, demonstrating that the more stable firms have been able to perform better.
17	Boachie (2021)	Ghana	23 Banks	2006–2018	Audit Committee Size, Proportion of Non-Executive Directors on Board, Board Size, CEO Duality, Local Institutional Ownership and Board Ownership	Return on Assets (ROA), Return on Equity (ROE), and Tobin's Q	Total Assets, Inflation, Credit Risk, Exchange Rate, Deposits, and GDP Growth Rate	Random Effects	Audit independence, CEO duality, non-executive directors and bank size have a positive impact on performance. Foreign ownership has an interacting effect T Audit independence, CEO duality, non-executive directors and bank size have a positive impact on performance.
18	Aslam and Haron (2020)	Middle East, South Asia, and Southeast Asia	129 Islamic Banks	2008–2017	Board Size, Number of Non-Executive Directors on Board, CEO Duality, Audit Committee Size, Shariah Board Size, and Risk Management Committee Size	Return on Assets (ROA) and Return on Equity (ROE)	Total Assets, Debt to Equity Ratio, Foreign Ownership, Market Share of Assets, CEO Gender, Board Meetings, Inflation, and GDP Growth	Generalised Method of Moments (GMM) Two-Step Wise	Audit committee and Shariah board have positive impact on the performance of Islamic Banks (ROA and ROE). Board size and risk management committee have negative and significant effect on the performance of Islamic Banks. CEO duality and non-executive directors have mixed relationship with the performance of Islamic banks. These results support the argument that Islamic banks need to improve their financial performance through appropriate governance mechanisms.
19	Issa et al. (2021)	11 Middle Eastern Countries	80 Banks	2011–2018	Board Nationality Diversity, Board Gender Diversity, and Board Educational Level	Return on Assets (ROA) and Return on Equity (ROE)	Board Size, Board Independence, CEO Duality, Board Meetings, Total Assets, Equity to Assets Ratio, Deposits to Assets, High-Income Countries	Generalised Method of Moments (GMM)	A significant relationship exists between board diversity and financial performance in banks. Board diversity related to nationality has a significant positive impact on bank performance. An insignificant association exists between gender and

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
							as Dummy, and Year Effect		educational level diversity and bank performance.
20	Agyei-Mensah (2021)	Ghana	30 Firms Listed on Ghana Stock Exchange	2014–2018	Board Size, Proportion of Independent Directors on Board, Board Gender Diversity, Financial Experts on Board, and Board Meetings	Investment Rate	Return on Assets (ROA), Institutional Ownership, Non-Current Liabilities to Equity Ratio, and Current Assets to Current Liabilities Ratio	Ordinary Least Square Regressions (OLS)	Board size and meetings negatively insignificantly impact investment rate. Proportion of independent directors and financial experts on board negatively and significantly affect investment rate. Board Gender Diversity positively insignificantly affects investment rate. ROA, institutional ownership, and current assets to current liabilities ratio affect negatively insignificantly investment rate, while non-current liabilities to equity ratio affects positively insignificantly investment rate. The overall findings imply that independent directors and financial experts on the board can help firms reduce overinvestment and improve investment efficiency.
21	Fariha et al. (2022)	Banglade sh	30 Banks Listed on Dhaka Stock Exchange	2011–2017	Board Size, Board Independence, Female Directors on Board, Family Duality, Board Meetings, Audit Committee Size and Meetings, Audit Committee Independence, and Independence of Audit Committee Chairman	Return on Assets (ROA), Return on Equity (ROE), Tobin's Q, and Stock Return	N.A.	Ordinary Least Square Regressions (OLS)	Board independence has a negative and significant relationship with ROA and Tobin's Q. Board independence has a positive and significant relationship with stock return. Boardd diversity has a negative and significant relationship with ROA and ROE, which implies inefficiency of diversified board members in the context of Bangladesh. Family duality has a positive and significant relationship with ROA and a negative and significant relationship with stock return.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
									Audit committee size has a negative and significant relationship with Tobin's Q. Independence of audit committee chairman has a negative and significant relationship with Tobin's Q and stock returns. Presence of non-executive directors and number of audit meetings have no significant relationship with any of the predicted variables.
22	Jatana (2023)	India	196 Firms Listed on S&P Bombay Stock Exchange 500	2010–2019	Block Ownership, Ownership Concentration, Board Size, Board Independence, CEO Duality, and Return on Equity	Total Compensation and Cash Compensation	Total Assets, Firm Age, Debt to Equity Ratio, Stock Volatility, Industry Dummies, and Year Dummies	Random Effects and Generalised Method of Moments (GMM)	Block ownership and ownership concentration negatively impact CEO compensation measures and pay performance relationship. Board size had a negative direct and moderating impact on CEO compensation; however, the linkages were generally insignificant, especially for total pay. Outsider block holders were found to be playing an insignificant role. Board independence positively influences CEO compensation levels and pay performance relationship, though the results were mixed with respect to significance. A comparison before and after the new Indian Companies Act 2013 also revealed similar results, particularly in the after period.
23	Ronoowah and Seetanah (2023)	Mauritania	38 Non-Financial Firms Listed on the Mauritanian Stock Exchange	2009–2019	Mauritius Corporate Governance Index and Debt to Equity Ratio	Return on Equity (ROE) and Tobin's Q	Revenue Growth, Current Assets to Current Liabilities Ratio, Firm Age, Total Assets, Fixed Assets to Total Assets Ratio, and Audit Quality	Panel Data Techniques of Random and Fixed Effects	Corporate governance has a positive but insignificant influence on ROE and Tobin's Q. Capital structure has a significant negative impact on both ROE and Tobin's Q and supports the pecking-order theory (POT). The interaction of corporate governance and capital

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
									structure influences financial performance, but the strength of the moderating effects depends on the performance measure being used. Both corporate structure and corporate governance have no mediation effects in their relationship with financial performance measured by ROE and Tobin's Q. The results indicate that the combination of high leverage ratio and good governance practises of companies can improve FP and increase investor confidence, resulting in a positive reaction on their market share prices.
24	Fiador (2022)	Ghana	26 Selected Banks	2006–2016	Board Size, Board Independence, CEO Duality, Board Gender Diversity, and GDP	Z-Score, Non-Performing Loans Ratio, and Loan Loss Provisions Ratio	N.A.	Panel Corrected Standard Errors (PCSE) – 2-Stage Least Squares (2SLS)	Independence, gender diversity, size and leadership consolidation can have significant effects on the risk profile of banking firms. Female board gender diversity on Ghanaian banking boards follows the tokenism theory. Attaining a critical mass of female board members imposes a significant control on risk-taking behaviour by banks.
25	Lin and Qamruzzaman (2023)	Bangladesh	75 Financial Institutions Listed on Dhaka Stock Exchange	1990–2019	IT Adoption, Financial Disclosure Quality, Environmental Disclosure, and Corporate Governance Index Constructed by the Authors (Utilising Board Meetings, Female Directors, Institutional Ownership, Number of	Market Value Added, Return on Equity (ROE), Stock Return	Total Assets, Firm Age, and Debt to Finance Operating Activities	Ordinary Least Squares (OLS) and Generalised Method of Moments (GMM)	A positive and statistically significant association between a firm's sustainability and target explanatory variables. The study extended the empirical valuation by implementing a system-GMM and documented a positive linkage between financial and environmental disclosure, IT adaptation, good governance, and the firm's performance sustainability. Information symmetry, investor protection, and

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
					Committees Established, and Dividend Payments)				access to financial services foster and stabilize the firms' performance. Corporate governance effects a mediating role with positive influences on financial performance augmentation. The study postulated that financial policymakers should address fairness and integrity in disclosing information to the public.
26	Neves et al. (2022)	Portugal	34 Portuguese Non-financial Firms Listed on Euronext Lisbon Stock Exchange (Excluding Firms in the Sports Sector)	2015–2019	Board Size, Board Gender Diversity, Board Independence, Presence of Audit Committee (Y/N), Presence of CSR Committee (Y/N), and Environmental Expenses	Return on Assets (ROA), Return on Equity (ROE), Tobin's Q, and Stock Return	Debt to Equity Ratio and Firm Age	Generalised Method of Moments (GMM)	From the managers' perspective, the existence of an audit committee and environmental expenses increase costs and reduce results, negatively influencing corporate performance, but the company's maturity adds synergies in resource management and positively influences performance. Shareholders consider that gender diversity and board independence positively influence performance, whereas for external stakeholders and long-term investors gender diversity and the social responsibility committee harm the performance of Portuguese companies. But environmental and social expenditures have a positive effect, showing that the market's perception is that, in the long run, it is essential to eradicate poverty and protect the environment.
27	Bezawada and Adavelli (2020)	India	34 Commercial Banks	2009–2018	Board Size, Proportion of Independent Directors, Proportion of Executive Directors, Proportion of Directors on More than Three	Return on Assets (ROA), and Non-Performing Loans Ratio (Asset Quality)	Total Assets and Equity to Assets Ratio	Fixed Effects	Board size and percentage of independent directors have significantly positive impact on ROA. Board size and percentage of independent directors have significantly negative relationship with banks' NNPAs.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
					Boards (Busy Directors), and Board Meetings				Boards of directors play a significant role in bank governance in India.
28	Tjahjadi et al. (2021)	Indonesia	117 Non-Financial Firms Listed on the Indonesia Stock Exchange	2013–2017	Board of Commissioners Size, Chairman Education, Top Management Team Size, and CEO Education	Economic Sustainability Performance, Environmental Sustainability Performance, and Social Sustainability Performance	Sales Growth, Debt to Equity Ratio, Firm Age, Total Assets, Return on Assets (ROA), Year Effect, and Industry Effect	Ordinary Least Square Regressions (OLS)	BoC education has a negative effect on economic and environmental sustainability performance and no effect on social sustainability performance. CEO's education has a negative effect on economic sustainability performance, and no effect on environmental and social sustainability performance. Top management team size has a negative effect on economic and environmental sustainability performance and no effect on social sustainability performance.
29	Brogi and Lagasio (2022)	Europe	30 European Banks Listed on EuroStoxx Index	2008–2016	Accounting Measures (Net Interest Margin, Non-Performing Loans Ratio, Equity to Assets Ratio, Cost to Income Ratio, and Long-term Interest Rate with 10-Year Maturity for Convergence Purposes) Corporate Governance Mechanisms (Proportion of Directors of Audit, Nomination & Renumeration Committee Relative to Board Size) Board Independence (Proportion of Independent Directors on Audit,	Z-Score, Leverage Risk, Portfolio Risk, Tobin's Q, and Price-to-Book Value (P/BV)	Total Assets and Board Size	Fixed Effects	Board independence and board and committees' size are the most relevant characteristics for banks' risk-taking and in line with the agency theory, results show that independence increases the solvency of banks, and size reduces it.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
					Nomination & Renumeration Committees) Directors' Age, Directors' Tenure, Proportion of Foreign Directors, Number Of Quoted Boards, Directors' Education, Presence of Corporate Governance Committee, Board and Committee Meetings, ESG Rating, and Corporate Governance Score				
30	Chen et al. (2019)	China	478 Chinese Non-Financial Listed Firms	2000–2018	Corporate Governance Index	Sales Revenue, Liquidity Index (Current Debt to Current Assets Ratio), Z-Score, and Inventory Turnover	Total Assets, Price to Earnings Ratio (P/E), Profitability, Fixed Assets Ratio, Cash Ratio, Firm Age, and Ownership	Two-Way Fixed Effects	Board independence and board and committees' size are the most relevant characteristics for banks' risk-taking and in line with the agency theory, results show that independence increases the solvency of banks, and size reduces it.
31	Bătae et al. (2021)	Europe	39 Banks	2010–2019	ESG Combined Score, Environmental Score, Social Score, Corporate Governance Quality Score	Return on Assets (ROA), Return on Equity (ROE), Stock Market Returns, and Tobin's Q	Total Assets, Capital Adequacy Ratio (CAR), Liabilities to Equity Ratio, Loans to Deposits Ratio, Customer Deposits to Total Liabilities Ratio, Liquid Assets Ratio, GDP per Capita, and GDP Growth Rate	Fixed and Random Effects	A bank's accounting and market performance may be at odds with its product quality and social responsibility policies. An increase in the quality of a bank's corporate governance system was found to negatively affect company financial performance. The predictions related to stakeholder theory and the resource-based view were confirmed, as banks show interest in resource efficiency, environment-

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
									aware products and services, and process digitisation. Corporate governance quality contributes negatively to accounting performance and market valuation, going against the hypotheses of agency theory. This could mean that market investors do not value a bank's involvement in social responsibility initiatives and do not endorse the adoption of best governance practises that could reduce the riskiness of a bank's portfolio.
32	Lu et al. (2021)	Pakistan	339 Non-Financial Firms Listed on Pakistan Stock Exchange	2010–2019	CEO Power (CEO Compensation Relative to Total Board Compensation), Board Independence, Board Size, Managerial Ownership, Ownership Concentration, Audit Quality, Corporate Social Responsibility (Total Additions of Earnings per Share, Total Taxes, Staff Salaries, Interests, and Public Expenses Minus Social Cost Divided by Total Equity)	Economic Value Added and Sustainable Growth Rate	Fixed Assets Ratio, Total Assets, Asset Turnover, and Environmental Awareness	Ordinary Least Square (OLS) for Endogeneity Testing, Fixed Effect (FE), Generalized Method of Moments (GMM), and Feasible Generalized Least Square (FGLS)	All internal corporate governance factors are positively linked with firm performance. Corporate social responsibility (CSR) is the most valuable tool for improving profitability. All internal corporate governance factors are positively linked with firm performance because of the interactive role of CSR. This study practically contributes to the literature by suggesting the imperative role of CSR for internal corporate governance, which may help to reduce climate and social problems.
33	Amrani and Najab (2023)	International (17 Countries)	76 Commercial Banks	2007–2019	Board Size, Board Meetings, Board Gender Diversity, CEO Duality, CEO Gender, and Chairperson Gender	Return on Assets (ROA) and Return on Equity (ROE)	Total Assets, Bank Age, Leverage, Shareholders' Equity, GDP Growth Rate, and Inflation Rate	Random Effects	CEO duality has a negative and significant impact on bank performance during the full study period. Board size and gender diversity within the board have no influence on bank performance but in crisis time, a female CEO has a

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
									positive and significant impact on bank's performance.
34	(Batae and Feleanga (2020)	Europe	108 Banks (81 from Developed Europe and 27 from Emerging Europe)	2018	ESG Combined Score, Environmental Score, Social Score, Corporate Governance Score, and the ESG Controversies Score	Return on Assets (ROA), Return on Equity (ROE), Total Assets, Number of Employees, Liabilities to Equity Ratio, Capital Adequacy Ratio (CAR), Audit Fees, and GDP per Capita	N.A.	Group Test and ANOVA Test Methods	Banks in Southern European countries and the small GDP/large population cluster have a significantly higher ESG combined score. The governance pillar score and ESG controversies score for Western banks are significantly higher than the ones of Northern banks. The number of employees from the small GDP/large population cluster is significantly higher than the average number of bank employees in large GDP/small population countries.
35	Birindelli et al. (2020)	International (40 Countries)	215 Listed Banks	2008–2016	Proportion of Female Directors on Board and Critical Mass of Female Directors (1 if Three or More Female Directors on Board and 0 Otherwise)	Common Equity to Risk Weighted Assets Ratio, Tier 1 Capital to Total Assets, Non-Performing Loans Ratio and Price Volatility	Board Size, Board Independence, CEO Duality, Board Tenure, Board Meetings, Total Assets, Deposits to Assets Ratio, Loans to Assets Ratio, Return on Assets (ROA), GDP per Capita, Soft Gender Quotes (if Country Has Recommended Gender Quotas), and Hard Gender Quotes (if Country Has Established Gender Quotas)	Fixed Effects and Two-Step Generalised Method of Moments (GMM)	An increase in the number of female directors does not reduce bank risk when banks are unsound. When banks are sound, female directors have a significant and positive role in reducing risk, only until reaching a critical mass of women.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
36	Chou and Buchdadi (2017)	Indonesia	38 Banks Listed on Indonesia Stock Exchange	2013–2015	Board Independence, Board Meetings, Board Meeting Attendance, Board Executive Meeting, Executive Board Meeting Attendance, Audit Committee Size, Audit Committee Meetings, Audit Committee Meeting Attendance, Risk Committee Size, Risk Committee Meetings, Risk Committee Meeting Attendance	Return On Assets (ROA), Net Interest Income (NIM), and Tobin's Q	Total Assets	Two-Stage Least Square (2SLS) Panel Data Regression Model	The findings reveal that the independent board has a positive impact on net interest margin among big-scale banks. Among small-scale banks, the independent board of directors has the positive impact on the market value, but they will have the lack of information that could obstruct the accounting-based profit of the bank. The findings of this study also explain the important role of meeting attendance for the accounting-based profitability of the bank.
37	Osemene and Fakile (2018)	Nigeria	21 Banks Listed on the Nigerian Stock Exchange	2013–2017	Audit Committee Independence, Financial Expertise of Audit Committee, and Audit Committee Meetings	Return on Assets (ROA) and Return on Equity (ROE)	Audit Committee Size	Correlation and Ordinary Least Square (OLS)	Audit committee financial expertise and audit committee meetings significantly influence deposit money banks' financial performance. Frequency of meetings of audit committee members should be improved by ensuring that adequate and sufficient time is dedicated to pressing and current issues as it relates to each deposit money bank.
38	Alam et al. (2020)(Alam et al., 2020)	10 Islamic Countries	39 Islamic Banks and 97 Conventional Banks	2006–2016	Board Meetings, Board Size, Board Independence, CEO Duality, Shariah Supervisory Board Size, Shariah Supervisory Board Interlock in Other Banks' Shariah Board, Bank Type	Loan Loss Provision, Non-Performing Loans, Change in Non-Performing Loans, Change in Loans, Earnings Loss Avoidance	Total Assets, Liabilities to Assets Ratio, Operating Cash Flow, GDP Growth Rate, and Inflation Rate	Random Effects	Contrary to public belief, additional value-based attributes, such as the Shariah Supervisory Board (SSB) that promotes ethical and religious values, do not help restrict opportunistic behaviour in Islamic banks. Attributes such as board size, firm size and leverage have a significant negative influence on EM of both Islamic and conventional banks.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
					(Conventional & Islamic)				This study's results are important in determining that the word 'Islamic' must not be used merely for profit, but instead must promote a value-based business, which in turn could ensure reliability and sustainability.
39	Dedu and Chitan (2013)	Romania	Banks Listed on Bucharest Stock Exchange	2004–2011	Transparency Score of Operation, Existence and Independence of Audit, remuneration, and Risk Committees, Risk Management Framework, Internal Control Framework, Institutional transparency, Management Body Size, and Foreign Ownership Proportion	Return on Assets (ROA), Return on Equity (ROE), and Z-Score	Nominal GDP in Current Prices	Fixed Effects	Internal corporate governance index negatively influenced the bank performance, determining the need to improve and countercyclically implement the measures of corporate governance, the need to increase the number of independent members within the management body and the need to change the business behaviour of shareholders to reduce exposure to risks.
40	El-Faitouri (2012)	United Kingdom	634 Firms Listed on London Stock Exchange	1999–2009	CEO Duality, Board Independence, Independent Chairperson, Senior Independent Director, Presence and Independence of Audit, Remuneration, and Nomination Committees, Audit Committee Meeting, Audit Committee Financial Expertise, and Corporate Governance Compliance Index	Return on Assets (ROA) and Tobin's Q	N. A	Ordinary Least Square (OLS), Fixed Effects, and Generalised Method of Moments (GMM)	Both the level of compliance with corporate governance regulations and board structure are partly determined by past corporate performance. The level of compliance with the Combined Code on Corporate Governance also has no impact on Tobin's Q as a proxy of corporate performance. These findings are inconsistent with many prior empirical studies and policy recommendations on corporate governance, which suggests that corporate governance mechanisms develop corporate performance. The findings indicate that the results of the earlier corporate governance studies

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
									that do not take into account the dynamic nature of corporate governance may be affected by bias.
41	Sobhy et al. (2018)	Ten Asian Countries	226 Banks	2009–2013	Board Size, Board Meetings, Board Independence, CEO Duality, Number of Female Directors on Board, Presence of Audit Committee, Presence of Remuneration Committee, Ownership Concentration, Director Ownership, Family Ownership, Institutional Ownership, and Government Ownership	Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM)	Total Assets, Bank Type (Conventional vs. Islamic), and Long-Term Debt to Assets Ratio	Ordinary Least Square Regressions (OLS)	There is a negative relationship with board independence on performance measured by ROA and this is consistent with the stewardship theory, a positive relationship with director ownership, bank size, bank type and leverage on performance measured by ROA. The effect of corporate governance on banking performance measured by ROE (as Model 2 shows) demonstrates that there is a negative relationship with audit committee, board independence and ownership concentration on performance as measured by ROE. There is a negative relation with duality on performance measured by ROE, which is consistent with Agency theory, and a positive relationship with director ownership on performance as measured by ROE. A positive relationship with board meeting on performance measured by NIM is found in this study, consistent with the agency theory, and a positive relation with duality on performance measured by NIM, again consistent with stewardship theory.
42	Hanh et al. (2018)	Vietnam	94 Non-Financial Firms Listed on Ho Chi Minh	2013–2015	Board Meetings	Return on Assets (ROA), Return on Equity (ROE), and Return on Sales (ROS)	Total Assets and Liabilities to Equity Ratio	Ordinary Least Square Regressions (OLS)	There is a negative relationship with board independence on performance as measured by ROA, consistent with the stewardship theory, a

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
			Stock Exchange						positive relationship with director ownership, bank size, bank type and leverage on performance as measured by ROA. The effect of corporate governance on banking performance as measured by ROE demonstrates that there is a negative relationship with audit committee, board independence and ownership concentration on performance as measured by ROE. There is a negative relation with duality on performance as measured by ROE, which is consistent with agency theory, and a positive relationship with director ownership on performance as measured by ROE. A positive relationship with board meetings on performance as measured by NIM is found, consistent with the agency theory and a positive relation with duality on performance.
43	Andries et al. (2017)	17 Countries in Central and Eastern Europe	156 Banks	2005–2012	Proportion of Female Directors on Board and Presence of Female Chairperson	Return on Assets (ROA), Return on Equity (ROE), Impaired Loans Ratio, Loan Loss Provision Ratio, and Z-Score	Total Assets, Equity to Assets Ratio, Loans to Assets Ratio, and Board Size, Banks Deposits to GDP Ratio, Bank Concentration (Sum Squares of Banking Market Shares), Net Interest Margin, Index of Regulation and Supervisory Framework, GDP Growth Rate, and Inflation Rate	Fixed Effects	Banks with a chairwoman and a higher proportion of women on a bank's board record a higher level of profitability and tend to have a lower level of credit losses. The higher proportion of women on the bank's boards, on average, the higher the bank stability during the financial crisis. The regulatory framework in the host-country affects the relationship between board gender diversity and bank performance and risk

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
44	Alenazi (2016)	United Kingdom	FTSE All Shares Non-Financial Firms Listed on London Stock Exchange	2005–2010	Board Size, Independent Directors, CEO Duality, Audit Committee Size, Managerial Ownership, Executive Remuneration, Non-Executive Remuneration, Total Debt to Assets Ratio (Debt Policy), Dividend Per Share to Earnings Per Share Ratio (Dividend Policy)	Return on Assets (ROA) and Tobin's Q	Total Assets and Industry Classification	Ordinary Least Square (OLS)	In general, based on market measures (Tobin's Q), some governance mechanisms (independent directors, board size [apart from in 2006], role, managerial ownership [apart from in 2008], executive remuneration and debt [apart from in 2005]) positively relate to firm performance, while audit (apart from in 2010) negatively relates to firm performance. Based on accounting measures (ROA), independent directors (apart from in 2010), role (apart from in 2006), managerial ownership and executive remuneration positively relate to firm performance. Further analysis using two-stage least square regressions indicate that any causal effect runs from governance to firm performance rather than in the opposite direction. Variables showing significant explanatory power at the start of the sample period may cease to be significant or change sign at the end of the sample period.
45	Shakil et al. (2020)	USA	37 Banks	2013–2017	Board Gender Diversity	Environmental, Social, and Governance (ESG) Score	Moderating Variable: ESG Controversy Score and Interaction of ESG Controversies and Board Gender Diversity Control Variables: Long Term Debt to Assets Ratio, Price to Book Value Ratio, Dividend Yield, and Return on Assets (ROA)	Dynamic Generalised Method of Moments (GMM)	A significant positive relationship between board gender diversity and the ESG performance of US banks. The result propounds non-significant moderating effect of ESG controversies on the board gender diversity/ESG performance nexus.

No	Scholars	Country / Region of Study	Sample Size	Period	Independent Variables	Dependent Variables	Moderating / Control Variables	Research Methods	Main Findings and Results
46	Jizi (2013)	USA	107 National Commercial Banks Listed on the US Stock Exchanges	2009–2010	Board Size, Board Independence, Audit Committee Size, Audit Committee Financial Experts, and CEO Duality	Corporate Social Responsibility (CSR) Disclosure Score and Risk Management Disclosure	Board Meetings, Audit Committee Meetings, Return on Assets (ROA), Total Debt to Assets Ratio, and Year	TOBIT Censored Regression Model and Ordinary Least Squares (OLS)	Boards with larger size, higher independence and CEO duality are inclined toward reporting a wider range of CSR and risk management disclosures in annual reports, aiming to benefit the bank's transparency and stakeholders' long-term mutual relationship. The study finds evidence supporting the association between CSR disclosure content and stock return, indicating investors' interest in and consideration of CSR information when valuing assets and building their trading decisions. The results also suggest that higher RM disclosure score reduces uncertainties of bank risk environment and provides investors with valuable information to assess financial assets and monitor management practises.
47	Bhagat and Black (2002)	USA		1988–1991	Independent Directors and Board Size	Return on Assets (ROA), Return on Sales (ROS), Tobin's Q, and Market Return		Ordinary Least Square (OLS) and Two-Stage Least Squares (2SLS)	Board size impacts negatively on firm performance while there is no relationship between independent directors and firm performance
48	Mehran (1995)	USA	153 Firms	1979–1980	Independent Directors	Return on Assets (ROA) and Tobin's Q		Ordinary Least Square (OLS)	No relationship
49	Abdullah (2007)	United Kingdom	Listed Firms on London Stock Exchange	1999–2001 2002–2004	Independent Directors and Board Size	Return on Assets (ROA), Sales to Assets Ratio, and Tobin''s Q		Two-Stage Least Square (2SLS)	Negative relationship
50	Vafeas and Theodorou (1998)	United Kingdom	250 Firms Listed on London Stock Exchange	1994	Independent Directors	Price to Book Value (P/BV)		Ordinary Least Square (OLS)	Negative relationship

- *Author's Own*

3.2.3. Holistic View of Corporate Governance

This section attempts to define holistic corporate governance by combining governance theories and approaches according to the researcher's understanding of the impact of corporate governance impact on the sociocultural economic environment. Corporate governance draws on multiple fields within the social and intellectual sciences, and includes legal, economic, financial, and societal perspectives. From a legal perspective, for example, corporate governance can be defined as a set of rules, regulations, procedures, and practises, developed through both explicit and implicit knowledge, which govern and direct the activities and operations of an organisation. Corporate governance is implemented by:

- Delegating authorities
- Assigning roles and responsibilities to key stakeholders related to the organisation's operations.
- Monitoring the activities of stakeholders by instilling transparency, credibility, and accountability

This enables the company to make decisions fairly, objectively, and effectively, and builds organisational structures that aim to achieve its goals and enhance performance while limiting opportunities for fraud and corruption. Seen through an economic lens, corporate governance can be defined as a regulatory and legislative system that constructs standards, policies, procedures, and structures to protect investors and shareholders' rights and encourages delegated principals to manage their wealth through the optimal utilisation of financial and human resources, and to add to the organisation's economic value emanating from its core values and strategy to ensure integrity, transparency, and accountability, thereby leading to a democratised economy on both macro and micro levels.

Holistically, corporate governance can be defined as an organisation's governing system and constitution, composed of a set of rules, regulations, standards, principles, mechanisms, structures, and procedures that direct and govern the organisation and simultaneously monitor its performance through practises that balance both societal and economic objectives. Corporate governance is designed and implemented to ensure proper guidance of operations and lead business activities towards long-term success as well as the continuous development of an organisation's ecosystem to achieve its strategic plans and goals. This in turn leads to economic, social, and environmental development through a reinforcement of principles of integrity, transparency, accountability, and justice in the organisation's environment for the benefit of stakeholders and the community as a whole.

To ensure the implementation of a holistic governance framework, the circumstances of each organisation must be taken into consideration, in which flexibility of implementation is required, depending on its situation and environment. When there are few stakeholders, a suitable level of governance can be achieved both legally and economically through capital-market requirements and the diligent preparation of financial statements.

When more stakeholders are involved, however, corporate governance procedures are required to ensure that suitable organisational structures are in place to limit the risk of accountability issues. When appropriate measures are set up, personnel entrusted with managing the organisation's affairs are accountable to stakeholders, and thus internal audits will increase. In cases of high stakeholder concentration, the corporate governance framework must be efficiently implemented to cope with this concentrated structure, which entails the enforcement of specific legal controls and methodologies as well as a highly active and involved board of directors that is highly responsible and accountable for organisational operations and activities. It is therefore imperative to separate the supervisory and managerial roles and put strong controls in place where there is a high ownership concentration and various stakeholder groups. This suggests the importance of corporate governance as a means to ensure accountability to all stakeholder groups and the community at large.

3.2.4. Summary

This review of the literature indicates that significant attention has been paid to corporate governance and financial performance. As outlined above, corporate governance is an important strategy that helps both financial and non-financial organisations to increase their overall financial, economic, and social performance. Corporate governance practises boost the ecology of a company and help maintain good relations with all stakeholders.

It can be summarised from the findings in the literature that the ROA, ROE, and management earnings are all important for banks, which, even in difficult conditions, try to manage these ratios in order to achieve efficiency and sustainability. Effective corporate governance practises help banks and other firms to increase their profitability ratios, either directly or indirectly, which in turn increases overall stability. The researcher has observed that internal corporate governance mechanisms (BOD structure attributes, audit committee structure attributes, CEO duality, gender diversity, and transparency) and bank-performance

relationships report mixed results. In some discussions in the literature, it is reported that the implementation of corporate governance standards and practises is highly dependent on cultural factors and each institution's corporate environment.

The current essay uses this Literature Review to develop its relevant hypotheses and seeks to add to the literature by offering a new perspective from developed countries (the G7 nations) regarding internal corporate governance mechanisms and how to improve their effect on bank performance. The inconclusiveness of the findings and mixed arguments in the studies cited above have prompted the researcher to examine the relationship between corporate governance mechanisms and the financial performance of banks in G7 countries, focusing on listed regional and diversified banks. Thus, this essay seeks to add to the debate by making it clear whether, from a G7 perspective, corporate governance characteristics (board size, board meeting frequency, board independence, audit committee size and meeting frequency, board gender diversity, CEO duality, governance disclosure score) impact banks' financial performance (the ROA, ROE, and NIM). The researcher also found few studies on the influence of corporate governance mechanisms on the financial performance of banks from the perspective of major advanced economies; in addition, no studies were found that assess the impact of corporate governance mechanisms on banks' net interest margins. This essay makes an original contribution to the examination of corporate governance practise developments in the social, political, and economic environments of the G7 countries' banking sector, which, apart from filling in these research gaps, will also contribute to the policies and development of bank governance structures in G7 countries.

3.3. Data and Methodology

3.3.1. Research Philosophy and Approach

The positivist approach supports quantitative market-based data collection. The increased availability of reliable online data has contributed to a surge in the collection of quantitative financial and non-financial data in accounting and finance research. Using statistical methods, the validity of the data is designed to assist the researcher to reach a conclusion in a scientific, irrefutable and methodological manner (Frankfort-Nachmias & Nachmias, 1996). As such, this research uses quantitative data collected from both primary and secondary sources by using the audited yearly reports and online quantitative data extracted from the Bloomberg and Reuters online database. The collected panel data was then examined to ensure their use is suitable for linear regression

analysis and to find the appropriate model to be deployed to determine the relationship between corporate governance and the financial performance of banks in G7 countries. Sample data was collected in conformity with the research population focus.

3.3.2. Data Sample

The focus of this research is the data of banks in G7 countries from 2011 to 2019. The banks were classified according to Global Industrial Classification Standards (GICS), which led to a 710-bank sample to be itemised as regional and diversified banks operating in the G7 countries. When this sample was scrutinised, only 397 banks offered sufficient data, with a total of 3,573 observations for each of the dependent variables. From this reduced sample, banks were then eliminated if seven to nine years of corporate governance and/or financial performance data was not available for them; as a result, 313 banks (mainly regional banks operating in the US) were excluded because of the unavailability of their financial performance metrics and/or corporate governance characteristics covering at least 70% of the study period. The study sample ends in 2019, immediately prior to the Coronavirus pandemic.

Table 3:2 *Cross-Section Data (Banks) Countries and Sub-Industry Allocations*

Country	**Total Number of Banks**			**Number of Regional Banks**			**Number of Diversified Banks**		
	Pre Treatment	*Included Sample*	*Excluded sample*	*Pre Treatment*	*Included Sample*	*Excluded sample*	*Pre Treatment*	*Included Sample*	*Excluded sample*
Canada	9	8	-1	2	1	-1	7	7	0
USA	571	285	-286	565	280	-285	6	5	-1
UK	11	8	-3	1	1	0	10	7	-3
France	15	3	-12	12	0	-12	3	3	0
Germany	4	3	-1	0	0	0	4	3	-1
Italy	14	10	-4	0	0	0	14	10	-4
Japan	86	80	-6	80	74	-6	6	6	0
Total	**710**	**397**	**-313**	**660**	**356**	**-304**	**50**	**41**	**-9**

- *Author's Own*

In order to differentiate between regional and diversified banks, it is worth mentioning that both diversified and regional banks engage in significant business operations related to lending to small and medium-sized corporations and retail banking. Furthermore, they both offer a diverse array of financial goods. However, the main distinction lies in the fact that diversified

banks have a national / multinational transnational presence and footprint, whereas regional banks operate within confined geographic boundaries, according to the S&P global categorisation brochure (GICS, 2014).

Primary and secondary data was collected to meet the data analysis requirement (Pajo, 2017). The data of banks operating in G7 countries was collected and classified as dependent variables (ROA, ROE, and NIM) and independent variables (corporate governance characteristics). Bloomberg and Refinitiv data were exported to Microsoft Excel and is mapped according to GICS classification, as is evident in Table 3.3below:

Table 3:3 *Global Industrial Classification Standards Sectoral Mapping Specifications*

Sector	Industry Group	Industry	Sub-Industry
Financials	Banks	Banks	Diversified Banks
			Regional Banks

- *Author's Own*

To confirm the data integrity, a random sample of 20 bank data was cross-checked between data extracted from Bloomberg and audited annual reports, which were found to reconcile perfectly.

Table 3:4 *Banking Sample Total Assets Share of GDP*

Country	Banking Sample Total Assets (Trillion USD)	GDP 2019 (Trillion USD)	Banking Sample Total Assets' Share of GDP
Canada	4.40	1.74	253%
France	5.94	2.73	218%
Germany	1.99	3.89	51%
Italy	2.52	2.01	125%
Japan	12.76	5.12	249%
UK	7.17	2.88	249%
US	13.74	21.37	64%
G7	**48.52**	**39.75**	**122%**
World	**87.54**		
G7 GDP Share of World GDP (Trillion USD)	**45.41%**		
Banking Sample Total Assets Share of World GDP (Trillion USD)	**55.42%**		

- *Author's Own*

- *Source of GDP: International Monetary Fund (IMF) Database (2019);*
- *Source of Banks' Assets: Bloomberg Online Database.*

3.3.3. Unbalanced Sample Treatment Approach

It is noteworthy that even when the sampling frame is selected properly, sampling bias can arise from non-responsive sampling units. Non-responses are particularly likely to cause bias whenever the reason for the non-response is related to the phenomenon under study (Panzeri et al., 2008). This is the case in our banking sample of G7 countries that suffer from sampling bias towards the USA regionals banks' representing more than half of the data set of G7 banks. Therefore, this research conducted further statistical modelling, analysing data of banks operating in the G6 (excluding US banks), in addition to the US banking sample as a standalone nation, in order to validate the results of G7 banks' sample and to cross-check for any dissimilarities and inaccuracies with the G7 banking sample regression estimates related to the impact of corporate governance mechanisms and banks' financial performance.

Based on the above, the unintentional sampling bias in our data which reflects the real world, and to eliminate doubts regarding the existence of any sampling strategies that were adopted by the researcher based on either judgment or convenience in selecting samples related to his area of interest, this essay utilises separate and comparative examination of the influence of corporate governance mechanisms on banks' performance for the G6 countries (excluding the US) and the US alone. (See Appendix A for detailed findings.)

3.3.4. Variables

This section describes the dependent and independent variables of this essay and defines the financial performance parameters. To examine the current financial performance of a firm, accounting-based measures such as the Return-On-Assets (ROA), Return-On-Equity (ROE), and Net-Interest-Margin (NIM) have been used (Daily et al., 2003). Different definitions of the ROE have emerged in the literature, which Kyereboah-Coleman and Biekpe (2006) have defined as the total net income divided by the book value of total assets while Zemzem and Kacem (2014) defined it as the total net income divided by the book value of equity. The use of accounting-based measures has been greatly criticized. by researchers, as they are measures of historical costs and revenue and disregard risk (Krivogorsky, 2006). It is also argued that accounting-based methods, techniques, and policies are

subject to changes and modifications (Mangena & Tauringana, 2007). Despite previous criticism, however, shareholders consider the ROA and ROE as important gauges of their return on investments and major indicators of the management utilisation of assets.

ROA, ROE, and NIM are accounting-based indicators used to evaluate the financial performance of banks. These measures reflect the management efficiency of a bank and ultimately demonstrate the robustness of its financial performance. Opinions in the literature have not concurred on the best indicators of financial performance, as every indicator has its own profit criterion (Haniffa & Hudaib, 2006). However, these ratios are used by financial institutions as performance indicators. It should also be noted that banks are evaluated based on the earnings and revenue they generate for their shareholders directly (dividends) or indirectly (by increasing shareholder equity and sustaining capital and liquidity). As banks' core business is the management of money, their earnings taken in isolation from other risk indicators might lead to the wrong course of action if needed to protect the bank from bankruptcy. The mere study of a bank's past earnings performance, while having an impact on the balance sheet, does not suffice for auditing the health of the bank. It has been suggested that in order to be able to take timely decisions, supervisors should be concerned with the bank's future position and future results (Couto & Luís, 2002). The ROA ratio compares total assets with net profit and assists in reducing the volatility of earnings linked with unusual items: the higher the ratio, the greater the return. It is an indicator of how efficiently the bank is using and managing its assets to yield profits (Gasbarro et al., 2002). The ROE shows how efficiently a bank is in using its own capital by comparing total equity with net profits: the higher the ratio, the greater the efficiency of the bank in enhancing yields by utilising its own capital (Christopoulos et al., 2011).

A further important indicator for analysing banks' performance is its NIM. This indicator gauges the ratio of interest income to the average earning of interest-bearing assets. Even though this indicator is not frequently used in financial statistics compared to the ROA and ROE, it provides an assessment of the effectiveness of banks' management of their interest-bearing assets: the larger the net interest margin, the more successful the management of interest-bearing assets. It should be noted that several factors affect NIMs: the market structure in which a bank operates; the degree of managerial risk-aversion; the size of transactions; and, most importantly, variations in interest rates. In other words, NIMs are linked to interest rate volatility, credit risk, operational costs, volume of loans, and market power (Hawtrey & Liang, 2008); for example, a study of net interest margins in Mexico concluded that a high interest margin was a result of market power and operating costs (Maudos & Solís, 2009). It was

also deduced that there was an inverse relationship between net interest margin and globalisation, and thus in essence that globalisation improves the efficiency of the banking system (Chang et al., 2013).

Profitability metrics such as ROA (Return on Assets), ROE (Return on Equity), and NIM (Net Interest Margin) are essential for evaluating the financial risks linked to banking activities. The CAMEL Rating System, along with other international rating systems, relies on these measures as crucial elements for evaluation by central banks in different countries. The CAMEL rating system is a globally acknowledged system that conducts a uniform on-site evaluation of banks in the United States. The Federal Reserve, the Office of the Comptroller of the Currency, and the Federal Deposit Insurance Corporation are among the US supervisory authorities that use it. The examination is carried out using five main dimensions, with an additional sixth dimension later introduced, which specifically addresses sensitivity to market risk. These dimensions pertain to the capital adequacy, asset quality, management efficiency, earnings quality, and liquidity of banking institutions.

The objective of this assessment is to appraise the fiscal condition, financial efficacy, operations, and compliance with regulations of banks. Additionally, it is worth noting that the five dimensions of the CAMEL rating system used in the United States share some similarities (although with different methods) with those employed in the Organisation and Reinforcement of Preventive Action (ORAP) by the French Banking Commissions, the BAKred Information System (BAKIS) by the German Federal Supervisory Office, the PATROL system by the banking sector of Italy, and the risk assessment, supervision, and evaluation tools introduced by the Bank of England and utilised by the British Financial Services Authority.(Sahajwala & Van Den Bergh, 2000) .

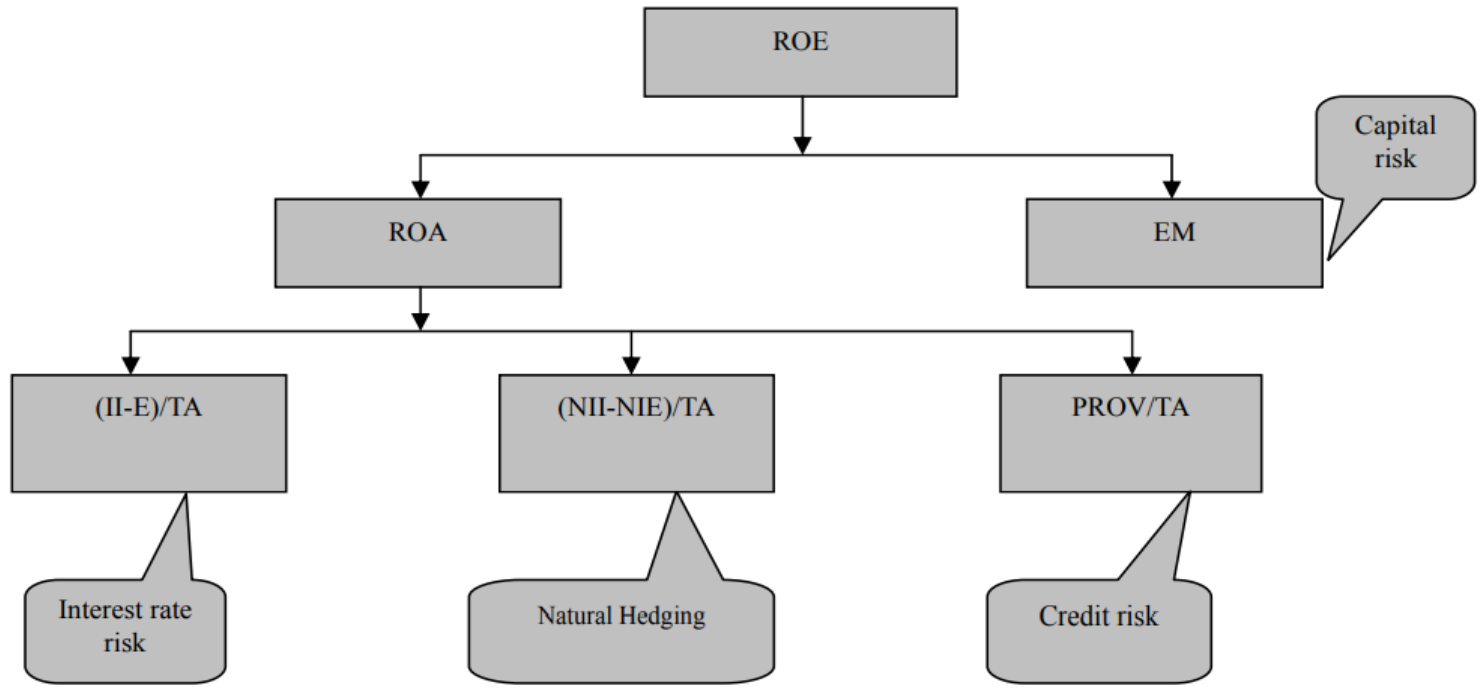
Additionally, from a risk-return paradox, researchers suggest a negative risk-return relationship while relying on accounting-based performance measures of ROA and ROE (Bettis & Mahajan, 1985; Fiegenbaum & Thomas, 1986).

According to Mahardian (2008), market risk refers to the potential losses that a bank may incur as a result of fluctuations in market interest rates and exchange rates affecting its portfolio. The researcher asserts that banks' market risk can be assessed through the net interest margin (NIM), which gauges the bank's capacity to effectively manage interest-bearing assets and liabilities in order to generate interest income. The majority of previous empirical studies in the banking industry have found a direct and statistically significant association between credit risk and banks' profitability and efficiency measures, such as Net

Interest Margin (NIM), Return on Assets (ROA), and Return on Equity (ROE). Stated differently, banks must bear operational losses and, as a result, lower profitability metrics like ROA and ROE. The higher the percentage of non-performing loans, the worse the bank's asset quality (Alper & Andar, 2011; Kolapo et al., 2012; Putrianingsih & Yulianto, 2016; Roman & Danuletiu, 2013; Sufian, 2009; Trujillo-Ponce, 2013).

The below diagram presents the conceptual model on relations between return on equity (ROE), return on assets (ROA), and equity multiplier (EM) the relations between bank profitability and types of banking risks.

Figure 3:1*Conceptual Model on Risk-Return Relation in Banks*



- Source: Bill et al., (2004, as cited in Fathi et al., 2012).

Interest rate risk in banks results in a decrease in banks' net income due to fluctuations in interest rates. The interest rate has an impact on the net interest margin (NIM) and influences the variation in return on assets (ROA). This alteration arises from the fluctuation in the financial prosperity of stockholders. The Net Interest Margin (NIM) of bank shareholders is diminished due to a decrease in the interest rate. Banks utilise swap and future contracts as a means of mitigating the impact of interest rate reductions. (Fathi et al., 2012).

Credit represents the monetary value that will be repaid at a later time, while credit risk arises from the possibility that the anticipated payments may not be fulfilled. Credit risk refers to the possibility of a customer experiencing losses due to their inability or refusal to repay their credit, either because they lack the financial means to do so or because they decline to repay (Rudra, 2009). Delayed repayments result in a decrease in the banks' assets and a reduction in the provision of total assets (PROV). Consequently, both Return on Assets (ROA) and Return on Equity (ROE) will be diminished. According to Rudra (2009), there exists an inverse correlation between credit risk and return on equity (ROE).

The capital-to-assets ratio indicates a bank's ability to withstand unexpected losses and indirectly safeguards the profits of guaranteed depositors. A high ratio in this context instills depositors' trust in the bank, but it may decrease the bank's return on equity (ROE). Therefore, the maximisation of Return on Equity (ROE) is contingent upon the correlation between Return on Assets (ROA) and the equity multiplier.

Banks improve the return on equity (ROE) for stockholders by increasing the equity multiplier. However, the higher equity multiplier indicates a low capital-to-assets ratio, which in turn leads to high capital risk. Consequently, it may result in the closure of banks. According to Anderson (2003), stockholders are believed to favour a low level of financial risk while maintaining a long-term perspective on the bank's ability to sustain dividend payments. This study examines the capital-to-assets ratio as a measure to assess banks' proficiency in managing capital risk. The capital adequacy coefficient is employed as a criterion to assess the level of capital risk. The coefficient mentioned refers to the appropriate level of capital required to mitigate capital risk, and is specifically allocated as capital stock (Raee, 2009).

Furthermore, to enhance the understanding of our findings, it is crucial to acknowledge the origins of using return on equity (ROE) in the banking industry. The reliance on Return on Equity (ROE) as a primary metric for evaluating the performance of banks emerged from the risk management framework that influenced capital regulation in the banking industry (Guill, 2009). This methodology entails the calculation of a distinct "capital charge" that is contingent upon the risk associated with each asset. The capital charge is directly correlated to the amount of capital needed to mitigate the risk of substantial potential losses. The capital charge is determined either by using internal risk models that align with the principals' agreement or by being mandated by the

regulator. Consequently, after determining capital charges, the primary goal of bank executive management is to effectively allocate funds towards investments that yield the greatest profits relative to the assigned capital charge.

The researcher conducted further investigations in this study, utilising additional accounting-based proxies to analyse the correlation between banks' corporate governance mechanisms and risk indicators, specifically the Capital Adequacy Ratio (CAR), Cost to Income Ratio (CTI), and Asset Quality (AQ).

On this basis, banks' financial performance can be measured as follows:

3.3.4.1. Return on Assets (ROA)

The ROA is calculated as a percentage of net income in relation to average total assets. This variable has been used in much of the literature (Adusei, 2012; Aebi et al., 2012; Epure & Lafuente, 2015; Fanta et al., 2013; Lai & Choi, 2014; Rachdi & Ben Ameur, 2011). In this essay, the ROA is used as a measurement variable for bank financial performance according to the following formula:

Equation (1):

ROAit = Net Income it divided by ((Total Assets year0 it Plus Total Assets year1 it) divided by 2)

Whereby; Year0 is the base (previous) year and Year1 is the latest year. i=bank and t= time.

3.3.4.2. Return on Equity (ROE)

The ROE, also known as a 'return on net worth', is the net income divided by shareholders' average equity. It is a crucial measure for investors to calculate the yield they are obtaining from their investments and compare it with other similar investments to decide on its solidity (Aebi et al., 2012; Chizema & Kim, 2010; Farazi et al., 2013; Uwuigbe & Fakile, 2012); according to the following formula:

Equation (2):

ROE it = Net Income it divided by ((Shareholders' Equity year0 it plus Shareholders' Equity year1 it) divided by 2)

Whereby; Year0 is the base (previous) year and Year1 is the latest year. i=bank and t= time.

3.3.4.3. Net Interest Margin (NIM)

The NIM is an accounting ratio which reflects bank efficiency in its intermediary role. It is defined as a bank's interest income minus the total interest expense over its total earning assets (Demirguc-Kunt & Huizinga, 1998). The NIM measures a bank's efficiency in managing its assets, gauges its performance relative to competitors, and measures its profitability (Angbazo, 1997; Bikker & Bos, 2008; Demirguc-Kunt et al., 2004) according to the following formula:

Equation (3):

NIM it = ((Total Interest Income it minus Total Interest Expense it) divided by Total Interest-Bearing Assets it)

Whereby; i=bank and t= time.

Table 3:5 *Description of Variables*

Type	Variable	Ticker	Measurement	Literature Sources
Dependent	Return On Assets	ROA	Net income divided by average total assets	Firtescu & Terinte (2019) Waddock & Graves (1997)
	Return On Equity	ROE	Net income divided by average total shareholders' equity	Zemzem & Kacem (2014); Zhang (2019)
	Net Interest Margin	NIM	Net interest income divided by the total interest-bearing assets	Chang et al. (2013)
Independent	Governance Disclosure Score	SGDS	A Bloomberg score based on a bank's governance disclosure as part of Environmental, Social and Governance (ESG) data. The score ranges from 0.1 for banks that disclose a minimum amount of governance data to 100 for those that disclose every data point collected by Bloomberg.	Siddique et al. (2021); Tunio et al. (2021); Xie (2019)
	Board Size	BODS	BOD's total number of members	Adams & Mehran (2012); Bhatia & Gulati (2021)
	Board Composition	BODC	Proportion of non-executive BOD members to total BOD members	De Andres & Vallelado (2008); El-Chaarani et al. (2022)
	Board Gender	BODGD	Proportion of women BOD members to total BOD members	Chen et al., (2019); Huang et al. (2020)
	CEO Duality	CEOD	Person holds both CEO and BOD chair position	Berger et al. (2016); Simpson & Gleason (1999)
	Board Meeting Frequency	BODMF	Total number of BOD meetings	Adams & Mehran, (2012)
	Size of Audit Committees	ACS	Total number of members of audit committee	Bosch (1995); Hermes et al. (2007)
	Audit Committee Meeting Frequency	ACMF	Total number of meetings of audit committee	Sun & Liu (2014)

- *Author's Own.*

- *To clarify and distinguish between the governance disclosure score and the other corporate governance mechanisms used in this research. Please note that according to Bloomberg database the governance disclosure score is used to measure the transparency level for banks by measuring the amount of governance data and mechanisms a bank report publicly. Governance Disclosure score is a Bloomberg propriety disclosure score determined based on the extent of a company's Governance mechanisms disclosures. The score measures the extent to which a company publicly reports governance data and is set from 0 (for companies that have no disclosure of any governance data) to 100 (companies with a detailed disclosure for every governance data). While each of the other governance mechanisms was used as explanatory standalone variables whereby each is measured as per the description provided in Table 3:5.*

Furthermore, this thesis includes a literature review on corporate governance mechanisms in Section 2.4 of Chapter 2. The purpose of this review is to provide a clear understanding of the internal corporate governance mechanisms used in this study, which are outlined in Table 3:5 above. These mechanisms primarily focus on the structure of the board of directors, the audit committee, transparency in reporting quality, and the separation and duality of leadership roles (CEO/chairperson). the researcher justification is built on four main pillars as follows:

1) Board of director and audit committees are marked as key internal governance mechanisms that play a vital role in decision making that balance the requirements for financial stability and quality of reported earnings by banks through optimal risk management and effective monitoring (Alharbi et al., 2022). The board of directors and audit committees can use their wider experience to promote the best interest of both the company and the shareholders and a strong representation of non-executive directors is able to monitor managers' actions more effectively, consequently restricting their self-interest (Chiu & Katelouzou, 2017; Peasnell et al., 2000).

   According to Bushman and Smith (2001) and Watts and Zimmerman (1978), good financial reporting limits managerial self-interest behaviour and aligns managers' interests with those of shareholders. To make accurate decisions, users of financial reports need high-quality information which must be reliable and trustworthy. The literature on banking governance commonly shows how critical the role of the board of directors and audit committee are in mitigating bank risk, and driving performance, earnings management and stock market valuation (Owen & Temesvary, 2018; Pathan & Faff, 2013; Trinh et al., 2020) (Bergeret al., 2014; Dong et al., 2017; 2018; Elnahass et al., 2020, 2022a).

Furthermore, it is noteworthy to mention that the researcher expressed reservations about including the risk committee during the initial stages of data collection. Subsequently, the research has discarded the notion of incorporating risk committee mechanisms due to: 1) The absence of risk committee data in the Bloomberg database, along with comprehensive research conducted by the researcher, has uncovered that 2) it is not obligatory for banks to maintain a distinct risk committee. It is widely acknowledged that the entire board of directors bears the ultimate responsibility for overseeing and managing risks. Banks have the choice to establish a separate risk committee or rely on the adequacy of an audit committee without a separate risk committee. For instance, in companies listed on the New York Stock Exchange (NYSE), the audit committee must incorporate into its charter the obligation to engage in discussions with management regarding the company's risk assessment and risk management policies, regardless of whether the board deems it necessary to establish a distinct risk committee. It should be noted that having a separate risk committee is not a complete solution. The determination of risks falling under the jurisdiction of a distinct risk committee will typically differ significantly depending on the industry's characteristics and the intricacy of the organisation's risks.

2) The corporate governance mechanisms examined in this study are universally recognised as mutual mechanisms, as they are incorporated in corporate governance codes and explicitly mentioned in central bank regulations worldwide. Hence, our study focuses on achieving consistency, integration, and accessibility of mechanisms in accordance with the regulations and banking practises of various countries. Specifically, we examine multinational operations within the G7 countries, taking into account the banks' practises that are associated with diverse corporate governance systems (please cite G7 corporate governance codes here).
3) In the early phases of our research, the researcher collected additional corporate governance mechanisms from Bloomberg's database, including 1) the average age of the board, 2) the presence of a female CEO, 3) the number of female executives, and 4) board meeting attendance. 5) Presence of a CSR/Sustainability committee, 6) Size of the CSR/Sustainability committee, 7) Non-Executive Director overseeing Corporate Social Responsibility (CSR), 8) Executive Director in charge of Corporate Social Responsibility (CSR), 9) Executive compensation tied to environmental, social, and governance (ESG) factors. 10) Executive compensation linked to climate-related performance. 11) Presence of an IT Strategy committee. 12) Board of

Directors' compensation linked to ESG criteria. However, we have excluded the aforementioned mechanisms from our study because there is either a lack of data or the available data is not sufficient.

4) From a statistical perspective, in order to obtain reliable estimates, it is recommended to limit the selection of independent variables to 8 to 12 corporate governance mechanisms (degrees of freedom) based on the sample size and penalised maximum likelihood estimation, considering the statistical limitations (Halinski & Feldt, 1970; Hocking & Leslie, 1967; Rubinfeld, 2011).

3.3.5. Data Analysis Methods and Hypotheses

To pursue a methodological process of examining and testing the research hypotheses in accordance with the deductive positivist approach, the statistical method of multiple regression was utilised to investigate the relationship between the chosen dependent and independent data variables, specifically the corporate governance characteristics and financial performance of banks operating in G7 countries. The use of the multiple regression method is based on the rationale of accurately determining the variables' mutual relation to satisfy the assumptions and hypotheses considered in the study (Cronk, 2019). Given that banks' information is observed across time and set into a panel data structure, the general equation of panel data regression modelling is as follows:

General Regression Model:

$$\Pi it = \alpha + \Sigma \beta j Xit + eit$$

Where Πit is the dependent variable which measures financial performance and is estimated by the ROA, ROE, and NIM for bank i at time t, with i =1…, and j =1…, scalar α measures the constant term, and e is the residual. β is the coefficient of the independent variable represented by the letter X.

Given that there are three dependent variables, three linear models are presented whereby each dependent variable represents a function of the explanatory variables. The following equations summarise these research econometric formulas:

General Model (1) – ROA as dependent variable:

$$ROAit = \alpha + \beta 1BODSit + \beta 2ACSit + \beta 3BODGDit + \beta 4ACMFit + \beta 5BODCit + \beta 6BODMFit + \beta 7GDSit + \beta 8CEODYit + eit$$

General Model (2) – ROE as dependent variable:

$$ROE_{it} = \alpha + \beta 1BODSit + \beta 2ACSit + \beta 3BODGDit + \beta 4ACMFit + \beta 5BODCit + \beta 6BODMFit + \beta 7GDSit + \beta 8CEODYit + eit$$

General Model (3) – NIM as dependent variable:

$$NIM_{it} = \alpha + \beta 1BODSit + \beta 2ACSit + \beta 3BODGDit + \beta 4ACMFit + \beta 5BODCit + \beta 6BODMFit + \beta 7GDSit + \beta 8CEODYit + eit$$

Multiple regression analysis was used to examine the relationship between one dependent variable and several independent variables by describing algebraically the regression lines, expressing the relationship between multiple variables (Hair et al., 1998). In this essay, multiple regressions were used as there are efforts to predict a single outcome from several factors (Field, 2009). Therefore, multiple regression analysis was employed to test the presence and strength of associations between the dependent financial performance variables (the ROA, ROE, and NIM) and the independent corporate governance variables (board size, board composition, board gender, CEO duality board meeting frequency and audit committee size).

To establish significance and confidence levels for the coefficients of the independent variables in predicting the dependent variable, p-value, which measures the significance level, was employed in this research on the following basis:

- A p- value less than or equal to 1.0% is indicated by three stars (***).
- A p-value greater than 1.0%, but less or equal to 5.0% is indicated by two stars (**).
- A p-value greater than 5.0%, but less than or equal to 10.0% is indicated by one star (*).

Testing the assumptions of regression models plays a vital role in contributing to valid estimates. Failure to test these assumptions leads to over-/under-estimation and results in insignificant outcomes (Greene, 1993; Gujarati, 2009). Econometricians have stated that to predict the suitability of regression models in relation to the dataset, they must be assessed in accordance with five pre-defined diagnostic tests, namely linearity, heteroskedasticity, multicollinearity, autocorrelation, and normality, to confirm alignment with validation requirements. Determining the appropriate regression model between the OLS and alternative fixed and random-effect was based on the results of both the Breusch-Pagan multiplier test and the Hausman test. While the Breusch-Pagan null hypothesis states that the pooled OLS model is adequate (in favour of the random effects), it was rejected if the p-value was below 0.05; otherwise, the pooled OLS model was adequate. On the other hand, if the diagnostic tests

suggested a violation of estimates, the Hausman test was utilised to determine the appropriate regression model between fixed effects and random effects. Therefore, the null hypothesis that the random-effects model is consistent was rejected if the p-value was equal or below the 0.05 level in favour of the fixed-effects regression model.

The statistical analysis in this essay was conducted using Gretl and SPSS Modeler Software, which are considered a powerful visual and command-line interface statistical package for econometrics and are used to build a variety of regression modelling. The SPSS Modeler also operates additional complex statistical models using machine learning algorithms while building artificial intelligence (AI) engines.

3.3.6. Ethics

The data for this research was gathered from public sources in the form of quantitative data and information.

3.3.7. Limitations of Research

In this research, the use of secondary data restricts the latter's uniqueness. The relationship between variables that affect performance is not publicly included in financial reports. However, this research, through studying the data, found correlations that can be defended. As this research is limited to a nine-year span and studies only eight corporate governance traits, it does not discount the importance of traits not tackled here such as bank size and ownership structure. However, the statistical analysis of this essay examines only the outlined relations and does not seek to deny the possible importance of other variables.

3.3.8. Summary

This section concludes with an overview of the strategy employed in the study to conduct data analysis. Using the existing theoretical base, this research was able to identify and rely on the pre-existing theories on which the research hypothesis is based while adhering to the deductive positivist paradigm. The analysis method employed in this study was that of multiple regression. The data sample, selection criteria, and dependent and independent variables are also described in this section. This essay relies on Bloomberg online data and banks' annual reports of the G7 nations' regional and diversified banks as defined by the GICS (Global Industry Classification Standard). Several measurement approaches have been used in order to evaluate boards' corporate governance characteristics, including measuring the influence of board size, board composition, board gender, CEO duality, board meeting frequency, and audit committee size. In order to assess banks' financial performance, the ROA, ROE, and NIM were

used in this study due to their effectiveness in measuring management efficiency and the overall financial performance of banks. However, this essay has only examined the data of 397 banks from 2011 to 2019, of which 356 are regional banks and 41 are diversified.

3.4. Findings and Discussion

3.4.1. Introduction

This section analyses and investigates the relationship between corporate governance mechanisms and banks' financial performance in G7 countries before presenting and discussing the results of the analyses, which reveal the importance of the independent variables' influence on the dependent variables, to identify the effect of corporate governance on a bank's financial performance as measured by the ROA, ROE, and NIM from a management perspective. The analysis is made using Gretl statistical software. The sample comprises 397 local banks in the UK, US, Germany, France, Italy, Canada, and Japan listed by the Global Industrial Classification Standards (GICS) for the period 2011–2019. To answer the research questions posed in the first section in this essay, this section is divided into four subsections. Section 3.4.2 presents the descriptive statistics for the sample banks, Section 3.4.3 shows the results of diagnostic tests, and Section 3.4.4 presents and discusses the findings of the analysis of corporate governance and the three financial performance measures.

3.4.2. Descriptive Statistics

To provide a better representation of the variables and their distribution, descriptive statistics was conducted on the data. The minimum, maximum, mean, median, standard deviation, and number of observations were included in the analysis. The essay uses data collected between 2011 and 2019, which includes large numbers of diversified and regional banks from seven G7 nations. In this analysis, three financial performance metrics were examined: the ROA; ROE; and NIM. Table 3.6 below exhibits the dependent and independent variables, which indicates that those banks operating in the major advanced economies (such as the US, Canada, U K, Germany, France, Italy, and Spain) have an average ROA, ROE, and NIM of 0.7%, 7.7%, and 3.1% respectively, and a minimum value of –10.7%, –90.6%, and –29.5% respectively, with a maximum value of 8.1%, 90.1%, and 67.1% respectively.

The negative minimum value of NIM shown in the table below caused some concern to the researcher considering that NIM is a core indicator to the banking business operations. Consequently, the researcher further investigated the reasoning behind the negative value generated for NIM in G7 countries and the data revealed that this value resulted from a bank in Japan spanning across 2 years only (2013 and 2014). Accordingly, the researcher went further into analysing this bank's 2014 financial report in depth to validate the negative NIM value and determine its underlying causes. It was revealed that the bank truly experienced a negative NIM during that period as the bank has recorded interest income of ¥809 million and an interest expense of ¥1,806 million in 2014 in comparison to an interest income ¥572 million and an interest expense if ¥1,627 million in 2013. Although the bank achieved a positive net income of ¥21,236 million and ¥19,377 million in 2014 and 2013 respectively due to the reliance on fees and commission income, the negative NIM resulted as the bank appeared to be highly utilising 64% of its funds (liabilities and shareholders' equity) in cash and deposits due from banks, 12% in securities, and 11.7% in ATM-related payments. while loans formed only 0.67% of the total balance sheet according to the financial statements of 2014.

Table 3:6 *Summary Statistics for Sample of G7 Banks (2011–2019)*

Field	Min	Max	Mean	Median	Standard Deviation	Unique	Valid Rows
Ticker	--	--	--	--	--	397	3,573
Country	--	--	--	--	--	7	3,573
Year	2011	2019	2015	2015	--	9	3,573
Financial performance variables							
ROA	-0.107	0.081	0.0074	0.008	0.007	--	3,573
ROE	-0.906	0.901	0.0768	0.081	0.07	--	3,573
NIM	-0.029	0.671	0.0311	0.034	0.022	--	3,573
Corporate governance variables							
BODS	4.00	33.00	11.52	11.00	3.24	--	3,573
ACS	0.00	14.00	3.78	4.00	2.097	--	3,573
BODGD	0.00	0.5625	0.12	0.10	0.112	--	3,573
ACMF	0.00	51.00	9.25	8.00	4.934	--	3,573
BODC	0.00	21.00	7.89	8.00	3.891	--	3,573
BODMF	2.00	57.00	11.96	12.00	4.768	--	3,573
GDS	0.01	0.875	0.473	0.482	0.146	--	3,573
CEOD	0.00	1.00	0.368	1.00	0.483	2	3,573

- *Author's Own*

- *ROA: Return on Assets; ROE: Return on Equity; NIM: Net Interest Margin; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

In regard to corporate governance characteristics, as can be seen from Table 3:6, the average bank has 11 members on its board, of whom 12% are women and eight are independent directors, who meet on average of 12 times a year. Meanwhile, the audit committee consists of four members on average, who meet nine times a year. CEO duality is set as a dummy variable in each of the models because of its categorical components of two values (no/yes). It can be seen that 63.1% (2,255) of the bank-year observations assume a separation of roles between the CEO and chairperson, while 36.9% (1,318) integrate the two roles.

3.4.3. Diagnostic Tests Results

In order to illustrate the impact of implementing inappropriate econometric techniques when modelling the governance performance relation, a baseline approach must be selected against which to compare alternative methodologies. More specifically, given its widespread use in the early governance–performance literature, the pooled OLS method of estimation was employed as our baseline analysis despite its strict exogeneity assumptions. The results of the panel assumptions of the pooled OLS model for each of the financial performance models are reported in the following Tables in this section and suggest violations of estimates for all models. Therefore, panel modelling techniques were applied, to decide the type of model between fixed effects or random effects. Therefore, it must be decided whether these effects are to be treated as fixed or random or a combination of both, which required the application of the Hausman test as previously discussed in the Methodology Section 3.3.4 of this research. In the first phase, the Hausman involved estimating a model with random effects. A high value of the chi-square ($\chi 2$) statistic of the Hausman test, corresponding to a p-value probability lower than the significance threshold α of 0.05, led to significant differences between the coefficients, which required the rejection of random effects as inconsistent; it was found that the panel estimation based on fixed effects is more appropriate. In the case of a relatively low p-value of the test in the analysis based on panel data, homoskedasticity is a basic hypothesis, which must be verified. The White's test was used to test the homoskedasticity hypothesis, while the autocorrelation of errors in the model estimation was tested by applying the Durbin–Watson and Wooldridge tests, noting the absence of collinearity violations.

After running the pooled OLS regression analysis, five diagnostic tests were conducted to predict the validity of the dataset and the appropriateness of the pooled OLS as a multiple linear regression analysis technique, which included linearity, normality, multicollinearity, autocorrelation, and endogeneity. According to the test results shown in Tables 3:8, 3:9, and 3:10, the panel assumption of the pooled OLS model was violated. Normality, autocorrelation, and heteroskedasticity were detected across all three models according to the Jarque-Bera, Wooldridge, and White's test results respectively. In regard to multicollinearity, the test results showed an absence of collinearity issues in both the Pearson correlation matrix and the variance inflation factor (VIF) tests.

Table 3:7 *Pearson Correlation Matrix*

	CEOD	GDS	BODMF	BODC	ACMF	BODGD	ACS	BODS
BODS	0.134	0.131	-0.041	0.575	0.013	0.241	0.283	1.000
ACS	0.196	0.212	-0.237	0.709	-0.299	0.355	1.000	
BODGD	0.151	0.383	-0.101	0.460	-0.121	1.000		
ACMF	-0.169	0.053	0.356	-0.318	1.000			
BODC	0.255	0.232	-0.234	1.000				
BODMF	0.022	-0.009	1.000					
GDS	0.043	1.000						
CEODY	1.000							

- *Author's Own*
- *ROA: Return on Assets; ROE: Return on Equity; NIM: Net Interest Margin; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

As can be seen in Table 3:7, the Pearson correlation matrix indicated the absence of multicollinearity. The results of the independent variables ranged between a minimum of –31.8% for the audit committee meeting frequency and number of independent directors on a BOD, and a maximum of 70.9% for the audit committee size and number of independent directors on a BOD. It is noteworthy that the two independent variables (audit committee size and the number of independent directors) were highly intercorrelated due to the fact that the audit committee members were mainly independent directors, and normally represent more than one third of the committee and more than half of the board of directors. Furthermore, to strengthen the results of the Pearson correlation matrix for the multicollinearity problem, the researcher used the variance inflation factor (VIF). The results

of the VIF were below ten across all independent variables included in the four models, as shown in Table 3:8 below. Therefore, the results were consistent with the correlation matrix, suggesting no collinearity issue.

Table 3:8 *Variance Inflation Factor (VIF) Test for Multicollinearity*

Independent Variables	VIF
BODS	1.663
BODMF	1.193
ACS	2.14
ACMF	1.341
BODC	3.445
BODGD	1.43
GDS	1.205
CEODY	1.099

- *Author's Own*
- *ROA: Return on Assets; ROE: Return on Equity; NIM: Net Interest Margin; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

Moreover, as shown in Table 3:9, the results of the remaining diagnostic tests used in this study, and as discussed in the Methodology Section 3.3, namely the Wooldridge test for autocorrelation, the test statistics for normality, and the White test for heteroskedasticity, failed to accept the null hypothesis of each test. Therefore, three issues in the data set needed to be considered: normality, endogeneity, and serial correlation. Given that the former issues cause the pooled OLS estimates to be biased and inconsistent, the pooled OLS model as an estimation method for the panel data set was considered inadequate to conduct the analysis as it would generate biased results.

Table 3:9 *Diagnostic Tests for Panel Regression Assumptions*

OLS Assumptions	Result	ROA	ROE	NIM
Autocorrelation	*t-statistic*	20.75	19.313	42.92
Wooldridge	*P-value*	*<0.0001****	*<0.0001****	*<0.0001****
Normality	*Chi-square*	443.56	243.71	538.39
Test Statistic	*P-value*	*<0.0001****	*<0.0001****	*<0.0001****
Heteroskedasticity	*LM*	255.598	272.301	235.15
White's	*P-value*	*<0.0001****	*<0.0001****	*<0.0001****
Cross Sectional Dependence	*Z*	63.05	36.72	40.42
Asymptotic Test	*P-value*	*0.000****	*<0.0001****	*0.000****
Time Dummies	*Chi-square*	221.46	132.11	59.53
Wald Joint Asymptotic Test	*P-value*	*<0.0001****	*<0.0001****	*<0.0001****
OLS Or Fixed Effects	*F*	11.4	10.514	25.34
Joint Asymptotic	*P-value*	*0.000****	*0.0000****	*<0.0001****
OLS or Random Effects	*LM*	3649.38	3600.46	5553.9
Breusch-Pagan	*P-value*	*0.0000****	*0.0000****	*0.0000****
Random or Fixed Effects	*H*	106.79	49.33	505.97
Hausman	*P-value*	*<0.0001****	*<0.0001****	*<0.0001****

- *Author's Own.*

- **: Significant at 10%, **: significant at 5%, ***: significant at 1%*

- *Wooldridge test for autocorrelation in panel data – Null hypothesis: No first-order autocorrelation.*
- *Test for normality of residual – Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity – Null hypothesis: heteroskedasticity not present.*
- *Cross-Sectional Dependence – Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies – Null hypothesis: No time effects.*
- *Joint Asymptotic test – A low p-value counts against the null hypothesis that the pooled OLS model is adequate in favour of the fixed effects alternative.*
- *Breusch-Pagan Test – A low p-value counts against the null hypothesis that the pooled OLS model is adequate in favour of the random effects alternative.*
- *Hausman Test – A low p-value counts against the null hypothesis that the random effects model is consistent, in favour of the fixed effects model.*
- *ROA: Return on Assets; ROE: Return on Equity; NIM: Net Interest Margin.*

The analysis went further by testing between the fixed and random effects as an alternative analysis technique for panel data, the Joint Asymptotic test, Breusch-Pagan test, and Hausman test were used. This was done because of the pooled OLS assumptions and in order to choose the most reliable model to conduct this research. Table 3:9 shows that the significance level of the test statistic produced by the Hausman test was at a level of below 5.0% across all models, suggesting that the random effects model should be rejected in favour of the fixed effects as the appropriate estimation method for assessing the impact of corporate governance on the financial performance of banks in G7 countries, as measured by the ROA, ROE, and NIM.

Despite the aforementioned test assumptions, the researcher deployed further testing to diagnose the fixed effects model's reliability and validity utilised in this essay. In view of the fact that the fixed effects model, as mentioned previously and with the support of the previous literature, analysed the dataset by taking into consideration the cross-sectional (banks') effects while excluding time effects, the researcher ran a fixed effects model with time dummies and concluded the presence of a statistically significant impact due to time. Therefore, the fixed effect was deemed unreliable for our research purpose. Accordingly, the data was exported into the SPSS Modeler, a software for data mining and text analytics. Machine learning nodes were used to analyze the data using a Generalized Linear Mixed Model (GLMM). The GLMM is based on complex covariance tables that combine analysis techniques from both fixed effects and random effects models. This approach produces reliable and valid outputs for the research problem. The data was exported into the SPSS Modeler, a software used for data mining and text analytics. Machine learning nodes were employed to analyze the data using a Generalized Linear Mixed Model (GLMM). The GLMM incorporates complex covariance tables that combine analysis techniques from both fixed effects and random effects models. This approach generates conservative, reliable, and valid results for the research problem. IBM defines the GLMM model as a complex multilevel model that is used for non-normal distributed longitudinal data, which is considered an extension of the linear model whereby it assumes that the dependent variable is linearly correlated to the independent variables and covariates through a specific link distribution function while having non-normal distribution (Kanters, 2022; Mcculloch, 2023; West et al., 2022; Wolfinger & O'connell, 1993).

3.4.4. Findings

This section presents and discusses the results of the multiple regression analysis in relation to the impact of corporate governance mechanisms and financial performance of banks in G7 countries. Tables 3:10, 3:11 and 3:12 show the multi-modelling regression results concerning the relationship between corporate governance characteristics and banks' financial performance as measured by the ROA, ROE, and NIM.

Generally, the results shown in the tables below indicate that the corporate governance mechanisms in G7 countries had a significant impact on banks' financial performance as measured by the ROA, ROE, and NIM with mixed relationships. With respect to the independent variables, five of eight corporate governance mechanisms, namely board size, board gender diversity, the number of independent directors on the BOD, audit committee size, and the governance disclosure score were found to have a significant effect across all financial performance measures. By contrast, BOD and audit committee meeting frequency were found to have a significant effect on only one financial performance measured by ROA, while the presence of a dual leadership role was found to have a significant effect on the net interest margin only.

Table 3:10 *Summary of Results – Dependent Variable: ROA*

Dependent: ROA	Pooled OLS	Fixed Effects	Random Effects	GLMM
Const	0.011	0.00703	0.0087	-4.713
	*<0.0001***	*<0.0001***	*<0.0001***	*0.000***
BODS	-0.00047	-0.000011	-0.0003	-0.048
	*<0.0001***	*0.8619*	*<0.0001***	*0.000***
BODMF	-0.00027	-0.00018	-0.0002	-0.019
	*<0.0001***	*<0.0001***	*<0.0001***	*0.000***
ACS	0.00017	-0.000026	0.0001	0.019
	0.105	*0.7518*	*0.2463*	*0.044***
ACMF	-0.000013	0.000031	0.000	-0.008
	0.738	*0.4239*	*0.6024*	*0.042***
BODCI	0.00056	-0.0000058	0.0003	0.049
	*<0.0001***	*0.9412*	*<0.0001***	*0.000***
BOGD	-0.00062	0.0073	0.0052	0.372
	0.693	*<0.0001***	*<0.0001***	*0.005***
GDS	0.0027	0.0039	0.0037	0.169
	*0.0453***	*0.0001***	*0.0002***	*0.058**
CEODY	-0.00057	-0.00013	-0.0002	0.026
	*0.0744**	*0.5999*	*0.3784*	*0.325*
F (8, 397)	*60.91496*			*18.925*
P-value(F)	*<0.0001****			*<0.0001****
R-squared / LSDV	*0.28141*	*0.703681*		
Adjusted R-squared / Within	*0.2798*	*0.06094*		
Schwarz criterion	*-25722.3*	*-24312.7*	*-25611.7*	*2911.7*
Akaike criterion	*-25666.6*	*-26816.0*	*-25667.3*	*2850.4*

- *Author's Own*
- **: Significant at 10%, **: significant at 5%, ***: significant at 1%*
- *All models were conducted with the function Robust (HAC) standard errors in order to reduce the error term.*
- *ROA: Return on Assets; ROE: Return on Equity; NIM: Net Interest Margin; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

Table 3:11 *Summary of Results – Dependent Variable: ROE*

Dependent: ROE	**Pooled OLS**	**Fixed Effects**	**Random Effects**	**GLMM**
Constant	0.094	0.087	0.0959	-2.303
	*<0.0001****	*<0.0001****	*<0.0001****	*0.000****
BODS	-0.0035	0.000091	-0.0025	-0.039
	*<0.0001****	*0.887*	*<0.0001****	*0.000****
BODMF	0.001	0.000075	0.00186	0.016
	0.297	*0.931*	*0.2038*	*0.15*
ACS	0.028	0.039	0.0404	0.416
	0.116	*0.0071****	*0.013***	*0.001****
ACMF	-0.00022	0.00014	0.0000685	-0.006
	0.517	*0.731*	*0.8934*	*0.156*
BODCI	0.0031	-0.0013	0.00154	0.031
	*<0.0001****	*0.0972**	*0.1095*	*0.000****
BOGD	-0.0014	-0.0013	-0.00222	-0.02
	*0.0003****	*0.0027****	*0.0014****	*0.000****
GDS	0.029	0.026	0.02927	0.259
	*0.0269***	*0.0034****	*0.0437***	*0.012***
CEODY	-0.0025	-0.0034	-0.003865	-0.003
	0.382	*0.218*	*0.1899*	*0.903*
F (8, 397)	*26.14068*			*20.837*
P-value(F)	*<0.0001****			*<0.0001****
R-squared / LSDV	*0.149985*			
Adjusted R-squared / Within	*0.1481*			
Schwarz criterion	*-9085.86*	*7678.84*	*-9071.297*	*3,818.808*
Akaike criterion	*−9141.486*	*10182.21*	*-9126.928*	*3,794.104*

- *Author's Own*
- **: Significant at 10%, **: significant at 5%, ***: significant at 1%*
- *All models were conducted with the function Robust (HAC) standard errors in order to reduce the error term.*
- *ROA: Return on Assets; ROE: Return on Equity; NIM: Net Interest Margin; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

Table 3:12 *Summary of Results – Dependent Variable: NIM*

Dependent: NIM	**Pooled OLS**	**Fixed Effects**	**Random Effects**	**GLMM**
Const	0.0427	0.0303	0.0342	-3.447
	*<0.0001****	*<0.0001****	*<0.0001****	*0.000****
BODS	-0.002	0.000089	-0.00072	-0.016
	*<0.0001****	*0.431*	*<0.0001****	*0.000****
BODMF	0.0011	-0.0002	0.00026	0.003
	*<0.0001****	*0.0775**	*0.0462***	*0.303*
ACS	-0.022	-0.0073	-0.0091	-0.136
	*<0.0001****	*0.0049****	*0.0001****	*0.011***
ACMF	-0.0002	0.000012	-0.00018	-0.002
	*0.0055****	*0.842*	*0.001****	*0.199*
BODCI	0.0021	-0.0002	0.00074	0.02
	*<0.0001****	*0.0966**	*<0.0001****	*0.000****
BOGD	-0.0005	-0.000013	-0.00014	-0.003
	*<0.0001****	*0.804*	*0.0047****	*0.004****
GDS	-0.0011	0.0049	0.0044	0.101
	0.7302	*0.0686**	*0.0914**	*0.098**
CEODY	0.0008	-0.00034	0.00019	0.014
	0.2645	*0.317*	*0.5909*	*0.035***
F (8, 397)	*153.4931*			*7.756*
P-value(F)	*<0.0001****			*<0.0001****
R-squared / LSDV	*0.51166*	*0.882828*		
Adjusted R-squared / Within	*0.510564*	*0.017156*		
Schwarz criterion	*-17834.31*	*-15636.96*	*-17820.76*	*-2,995.844*
Akaike criterion	*-17889.94*	*-18140.33*	*-17876.39*	*-3,020.548*

- *Author's Own*
- **: Significant at 10%, **: significant at 5%, ***: significant at 1%*
- *All models were conducted with the function Robust (HAC) standard errors in order to reduce the error term.*
- *ROA: Return on Assets; ROE: Return on Equity; NIM: Net Interest Margin; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

3.4.4.1. The Impact of BOD Size on the Financial Performance of Banks

As can be seen from Tables 3:11, 3:12, and 3:13 above, the board size of banks in G7 countries was found to have a significant negative impact on financial performance as measured by the ROA, ROE and NIM at a level of below 1%. Larger boards in G7 countries were found to impact banks' financial performance measures statistically significantly negatively, indicating that one additional member serving on the board decreases banks' net income relative to their assets by 4.8% while also decreasing the net income relative to shareholders' equity by 3.9% and the profit spread between interest income and interest expense relative to the total interest-bearing assets by -1.6%.

The findings of this essay are inconsistent with the agency, stakeholder and resource dependence theories and consistent with previous research such as that of Pathan and Faff (2013), who found a negative relation between large board size and performance in a study of 300 US banks, arguing that large board sizes increase operating costs in a way will ultimately burden the institution, especially in turbulent economic times. De Andres et al. (2005) discussed the existence of a significantly negative relationship between larger board size and firm performance in market-based economies such as the UK, US, and Canada, and internal systems in some western European countries such as Italy, France, and Switzerland. These results, indicating a significant negative relationship between board size and the ROA, also support the findings of Haniffa and Hudaib (2006); Staikouras et al. (2008) in their study of a sample of 68 US banks between 2005 and 2007; Sheikh and Wang (2012) indicate a negative link between board size and bank profitability. As board size increases, agency issues emerge, leading to a decrease in the effectiveness of the board due to lack of communication, organisation and involvement, in addition to worse financial reporting supervision and reduced company performance (Eisenberg et al., 1998; Mak & Kusnadi, 2005). These studies suggest that negative impacts on the ROA are likely because larger boards tend to be indecisive owing to ineffective communication and coordination problems, which ultimately leads to less effective management and reduced overall performance. Moreover, Romano et al. (2012) state that, as boards become larger, they become less effective, perhaps because members feel a reduced sense of responsibility towards the organisation, which can lead to more bureaucratic issues.

On the other hand, Adams and Mehran (2012b), Coles et al. (2008), Kajola (2008), Sanda et al. (2010), and Sheikh and Wang (2012) have indicated that a larger board size has a favourable correlation with financial performance. According

to the findings of Sheikh and Wang (2012), larger board sizes cause markets to respond favourably, and large boards contribute to the ability to monitor poor operating performance since a diversity of backgrounds allows for better coordination of communication. In addition, Aebi et al. (2012) concluded that board size is positively correlated to financial success metrics such as ROE, based on a sample of US banks from 2007–2008.

On the basis of the negative significant results of BODS generated in this essay, the banking sector in G7 countries may be advised to consider decreasing the number of board members in support of enhanced performance while determining the optimal number of board members that is appropriate for each bank's ecology and situation at a given time. The negative significant results of the impact of board size on banks' financial performance metrics in G7 countries and the strategic importance of board size as a major component of decision-making in accordance with the codes of corporate governance across different nations are supported by previous empirical works.

3.4.4.2. The Impact of CEO Duality on the Financial Performance of Banks

Based on all financial performance measures (ROA, ROE, and NIM), the CEO duality in G7 countries was found to have a statistically significantly positive impact on financial performance as measured by NIM at a level of below 5%. As shown in Tables 3:11, 3:12, and 3:13, the existence of duality impacted slightly positively insignificantly banks' ROA, insignificantly negatively the ROE, and significantly positively the NIM by 2.6%, –0.003%, and 1.4% respectively. The positive results were found to be consistent with stewardship theory, which suggests combining CEO and chairperson roles will boost performance as agents will be functioning in the interests of shareholders. While this essay's findings are inconsistent with agency theory, the duality of roles generates agency problems which, in turn, leads to poor corporate performance, as a board's monitoring function becomes less effective and compromised while producing difficulties for the flow of information (transparency) (Finkelstein & D'aveni, 1994). Our findings also undermine corporate governance codes and regulators' recommendations that the roles should be separated.

It has been noted in the Literature Review in this essay that different studies on duality have found conflicting results as to its impact on banks and other non-financial firms. Our findings reinforce that when the CEO and chair are one person, this leads to more effective decisions and enhanced overall performance. These results are consistent with studies of previous researchers who support the concept of duality of the CEO and chairperson roles and argue that the chair is

more knowledgeable about a bank due to their combining roles and responsibilities in respect of both monitoring and execution, which leads to sounder decisions. Brickley et al. (1997) have stated that a duality of roles provides the CEO with leadership and the skills needed to efficiently respond to challenges and deal with crises as they present themselves. Supporters of this viewpoint also add that duality improves and accelerates the decision-making process and improves corporate performance by allowing the chairperson/CEO to focus on the operations and achieve company goals (Haniffa & Hudaib, 2006).

By contrast, other researchers have stated that where a dual CEO and Chairperson role is in operation, the possibility of CEO corruption is limited as the board will have the independence it needs to monitor and evaluate the performance of the CEO effectively and efficiently (Haniffa & Cooke, 2002; Lipton & Lorsch, 1992). Combining both leadership roles, it is further argued, has a direct effect on the control of the board as it creates a strong individual power base (Donaldson & Davis, 1991; Fama & Jensen, 1983; Jensen & Meckling, 1976; Whittington, 1993). According to some researchers, a duality of roles affects performance negatively (Jensen, 1993; Lipton & Lorsch, 1992), while it has been noted that duality will increase agency costs as the chairperson, as part of the board, has the responsibility for compensating the CEO. The authors reiterate that it is crucial in banks to separate the two roles because the discipline of the CEO will be obscured by the opacity and complexity of the bank's operations. In his study of the relationship between CEO duality and a bank's risk-taking indicators through an analysis of a sample of US banks from 1997–2004, Pathan (2009) showed that appointing a risk-averse CEO in a dual-control environment did not incentivise a bank to take risk insofar as CEO duality negatively affects banks' risk-appetite and therefore potentially negatively their performance. This is also consistent with the findings of Simpson and Gleason (1999) who elaborated that the behaviour of a bank CEO with dual leadership control will be focused on human capital while operating more conservatively on risky projects and investments in order to protect his/her own benefits and thereby lower the probability of bank default.

It is concluded that the positive impact of the presence of dual control on banks' financial performance in G7 countries is inconsistent with agency theory and supports stewardship theory (Weir et al., 2002). Therefore, it is essential for regulators and banks in G7 countries to reconsider combining both roles of the CEO and chairperson in order to

implement effective governance practises, increased transparency, more effective monitoring, sound decision-making, and enhanced overall bank performance while focusing on the perception of ethical behaviour.

3.4.4.3. The Impact of BOD Gender Diversity on Banks' Financial Performance

The findings show that female directors serving on boards in G7 countries statistically significantly positively impacted banks' financial performance, as measured by the ROA and ROE, at a level of below 1% while significantly negatively affecting financial performance, as measured by the NIM, at a level of below 5%. This indicates that a higher board composition of women in G7 countries increases banks' net income relative to assets and shareholders' equity by 37.2% and 41.6% respectively, although it decreases banks' profit margins relative to their interest-bearing assets (NIM) by 13.6%.

Based on both the ROA and ROE performance measures, the results were consistent with the stakeholder theory, which states that the representation of minorities on boards, including women, is valuable and socially beneficial to corporations because women offer diverse views, unique perspectives for sound decision-making, and better represent diverse stakeholders' groups within communities. These findings are also consistent with previous international studies that have found a positive correlation between the representation of women on boards and corporate performance. Research shows that female representatives on both corporate boards and in senior management will positively impact the financial performance and success of the company. The positive relationship between financial performance and women is foregrounded in studies by (Carter et al., 2003; Simkins & Simpson, 2003; Smith et al., 2006). According to Prihattiningtyas (2012), who studied the impact of gender diversity on profitability and financial positions such as the ROA, ROE, and return on sales (ROS), having more women on the board of directors increases the level of creativity and subsequently positively affects the strategic direction. Campbell and Mínguez-Vera (2008) also argued that women have a positive impact on the BOD as the quality of management, and therefore the financial performance, improves.

The positive relationship between board gender diversity and financial performance may be due to gender differences; specifically, in their ability to effectively monitor and coordinate activities, women may provide a benefit to the board due to their having different natures and social networks from men (Conyon & He, 2017). Similarly, it is argued that women serving on boards generally offer in-depth discussions as they search for information, value different opinions,

and offer diverse points of view (Post & Byron, 2014). Women also typically provide enhanced consensus within the group, and their presence may lead to more disciplined behaviour in the boardroom, which leads to improved decision-making (Pucheta-Martínez et al., 2016). Moreover, in their study, Andres et al. (2017) using a sample of 156 banks from Eastern and Central European countries between 2008 and 2012, found that the higher the percentage of women on the board, the greater the bank's stability during the financial crisis, as evidenced by the identified negative significant relationship between women on the board and non-performing loans.

Nevertheless, the ROA and ROE models extrapolated positive results that contravene other studies and empirical works that have found a negative relationship between gender diversity in corporate governance and financial performance. Although these studies support our results regarding the impact on banks' financial performance as measured by the NIM, they reveal that a higher percentage of women serving on a board either has a negative impact or does not affect corporate performance (Adams & Ferreira, 2009; Dobbin & Jung, 2010; Prihattiningtyas, 2012). This implies that there are possible weaknesses associated with a higher proportion of women on boards related to their dissimilarities from men that may cause problems with consistency, communication effectiveness, and coordination.

Although there is no consensus concerning the effect of a board's gender diversity on a bank's financial performance, the majority of research has confirmed that the presence of women on boards and in management makes a distinct positive impact on the strategic and financial direction of corporations. The present essay found that women on boards have a significant impact on banks' financial performance in G7 countries in terms of positive and negative relationships, indicating that an optimal percentage of women serving on banks' boards should be determined that balances the advantages and disadvantages. While a higher percentage of women may cause communication problems and conflicts among board members and management, and create a highly risk-averse environment that causes limitations and challenges for growth and expansion plans due to women's sociological and psychological nature, advantages such as enhanced and effective monitoring, diverse and unique opinions and perspectives may lead to deep discussions and better decision-making, and improve societal satisfaction, especially among minority groups in the community.

3.4.4.4. The Impact of Audit Committee Size on the Financial Performance of Banks

The results showed a positive significant link between audit committee size and banks' financial performance as measured by the ROA, while positively insignificantly impacts ROE and NIM. The results obtained indicated that a larger audit committee size in G7 countries' banks is important for their financial performance as a large committee increased the ROA by 1.9% at a level of below 5%, although the mechanism had a weak positive insignificant impact on banks' ROE and NIM of 1.6% and 0.3% respectively.

The above findings lend empirical support to previous studies that found positive coefficients with financial performance, especially the significant positive effects on the ROA generated in this research, which may indicate that audit committees have a crucial role in monitoring management and the integrity of financial reporting and transparency (Jensen, 1993; Vafeas, 2005). The findings of this research relating to banks in G7 countries support the agency and resource dependency theories that suggests that larger audit committees are more effective due to the diverse knowledge and expertise their members add to the board, thereby enhancing their financial practises (Hamdan et al., 2013). Moreover, Allegrini and Greco (2011) have stated that the resource dependency theory suggests that audit committees with a greater number of directors offer diversity and a better capacity to effectively carry out their roles and responsibilities (Bédard & Gendron, 2010). Previous studies suggest that the financial expertise, knowledge, and skills of members serving on the audit committee are among their most important attributes, leading to a higher quality of financial reporting and diligent monitoring (Abbott et al., 2003; Carcello et al., 2002). This also enhances firms' position and their credibility among shareholders as it displays their ability to protect shareholders' interests, which in turn leads to improved performance and a higher value overall.

In contrast, studies conducted by Hamdan et al. (2013) and Yang and Krishnan (2005) found that audit committee size negatively impacts management earnings. Both studies suggest higher integrity in financial reporting is achieved when there is an optimal number of audit committee members. According to Jensen (1993) and Vafeas (2005), an optimal size of the audit committee should be determined to enhance the effectiveness of its role since too large a committee size can lower financial performance when coordination and communication issues arise that cause ineffective monitoring. When a committee is too small, on the other hand, financial performance might be affected negatively as the number of committee

members will be insufficient to properly fulfil their monitoring role. Specifically, it has been suggested that the ideal size of an audit committee is three to four members (Abbott et al., 2004; Vafeas, 2005).

Other scholars have found no relation between audit committee size and corporate performance. Thoopsamut and Jaikengkit (2009) reported that no significant relationship between audit committee size and earnings management. In addition, Durgavanshi (2014) found no relationship between the ROE and operational self-sufficiency (OSS) and the audit committee. In their study, Hayes et al. (2004) discerned that an audit committee composed of non-executive directors does not impact performance. Beasley (1996) reported that the structure of an audit committee is not correlated to the number of fraud events in a company, while Kajola (2008) found that an audit committee composed of a majority of independent directors has no impact corporate performance According to a study done by Carcello and Neal (2000), it has also been claimed that the inclusion of audit committees does not improve performance.

This essay has found that the corporate governance mechanism measured by audit committee size is vital to banks' financial performance, although the findings reveal a marginal insignificant impact on banks' ROE and NIM. However, these findings are consistent with the arguments that suggest a larger number of highly skilled members serving on the audit committee will be more effective in exposing problems and dilemmas during the course of reporting, and which leads to enhanced disclosure practises and transparency (Anderson et al., 2004; Persons, 2009).

3.4.4.5. The Impact of Audit Committee Meeting Frequency on Banks' Financial Performance

The findings in Tables 3:11, 3:12, and 3:13 above show that the number of audit committee meetings negatively affects all banks' financial performance measures while only impacting the ROA statistically significantly at a level of below 5%. The findings show that more frequent audit committee meetings minimally decrease banks' profitability measures of the ROA statistically significantly by 0.8% and of the ROE and NIM insignificantly by 0.6%, and 0.2% respectively. However, in respect of these findings, it has been argued that there is a positive correlation between a larger number of audit committee meetings and financial reputation as fewer incidents of fraudulent accounting practise occur (Abbott et al., 2004; Beasley, 1996; Xie et al., 2003).

These results further support the empirical findings of prior studies conducted on banks and firms operating in different countries. A larger audit committee may lead to inefficient governance, yielding more frequent meetings (Vafeas, 1999). Barakat and Hussainey (2013) examined the audit committee meetings and operational risk disclosure scores of European banks using a sample of 85 banks operating across 20 European countries between 2008–2010, revealing that banks with more frequent audit committee meetings provide higher quality operational risk disclosure. Their findings imply that strong audit committee effectiveness may limit bank risk-taking actions. Controversially, Raghunandan and Rama (2007) concluded that the frequency of audit committee meetings and the number of audit committee members are interrelated attributes and argued that more frequent meetings and a larger committee provide more effective monitoring, thus improving overall performance. It is suggested by Abbott et al. (2000) and Beasley (1996) that a higher frequency of audit committee meetings reduces the likelihood of fraud and hostile accounting activities and lowers the occurrence of earnings management (Xie et al., 2003). These studies imply that in order for the audit directors serving on the board to enhance the effectiveness of their monitoring activities and discharge their responsibilities more efficiently, audit committees should be active and hold regular meetings during the fiscal year.

In light of the results of this essay, we argue that banks in the G7 countries should lower the frequency of audit committee meetings to enhance their financial performance while focusing on valuable committee activities, as the results suggest a higher frequency of audit meetings lowers financial performance in a way that may be due to the fact that more audit committee meetings distract management from functioning efficiently, are time-consuming, and create conflicts with management. However, since either an excess or deficit of members and meetings may negatively affect the goal of achieving good governance in a way that is linked to more sustainable growth, this essay proposes that regulators and banks operating in G7 countries should reduce the number of meetings and make a determination of the optimal number of meetings of the audit committee deemed appropriate for each situation while focusing on the skills and competency of its members to ensure that a bank's actions are aligned with the interests of its stakeholders. Nevertheless, an imbalance in the number of members and meetings can hinder the objective of attaining effective governance, which is crucial for sustainable growth. To address this issue, this essay suggests that regulators and banks in G7 countries should decrease the frequency of meetings and determine the ideal number of audit committee meetings based on the specific

circumstances. Moreover, emphasis should be placed on the expertise and proficiency of committee members to ensure that a bank's actions align with the interests of its stakeholders. While a bank with multiple issues and weaknesses may require a greater meeting frequency, one with stabilised operations and strong management performance does not require a highly active audit committee as more frequent meetings will cause distractions and conflicts with the executive management.

3.4.4.6. The Impact of BOD Composition of Independents on Banks' Financial Performance

The findings in Tables 3:11, 3:12, and 3:13 above show that board composition mechanisms of corporate governance that measure the ratio of outsiders (independent directors) serving on boards impact banks' financial performance across all three measures significantly positively at a level of below 1%. Based on the ROA measure, an additional independent director serving on a G7 bank's board was determined to increase the proportion of net income relative to assets by 4.9%. This board composition mechanism was found to impact financial performance as measured by the ROE positively significantly: when the number of independent directors serving on the board increases by one, the ROE increases by 3.1%.

In regard to the banks' NIM, the number of independent directors representing depositors and minority shareholders in the boardrooms of banks in G7 countries positively and statistically significantly affects financial performance as measured by the NIM. Our analysis indicates that an additional independent director increases profit margins (spread between interest income and interest expense) relative to the amount of interest-bearing assets by 2.0%. These results, which indicate the importance of an independent director's role on a bank's board in G7 countries as a vital governance mechanism, and its impact on key financial measures for banks, are supported by other researchers, who have reported that the proportion of independent directors serving on boards positively correlates with banks' and non-financial firms' accounting-based performance measures (Alonso & Gonzalez, 2006; Cho & Kim, 2007; Cornett et al., 2011; Erkens et al., 2012; Fama & Jensen, 1983; Gordini, 2012; O'Connell & Cramer, 2010; Staikouras et al., 2008; Trabelsi, 2010; Yasser, 2011).

In a study of 58 European banks from 2002 to 2004, Staikouras et al. (2008) discovered that board composition has a favourable but statistically insignificant influence on both the ROA and ROE. They asserted that the experience of

independent directors provides better oversight value in relation to organisational performance. In a study conducted using a sample of 66 commercial banks operating in six OECD nations from 1996 to 2003, Alonso and Gonzalez (2006) revealed that independent directors were significantly correlated with financial performance as measured by Tobin's Q and the ROA. In their study sample of 300 publicly traded US banks for the years 2007–2008, Cornett et al. (2011) asserted a positive relation between the number of independent directors and a bank's performance, while in a 1999 sample of 347 Korean-listed businesses, Cho and Kim (2007) demonstrated a strong correlation between the rate of outside directors' engagement and company performance, as assessed by the ROA. These studies show that boards that feature a high number of external directors promote better performance.

Theoretically, these findings are also consistent with agency theory, which suggests that independent directors play a vital role in supervising and controlling managers. In addition, previous research argues that the independence of non-executive directors qualifies them to carry out their monitoring function in a more professional manner, as they are conscious of their reputation and will maintain a professional attitude in order to preserve it (Fama, 1980; Fama & Jensen, 1983). Fama and Jensen (1983) concluded that a high proportion of independent directors improves performance and signals to the market that the control system is efficient. One management innovation mechanism to mitigate agency cost is to have a greater percentage of independent directors on the board, as they are perceived as a tool to supervise and control management (Chizema & Kim, 2010).

In addition, such results are also consistent with the resource dependency and stakeholder theories, which suggest that outside directors offer their advice on strategic planning and investments in addition to providing access to their community and stakeholder networks, thereby adding value to the firm and improving its overall performance and profitability. There is a similarity between the results of banks' corporate governance practises measured by the board composition in relation to financial performance in G7 countries and the UK Corporate Governance Code (2011), which states that independent directors are responsible for sustaining the integrity and robustness of financial controls, procedures, systems, and risks. Thus, we conclude that independent directors should function as an effective tool for monitoring management, inducing it to produce a more reliable financial performance.

Stewardship theory suggests that board composition has an impact on banks' financial performance because inside directors are more efficient and effective in overseeing institutions as they are more informed about and specialised in the firm's complex operations and functionality. On this basis, the performance of the firm will be enhanced if a unified leadership structure that includes the executives is implemented, due to the fact that this will enable the latter to make more informed and enhanced decisions (Baysinger & Hoskisson, 1990). Controversially, however, previous studies have found a positive relationship between a higher proportion of independent directors and the performance of banks and other non-financial firms (Bhagat & Bolton, 2008; Bozec, 2005; Cheng, 2008; De Andres & Vallelado, 2008; Llewellyn & Muller-Kahle, 2012; Mangena et al., 2012; Sanda et al., 2010). Bhagat and Bolton (2008) found a negative relationship between board independence and performance as measured by the number of independent directors, while Yermack (1996) concluded that there is a negative correlation between performance and the number of outside directors. In addition, a study conducted using a sample of 25 Canadian businesses between 1976 and 2000 concluded that the relation between board composition and company performance was negative (Bozec, 2005). Based on a sample of 296 financial businesses during the recession of 2007–2009, Erkens et al. (2012) revealed that financial businesses with a proportion of independent directors serving on the board suffered from lower returns due to the level of independence of their boards. Moreover, Cheng (2008) found a negative relation between businesses' performance and board composition in his study of 2,980 US enterprises (including 122 financial firms) from 1996 to 2004. Finally, De Andres and Vallelado (2008) stated that because non-executive directors have other commitments, they may not devote sufficient time to the company and may also lack the knowledge and expertise required to make crucial decisions. On this basis, these authors do not agree with the concept of a positive relation between non-executive directors and bank performance.

Moreover, in contrast to our results, and using a sample of 296 major financial institutions operating across 30 countries during the financial crisis of 2007–2008, Erkens et al. (2012) found that banks with highly independent boards performed worse than those with boards subservient to shareholders, claiming that independent directors were crucial in compelling management to increase equity capital in the aftermath of the crisis because of their concern for capital sufficiency and to decrease the probability of bankruptcy due to the deterioration in value of risk assets at that time. This

prompted a wealth shift from current equity holders to debtholders since generating equity capital was exceedingly expensive during that time as financial institutions had to obtain more capital.

Some researchers have noted that independent directors do not have a significant relationship with performance (Llewellyn & Muller-Kahle, 2012; Minton et al., 2010). Llewellyn and Muller-Kahle (2012) found no connection between financial performance and an independent board. In addition, based on the banking data of 298 US banks between 2007 and 2008, Fernandes et al. (2016) stated that independent directors had no impact on the performance of financial institutions. Bonn et al. (2004) also concluded that the claims of extra knowledge, expertise, and skill sets offered by independent directors have been disproved and thus their impact on overall corporate performance was found to be insignificant.

There are mixed results regarding the impact of outside directors on banks and non-financial firms' performance. A number of studies, including ours, have found a positive relation between board composition and banks' profitability, where banks with a higher number of independent directors were found to outperform those with a lower number of independent directors (Al-Hawary, 2011; Al-Sahafi et al., 2015; Staikouras et al., 2007). To support the implementation of effective corporate governance that improves decision-making, the appointment of an independent director is crucial (BCBS, 2006; 2015; 2010). Generally, the positive and significant impact might be attributed to the fact that independent directors have knowledge of banks' operations and are highly skilled and competent in carrying out their monitoring function in a professional manner, as well as responsible for sustaining the integrity and robustness of financial control procedures, systems, and risks while enhancing financial performance. On the other hand, a number of previous studies and empirical works have generated findings that are inconsistent with our study and show that board composition is negatively linked to bank performance; for example, (Adusei, 2012; Al Manaseer et al., 2012; De Andres & Vallelado, 2008).

The results of this essay on banks operating in the G7 countries support the agency and stakeholder theories and undermine the stewardship theory, which states that independent directors have less ability to oversee and advice due to their lack of information, specifically concerning the bank's day-to-day operations, which in turn prevents them from

functioning efficiently and inhibits their ability to improve bank performance. Therefore, banks operating in G7 countries should reconsider increasing the number of independent directors in order to enhance their profitability while taking in consideration optimising the ratio of independent directors to ensure unbiased governance practises.

3.4.4.7. The Impact of BOD Meeting Frequency on Banks' Financial Performance

The time allocated by BODs in G7 countries to monitor banks' business and operations was found to be a crucial internal governance mechanism affecting their financial performance negatively and statistically significantly, whereby the number of board meetings had a negative significant relationship with all performance measures at a level of below 1%. The results revealed that an increase in the number of board meetings reduces the level of efficiency of banks in using their assets, thereby reflecting negatively on banks' profitability by 1.9%.

Based on the ROE performance measure in Tables 3:11, 3:12, and 3:13 above, a higher frequency of board meetings was found to have a marginal positive insignificant relationship of 1.6%. That is, more specifically, when the number of board meetings increases by one meeting during the fiscal year, profits relative to shareholders' equity of banks increased by 1.6%. The frequency of board meetings was found to have a positive insignificant impact on the NIM of 0.3%. This indicates that when board meetings increased, the net interest income increased by 0.3% relative to the amount of interest-bearing assets, due to the increase in the difference between interest income, generated mainly from creditors, and interest costs paid by the bank to debtholders (mainly depositors).

Generally, the results showed that board activity is important for G7 banks' financial performance. It was found that the higher the board meeting frequency, the lower the ROA. Therefore, it is argued, banks in G7 countries should consider holding important meetings at a lower frequency. The results allude to the issue that more frequent board meetings in G7 countries led to less productive operations and activities by diverting management time and resources. These findings are consistent with previous empirical studies that revealed a negative relationship between the number of board meetings and financial performance (Fich & Shivdasani, 2006; O. Ilaboya & Osasu, 2015; Lorsch & Maciver, 1989; Mace, 1986; Taghizadeh & Saremi, 2013; Useem & Zelleke, 2006). Lorsch and MacIver (1989) showed that the more frequent the board meetings, the more time, effort, and resources are wasted, thereby reducing productivity. This finding is consistent with those of (O. Ilaboya & Osasu, 2015; Useem & Zelleke, 2006).

In addition, a study by Johl et al. (2015) indicated that a reduced frequency of board meetings is advised because the findings indicated a detrimental influence of board meetings on firms' financial performance. Based on a study conducted on a sample of 500 firms on the Forbes list between 1989–1995, Fich & Shivdasani (2006) found that a higher frequency of board meetings affects firms' operating performance as measured by ROA negatively and statistically significantly. Moreover, in a study which assessed a sample of 150 publicly listed firms operating in Malaysia, Taghizadeh & Saremi (2013) reported that a greater number of board meetings resulted in lower profitability. Vafeas (2000) has asserted that, during a given fiscal year, there is a negative relationship between board meeting frequency and the financial performance of firms due to the expenses incurred from such meetings. However, the resource dependence theory suggests that board meetings are considered a resource for the firm (Lipton & Lorsch, 1992). Moreover, from the agency theory point of view, more active boards could, it is argued, enhance the monitoring and control capability of the board of directors, thereby reducing agency costs.

Our findings contradict other empirical evidence, such as that of Brick and Chidambaran (2010) who stated that corporate performance is positively impacted by the frequency of board meetings, as meetings may increase as a result of the pressure from regulators and shareholders, which generally has a positive impact on overall corporate performance, possibly due to the fact that a more active board will increase the effectiveness of monitoring and control functions by disseminating important information about a firm. Francis et al. (2012) and Ntim and Osei (2011) stated that firms with a low frequency of board meetings performed worse compared to firms with more frequent board meetings. In contrast, other scholars have found that a higher frequency of board meetings insignificantly impacts a firm's financial performance (Aliyu et al., 2021; Naseem et al., 2017).

In our view, due to the complex nature of banking operations, a board should have an active and dynamic role in order to maintain a sound and credible financial position, especially during periods of economic and financial uncertainty, as well as during times where major strategic decisions need to be debated and taken. However, a higher frequency of board meetings is deemed crucial in the banking environment as some banks' ecosystems may be surrounded by uncertainties and risks or there may be an important topic to discuss. The more frequent meetings may contribute to

preventing the agency issue, which argues that when decision-making is effectively monitored by an experienced and capable board, communication and discipline within an organisation is enhanced (Ntim & Osei, 2011).

As a result of the above, banks in G7 countries should assess and choose the ideal number of such meetings, as an increase in BOD meetings will negatively impact the performance of the banks, while noting that BOD should have the necessary knowledge and skills to avoid conflicts with management and get beneficial results from their operations.

3.4.4.8. The Impact of Governance Disclosure Scores on Banks' Financial Performance

Tables 3:11, 3:12, and 3:13 show that the governance disclosure score, which measures the level of transparency in disclosing governance data, affects positively and statistically significantly banks' financial performance in G7 countries at a level of below 10% for the ROA and NIM, and 5% for the ROE. These results further indicate the governance disclosure score implied that the greater the transparency in relation to the governance of banks in G7 countries, the higher banks' efficiency in (1) generating more returns by 16.9% by properly and effectively managing and using their total assets; (2) increasing the level of returns relative to shareholders' equity (the banks' net asset value) by 25.9%; and (3) increasing profit margins by 10.1% by effectively using interest-bearing assets including credit facilities, fixed-income investments, and various money market portfolios. The findings are supported by prior studies and empirical works that have investigated the relationship between corporate governance disclosures and the performance of banks and non-financial firms (Brown & Caylor, 2004; Florackis & Ozkan, 2009; Iatridis, 2008; Klein et al., 2005; Ntim et al., 2012; Othman & Ameer, 2012; Owusu-Ansah & Yeoh, 2005; Renders et al., 2010).

Iatridis (2008) stated that governance disclosure is considered an important tool to monitor the activities, characteristics, and practises of the BOD and enhances the overall business, who reported a positive relationship between corporate disclosure in regard to the annual report and financial performance. Othman and Ameer (2012) found that governance disclosure related to certain mechanisms, such as board attributes and structure, and had a positive impact on the performance measures of firms, noting that their results also indicated that governance disclosure impacts financial institutions more than non-financial institutions. Likewise, a highly positive correlation was detected between governance disclosure and financial performance as measured by the ROA when a sample of 14 publicly listed firms operating in emerging markets was examined (Klapper & Love, 2004).

Theoretically, greater disclosure offers more information about firms' managerial and financial positions, allowing a proper investment and financial assessment to be conducted by stakeholders, including shareholders, potential investors, creditors, and depositors, thereby affecting market discipline, which in turn impacts management behaviour and decision-making in a way that may allow a firm to avoid subsequent market reactions. In their studies, Bliss & Flannery (2002); Flannery (2001) stated that the amount of information disclosed to the public affects market discipline, as a higher flow of information will enhance creditors and investors' ability to examine a bank's position and assess its future state in different ways, thereby influencing management decisions and operational behaviour. Flannery (2001) claimed that greater disclosure of information reduces the risk funding premium of banks, which may lower the cost of funds and enhance the use of assets and more profitable investments because of market reactions.

Controversially, a number of previous studies found a negative and insignificant relationship between governance disclosure and firms' financial performance. An insignificant relationship between performance and corporate governance disclosure was reported by Bauer et al. (2004) which was later revised and transformed into a significantly and statistically negative relationship. However, other studies, such as those of Park and Shin (2004) and Prevost et al. (2002), were unable to generate any evidence of a relationship between the two variables. Other empirical works have studied the nature of the association between governance disclosure and certain aspects of a firm's performance; Jensen & Meckling (1976) reported that less information is disclosed when there is a block holder-and-director owner (a board member who is also a shareholder) serving on the board, suggesting that directors who own shares in the company will be lenient about the transparency level and the quality of information disclosed by management. Therefore, a negative relationship is asserted between director ownership and block ownership as to information disclosure, which may reduce overall corporate performance.

Since the financial crisis of 2007–2008, corporate governance disclosure and transparency have been seen as very important for the minimisation of financial uncertainties since ineffective monitoring of directors and a lack of information about governance and financials causes financial distress and defaults. Therefore, it is crucial for banks and non-financial firms to have good regulations and stricter requirements governing the disclosure of information. They must disclose accurate information to their shareholders and the public concerning their financial performance, assets, liabilities,

corporate governance, and ownership to allow current and potential investors to accurately assess the risks and rewards associated with any investment decision (OECD), 2004). The correlation between corporate governance disclosure and a firm's performance makes it clear that internal and external governance mechanisms lead to more effective operations (Chen & Lu, 2009). Access to the right level of information allows markets to properly assess a company's governance and the extent to which it responds to shareholders' needs, reveals any potential risks, and gives an accurate indication of the direction of future cash flows. Disclosure benefits both individual investors and the market as a whole (UNCTAD, 2011). Based on these findings, we find that a transparent board of directors and management of banks in G7 countries is essential due to its importance in enhancing the confidence and trust of stakeholders, including depositors, creditors, and investors.

3.4.4.9. Unbalanced Sample Treatment Approach: Summary of Results

Sampling bias is a common form of bias which occurs when data is collected in a manner that over-samples from one community and under-samples from another. This was the case in our dataset, albeit unintentionally (accidentally because of natural circumstances) as the data was extracted from the Bloomberg online database, which might reflect the behaviour of the cross-section observations (banks) regarding their disclosures and also reflects the real world whereby the US has more regional banking institutions than Canada, France, Italy, Japan, Germany, and the UK.

The major challenge is that the distribution of the observed data is not the same as that of the target population (Heckman, 1976). Sampling bias leads to a systematic distortion of the estimate of the sampled probability distribution. A common cause of sampling bias lies in the design of a study or in the data collection procedure, both of which may favour or disfavour collecting data from certain classes or individuals or in certain conditions. Sampling bias is also particularly prominent whenever researchers adopt sampling strategies based on judgment or convenience, and in which the criterion used to select samples is somehow related to the variables of interest. However, using a sampling frame does not necessarily prevent sampling bias. For example, a researcher may fail to correctly determine the target population or use outdated and incomplete information, thereby excluding sections of the target population. Furthermore, even when the sampling frame is selected properly, sampling bias can arise from non-responsive sampling units (e.g., certain classes of

subjects might be more likely to refuse to participate or be harder to contact, etc.) Non-responses are particularly likely to cause bias whenever the reason for the non-response is related to the phenomenon under study (Panzeri et al., 2008).

This essay aims to address the unintentional sampling bias in our data, which may not accurately represent the real world. To ensure that any doubts about the researcher's sampling strategies are eliminated, this study conducts a separate and comparative analysis of the impact of corporate governance mechanisms on banks' performance. The analysis focuses on the G6 countries (excluding the US) and the US alone. (See Appendix A for detailed findings.) Furthermore, the researcher utilised machine learning techniques, deploying a cluster analysis algorithm followed by regression modelling, as outlined in the upcoming section. The cluster analysis assisted in limiting the sampling bias by grouping banks with similar governance practises via the utilisation of unsupervised machine learning techniques in a way that was also helpful in dealing with endogeneity issues related to the sample, as recognised by empirical corporate governance works.

In conclusion, out of 24 coefficients representing the nature of relationship between eight corporate governance mechanisms and three financial performance measures, only 8 coefficients were found to match in their relationship nature and statistical significance in comparison between G7 and G6 countries, as shown in Table 3:13 below. (See Appendix A for detailed regression results of G6 and G7).

The nature of the relationship between corporate governance mechanisms and banks' financial performance in G7 countries was found to be different when compared to the results of G6 countries (excluding the US), except that 9 out of 24 results were found to be biased toward the US. Eight results were found to be similar while the remaining results were found to be different in their significance level. The board size and number of independent directors were found to be the most biased mechanisms towards US banks across all financial performance measures. The results indicate that larger boards have a negative impact on G7 while positively affecting G6 countries. This may indicate that banks in G6 countries endorse the resource dependence theory as opposed to the results when containing the US banking sample. Moreover, more independent directors were found to be affecting financial performance of G6 countries negatively while positively affecting G7 banks' performance. This may imply that outside directors serving on US banking boards offer their advice on strategic planning and investments in addition to providing access to their community and stakeholder networks, thereby

adding value to the firm and improving its overall performance and profitability, consistent with the UK Corporate Governance Code (2011), which states that independent directors are responsible for sustaining the integrity and robustness of financial controls, procedures, systems, and risks. Thus, independent directors should function as an effective tool for monitoring management, encouraging it to produce a more reliable financial performance.

Table 3:13 *Summary of GLMM Results – G7 vs. G6 Countries*

	ROA		ROE		NIM	
	G6	G7	G6	G7	G6	G7
BODS	Positive Insignificant	Negative Significant	Positive Insignificant	Negative Significant	Negative Insignificant	Negative Significant
ACS	Positive Significant		Positive Insignificant		Positive Significant	Positive Insignificant
BODGD	Positive Insignificant	Positive Significant	Negative Insignificant	Positive Significant	Negative Significant	
ACMF	Positive Insignificant	Negative Significant	Negative Insignificant		Negative Insignificant	
BODCI	Negative Significant	Positive Significant	Negative Insignificant	Positive Significant	Negative Significant	Positive Significant
BODMF	Negative Insignificant	Negative Significant	Negative Significant		Negative Insignificant	Negative Significant
GDS	Positive Insignificant	Positive Significant	Positive Significant		Negative Significant	Positive Significant
CEODY	Positive Insignificant		Positive Insignificant	Negative Insignificant	Positive Insignificant	Positive Significant

- *Author's Own*

In conclusion and based on the biased results towards US banking sample, the researcher conducted additional investigations, whereby advanced analytics via machine learning techniques were utilised in order to treat the unbalanced sample issues in addition to the endogeneity of corporate governance by using clustering analysis (unsupervised machine learning nodes) to segment and differentiate G7 banking sample based on their corporate governance behaviours.

3.5. Additional Investigations

G7 and G20 Banking Groups' Similarities and Differences in Practicing Corporate Governance and their Influence on Financial Performance Measures Using Data Mining and Machine Learning Techniques.

3.5.1. Introduction

During the data collection phase, and prior to determining the variables described and utilised in this essay, and to estimate the general impact of corporate governance mechanisms and financial performance of banks in G7 countries, various data fields concerning corporate governance mechanisms were extracted. However, due to the limitations of this essay, the additional data sets were excluded in order to focus on eight corporate governance mechanisms as independent variables. On the basis of the foregoing, and since the additional (unused) governance mechanisms datasets were already extracted and available, it was deemed necessary to analyse the data in relation to the general topic of this research and in line with its aim and objectives while introducing a modern advanced analytics tool supported by machine learning, artificial intelligence and pattern-matching and based on a combination of computer science, statistics, and the understanding of the research problem. In this way, this essay endeavours to draw hidden insights from the process of transforming the dataset into a body of useful and applicable knowledge. Accordingly, the researcher has assessed the data with a view to revealing correlations and relationships and extracting predictive information concerning the governance practises of banks in the G7 and G20 nations while evaluating their relationship with financial performance measures. In addition, the utilisation of clustering unsupervised techniques followed by (supervised) regression modelling was considered vital in regard to the sampling bias issue previously highlighted, as around half the observations were biased towards regional banks in the United States. Future scholars, market practitioners, regulators, and banking officials are encouraged to further investigate the data and contribute to the literature.

The extension of the research questions in accordance with the additional investigations are answered via the use of advanced analytics tools as follows:

- RQ4: How can G7 banks be classified by their corporate governance practises and ESG reporting behaviour?
- RQ5: How can G20 banks be classified by their corporate governance practises and ESG reporting behaviours?

- RQ6: To what extent do corporate governance practises impact different banking groups' financial performance in G7 countries?

Based on the above, the following additional hypotheses were created and empirically tested to obtain valid responses to our research questions:

Table 3:14 *Additional Investigations' Research Hypotheses*

Independent Variables	Additional Investigations: Research Hypotheses
BODS	***H01b:*** *Board size behaviours significantly differentiate banking groups' practises in G7 and G20 countries.*
BODMF	***H02b:*** *Board meeting frequency behaviours have a significant effect in differentiating banking groups in G7 and G7 countries.*
BODCI	***H03b:*** *Board composition of independent directors (outsiders) practised by G7 and G20 banks is considered an important governance mechanism and significantly differentiates banking segments.*
BODGD	***H04b:*** *Board gender diversity is an unimportant banking governance mechanism to the segmentation of banking clusters within the G7 and G20 countries.*
ACS	***H05b:*** *Audit committee size practises are vital to the separation of banking segments in G7 and G20 countries.*
ACMF	***H06b:*** *Audit committee meeting frequency practises insignificantly contribute to the separation of banking clusters in G7 and G20 countries.*
CEOD	***H7b:*** *Presence of dual leadership control behaviours is an important governance mechanism that significantly differentiates banking groups' practises in G7 and G20 countries.*
GDS	***H08b:*** *Information flow related to governance framework and practises (Governance Disclosure Score) has a significant impact on differentiating banking groups in G7 and G20 countries.*
*Environmental Disclosure Score (EDS)	***H09a:*** *Information flow related to environmental practises has a significant impact on differentiating banking groups in the G7 and G20 countries.*
*Social Disclosure Score (SDS)	***H10a:*** *Information flow related to banks' social practises has a significant impact on differentiating banking groups in G7 and G20 countries.*
*Independent Chairperson (Ind.Chair)	***H11a:*** *An independent chairperson of the board significantly differentiates banking groups' practises in G7 and G20 countries.*
*Unitary Board (U.Board)	***H12a:*** *Unitary board type selection significantly differentiates banking groups' practises in G7 and G20 countries.*

- *Author's Own*
- **: Additional corporate governance characteristics were added to our clustering and regression analysis and described precisely in the following sub sections.*

3.5.2. Sample Selection

The sample comprised listed diversified and regional banks operating in G7 and G20 respectively. A preliminary sample of 710 banks in G7 and 975 banks in G20 was identified from the Bloomberg database (prior to the data cleansing and preparation process) that included 12 corporate governance mechanisms; six items of financial performance data were collected for the period 2010–2019.

The selection criteria for the banking sample were in accordance with the aforementioned GICS mapping specifications (see Table 3.3 in Section 3.3.2) in the Methodology chapter). The essay utilised 369 banks' data in G7 from a total of 710 banks and 552 banks' data in G20 from a total of 975 banks. In all, 3,268 and 4,968 bank-year observations in G7 and G20 countries respectively were obtained for the dependent and independent variables, though it should be noted that observations for 2010 were excluded due to a lack of data. The sample of banks was chosen according to the following data criterion: any bank that provided seven to nine years' corporate governance data and/or financial performance had its data included in the sample. As a result, 341 banks in G7 and 423 banks in G20 were excluded due to the unavailability of their financial performance metrics and/or corporate governance characteristics covering at least 70% of the study period. It should be noted that the majority of the excluded sample were regional banks (above 95%), most of which had null values over the whole of the nine-year period. The sample began in 2011 and ended in 2019, the most recent year for which data were collected.

3.5.3. Input Variables

In addition to the dependent and independent variables used in the previous section to estimate the general impact of corporate governance mechanisms and financial performance respectively of banks in G7 countries (see Section 3.3), the following additional corporate governance mechanisms were used as input fields when running the cluster analysis as independent variables in the regression modelling that estimates the relationship between corporate governance mechanisms and financial performance measures for each of the resultant clusters of banking groups in G7 and G20 countries. The additional mechanisms collected from the Bloomberg database for the period 2011–2019 are described and defined below according to the Bloomberg measurement approach for each of the data fields. The dataset used in our essay was obtained from a public database that contains corporate governance mechanisms and financial performance measures along with other financial data of banks operating in G7

and G20 countries used for descriptive statistics only. The dataset for G7 banks included 3,268 cleansed observations for almost each field incorporated in the cluster analysis as described in Table 3:16 below.

3.5.3.1. Additional Financial Performance Measures (Dependent Variables)

3.5.3.1.1. Capital Adequacy Ratio (CAR)

This variable measures the ratio of total risk-based capital vs. risk-weighted assets. The ratio is known as Total Risk-Based Capital Ratio or Capital Adequacy Ratio (CAR) and is calculated as follows as per the Bloomberg online database (Hasbi & Haruman, 2011; Mckinsy &Co, 2023).

Equation (4):

CAR it = (Core Capital it Plus Supplementary Capital Ratios it) divided by Risk Weighted Assets it

whereby the supplementary capital ratio for banks is composed of:

- Perpetual preferred stock ineligible for Tier 1
- Perpetual debt and mandatory convertible securities
- Qualifying senior and subordinated debt
- Limited life preferred stock
- Qualifying allowance for credit losses
- i= bank
- t= time

In regard to the required benchmarks, the minimum ratio for commercial banks in the US, Canada, and Europe as set by their regulatory authorities is 8% (Tier 1 + Tier 2).

3.5.3.1.2. Management Efficiency Ratio

The Cost to Income Ratio (CTI), also known as the Efficiency Ratio, is a measure used to compare costs to revenues. The ratio is calculated in accordance with the below formula in accordance with Bloomberg online database:

Equation (5):

CTI it = Operating Expenses it divided by Operating Income it

Whereby; i= bank and t= time

3.5.3.1.3. Asset Quality (AQ)

This variable assesses the riskiness of assets, primarily the credit risk, held in a bank's portfolio and defined as the ratio of non-performing loans vs. net loans. The ratio is known as the asset quality ratio and measures the quality of a bank's loan portfolio. It is calculated as follows:

Equation (6):

Total Non-Performing Loans (impairments)it divided by Net Direct Credit Facilities it

Whereby; i= bank and t= time

The higher the quality of a bank's assets (lower credit risk), the lower the ratio and vice versa.

The above additional financial performance measures used in this research, in addition to the ROA, ROE, and NIM previously mentioned, are vital in assessing the strength of banks by their regulators whereby the measures are considered main inputs in the CAMEL rating system, identified in this study as an international rating system for supervisory authorities of the banking industry.

3.5.3.2. Additional Corporate Governance Mechanisms

The below scores were set by Bloomberg from 0 (for companies with no disclosure of any environmental data) to 100 (companies with a detailed disclosure for every data point). Companies absent from Bloomberg's ESG data were not scored, and their values represented by 'N/A'. The topics belonging to Environmental (E), Social (S) and Governance (G) pillars were weighted equally within the overall ESG Disclosure Score, and quantitative fields allocated a greater weight than binary fields. This score does not measure a company's performance on any data point.

3.5.3.2.1. Environmental Disclosure Score

The Environmental Disclosure score is a proprietary Bloomberg score based on the extent of a bank's environmental data disclosure, as a pillar of the ESG data (M. A. Siddique et al., 2021; Tunio et al., 2021; R. Xie, 2019). The score is set from 0 (for companies that make no disclosure of any environmental data) to 100 (companies with a detailed disclosure for every data point). Companies absent from Bloomberg's ESG data were not scored, and their values are represented as N/A. The scores were measured based on a pre-determined list of topics and data fields, and weights set accordingly. Although the topics and data fields have been primarily selected based on industry-agnostic frameworks across different sectors and regions, some topics may not be relevant to all industries. The topics within each pillar were weighted equally, and quantitative fields were allocated a greater weight than binary fields. This score does not measure a company's performance on any data point.

3.5.3.2.2. Social Disclosure Score

Similarly, to the Environmental Disclosure Score, the social disclosure score is also a proprietary Bloomberg score and addresses the social pillar of the ESG data. Identically to the Environmental score, the social score measures the extent to which a company publicly reports social data and is set from 0 (for companies that make no disclosure of any social data) to 100 (companies with a detailed disclosure for every data point). Companies that were absent from Bloomberg's ESG data were not scored, and their values represented as N/A (Siddique et al., 2021; Tunio et al., 2021; Xie, 2019).

3.5.3.2.3. Independent Chairperson

This variable portrays whether the company's chairperson is considered independent (either as of the end of the existing fiscal year when relevant, or as of the latest filing date). In the case of banks operating with a two-tiered board, independence is defined according to the bank's own criteria. Where the company has a two-tier board, this field refers to the chairperson of the supervisory board (Deloitte, 2014; Lewis, 2016).

3.5.3.2.4. Unitary Board

The variable indicates the type of system with which the board operates (One-Tier or Two-Tier). The variable is marked as 2 when the board has separate supervisory boards from management boards. Banks operating

across different countries and regions adopt the BOD system in a manner most suitable to the nature of their operations. For example, Islamic banks (which follow the Shariah code) typically have a Shariah supervisory board which operates as a separate entity to oversee the bank and its financial products. Banks in China have a two-tiered system where a bank may have a board of directors and separate supervisors, or a committee with combined representation from the bank's employees, executive management, and non-executive/ independent management. Indonesia is marked as 3, meaning it operates under a three-tiered system (Block & Gerstner, 2016; Huang, 2010).

3.5.4. Statistical Analysis Method Using Machine-Learning and Artificial Intelligence Nodes

Data grouping (data clustering) is a method that can produce classes of objects with similar characteristics. Clustering is often confused with classification, but there is a major difference between them, namely, in the case of classifying, objects are assigned to predefined classes, whereas in the case of clustering, those classes must themselves also be defined. Clustering techniques are used when the data are expected to group together naturally in different categories. A cluster is a category of items with many features in common. Classical methods of clustering use hierarchical or partitioning algorithms. The hierarchical algorithms form the clusters successively on the basis of clusters previously established, while the partitioning algorithms determine all the clusters at the same time, building different partitions and then evaluating them in relation to certain criteria. In the SPSS Modeler, clustering analysis can be performed using the Two-Step approach, K-means clustering, or the Kohonen Self-Organising Map, each of which relies on a different algorithm to create the clusters. The last two approaches are classical methods of classification based on hierarchical respectively partitioning algorithms, while the Two-Step method is especially designed for and implemented in the SPSS Modeler that combines both algorithms. In regard to the types of data considered for application, the Hierarchical Cluster is limited to small datasets, K-Means is restricted to continuous values, and Two-step can create cluster models based on both continuous and categorical variables.

Due to its ability to segment a set of observations into mutually exclusive clusters, an exploratory cluster analysis approach was used. The clusters were grouped based on a combination of variables and accordingly provide a test of variable significance.

The banks presented within each cluster have homogeneous governance practises, while banks presented across clusters have heterogeneous governance practises. Cluster analysis was used by Gillan et al. (2011). When analysing corporate governance

variables and to consider a suitable approach Bhagat and Bolton (2008) concluded that high-quality governance measures were substitutes for each other. The cluster analysis approach was also considered suitable for our research owing to its ability to identify associations and structures within the data which may not be readily apparent if an alternative approach were to be used. This method also provides a definition of a taxonomy, which was significant for this essay, without requiring any prior assumptions related to size for grouping the banks. Therefore, any issues that would have been prevalent due to classifying the banks based on size are automatically eliminated (Corter & Tversky, 1986).

In this essay, the SPSS Modeler (Data Mining & Text Analytics) was used for clustering and regression algorithmic analysis. This software is regarded as the leading solution for visual data science, data mining, and artificial intelligence. It is mostly utilised to build a variety of regression and predictive models as well as conducting other advanced statistical analytics tasks (IBM, 2018). The below procedure was followed using the SPSS Modeler to identify bank groups in both G7 and G20 countries with similar governance characteristics and to determine the impact of each group on financial performance measures:

- Corporate governance and financial performance panel data were imported from Microsoft Excel.
- The measurement type and role of each variable was determined as shown in Table 3:15 below.

Table 3:15 *Data Measurement: Type and Role*

Variable	Field	Ticker	Measurement Type	Role
Descriptive	Name	Name	Nominal	ID
	Country	Country	Nominal	Input
	Sub-Industry	Sub-Ind	Flag (Dummy)	Input
	Year	Year	Categorical	Input
Financial Performance Measures (Dependent)	Return On Assets	ROA	Continuous	Target
	Return On Equity	ROE	Continuous	Target
	Net Interest Margin	NIM	Continuous	Target
	Capital Adequacy	CAR	Continuous	Target
	Cost to Income	CTI	Continuous	Target
	Asset Quality	AQ	Continuous	Target
Corporate Governance Characteristics (Independent)	Board Size	BODS	Continuous	Input
	Board Meeting Frequency	BODMF	Continuous	Input
	Audit Committee Size	ACS	Continuous	Input
	Audit Committee Meeting Frequency	ACMF	Continuous	Input
	Board Composition of Independent Directors	BODCI	Continuous	Input
	Board Gender Diversity	BODGD	Continuous	Input
	Governance Disclosure Score	GDS	Continuous	Input
	Social Disclosure Score	SDS	Continuous	Input
	Environmental Disclosure Score	EDS	Continuous	Input
	CEO Duality	CEOD	Flag (Dummy)	Input
	Unitary Board	UBOARD	Flag (Dummy)	Input
	Independent Chairperson	Ind.Chair	Flag (Dummy)	Input
Control Variables	Leverage Ratio	LR	Continuous	Input

- *Author's Own*
- *Whereby: Input variable are the predictor variables (X): independent variables, and Target Variables are the predicted variables (Y): dependent variables.*

3.5.4.1. Data Preparation (Transformation) Approach

A Data Audit Node was utilised to obtain a general view of the data and to gain a preliminary understanding of the dataset with tools such as descriptive statistics, distribution graphs, outliers and extremes, blanks, null and missing values.

A Data Preparation Node was utilised to improve the modelling performance through intelligent screening techniques. Its importance arises from handling and identifying preliminary issues, screening problematic variables, and deriving new attributes when needed. In this essay, customised auto data preparation was conducted in a logical manner

relative to corporate governance mechanisms and financial performance. The following customised analysis of treatment and transformation rules were applied:

- Exclude fields with missing value above 30%.
- Exclude categorical fields with many values in a single category that exceeds 95%.
- Adjust the type of numeric and ordinal fields.
- Record nominal and categorical input fields to have the smallest category first and largest last.
- Cut-off outliers when standard deviation exceeds 3.00 and replace outlier values in continuous target fields with cut-off value.
- Discard extreme values in continuous target and input fields.
- Replace missing values of continuous input (governance mechanisms only) fields with median.
- Bin continuous fields while preserving predictive power p-value at or below 10% level.
- Perform feature selection to continuous input fields with p-value of below 10% level.
- Transform nominal and categorical fields.

As a result, the following actions were performed to the dataset:

- All the extremes and outlier data were treated in accordance with the above customised rules except for the outliers in corporate governance mechanisms. For example, outliers existed in the three disclosure scores due to high variations in the banks' scoring and could not be further reduced. If treated, the statistical and logical meaning of the data is impacted. As a result of this process, variables were standardised without any major changes in the scale.
- CEO duality categories of Y and N were reordered from lowest to highest (0 for Y and 1 for N) to improve stability in modelling.
- Unitary board categories of Tier1 and Tier2 were reordered from lowest to highest (1 for Tier 1 and 0 for Tier 2) to improve stability in modelling.
- Independent Chairperson categories of Y and N were reordered from lowest to highest (0 for Y and 1 for N) to improve stability in modelling.

3.5.5. Cluster & Regression Analysis Approach

The Auto-Clustering node in the SPSS Modeler was used to assess the optimal number of clusters in our analysis and determines the best-fit clustering algorithm to analyse our dataset. The Auto-Cluster Node was utilised via the SPSS Modeler to determine the most suitable segmentation (clustering) methods /models in analysing and identifying groups of banks from the dataset of G7 and G20 countries with similar corporate governance characteristics. This was conducted based on pre-defined input variables, enabling the researcher to run experimental analyses with multiple combinations of options in a single modelling pass. 12 governance mechanisms and one representing the country field were used in this study, namely 1) board size, 2) board meeting frequency, 3) audit committee size, 4) audit committee meeting frequency, 5) board composition of independent directors, 6) board gender diversity (% of women), 7) governance disclosure score, 8) social disclosure score, 9) environmental disclosure score, 10) CEO duality, 11) unitary board, 12) independent chairperson, and country.

These variables were defined as input variables in order to separate banking groups in both G7 and G20 countries that have similar corporate governance characteristics and practises. The Auto-Cluster Node then suggest which clustering model was best fit for our research purposes from the three on the SPSS Modeler (K-means, Kohonen, and Two-Step), and the model will be utilised to identify banking groups in terms of the similarities and differences in their governance practises in G7 and G20 countries respectively.

After conducting the cluster analysis for corporate governance practises of banks operating in both G7 and G20 countries, six financial performance measures, 12 corporate governance mechanisms, country field and one control variable analysed via the Auto Numeric node. This node automatically estimates and compares regression and classification models for continuous numeric range outcomes using multiple methods. This enabled the researcher to attempt various approaches in a single modelling run and select the best-fit algorithms with respect to the dataset. The result generated by the auto-numeric node was considered as the most suitable regression model to be utilised in explaining the relationship between each financial performance measure and corporate governance practises for each cluster. The cluster number field generated from the analysis was input as a split variable in order to separate the regression analysis for each banking group with similar governance practises (for each cluster). The regression analysis was performed for each of the six financial performance models, whereby each financial performance measure was

defined as the target and the corporate governance mechanisms are defined as input variables, while the Cluster number field is defined as a split field.

Based on the above, the results of the Auto-Cluster Node suggested that a 'Two-Step modelling node' was the best-fit clustering model for both G7 and G20 banks' governance practises with respect to the 13 aforementioned input variables, since the Two-Step Cluster is often preferred first for large datasets and second for the handling mixture, as previously mentioned. The Two-Step clustering algorithm was developed by Chiu et al. (2001) for the analysis of large data sets (SPSS, 2004) as a method whereby clusters are repeatedly merged until a single cluster group all records with similarities. The first step was to make a single pass through the data, compressing the raw input data into a manageable set of subclusters. The aim of this step was to generate a new data matrix with a smaller and more manageable data set to continue on to the next step. Hierarchical clustering was then used as the second step to merge the subclusters presented in step 1 into larger clusters. This was done by continuously comparing the distances between the subclusters, and the pair with the shorter distance was then merged into one cluster. This method of clustering is advantageous as it does not require a pre-determined number of clusters to be selected in advance nor another pass through the data when merging the subclusters into larger clusters (IBM, 2018).

The Two-Step cluster node allowed for the inclusion of continuous and categorical variables. The cluster procedure uses a likelihood distance measurement to determine the cluster values and the Akaike Information Criterion (AIC) or Bayesian Information Criterion (BIC) to identify the cluster solution. The Noise handling option was not applied, which removes any outlier cases during the calculations and subsequently reassigns them to the appropriate clusters once the cluster solution has been generated. Instead, outliers were detected as null values by the clustering model. The node clusters the dataset into distinct groups without using a target field. Two-Step cluster analysis was used to study the data structure with the aim of uniting the sample into homogeneous groups. Within a cluster, all sets were as similar as possible and were determined based on the measure of proximity (cohesion). Across clusters, there was a clear distinction among the sets, which was determined based on a measure of distance (separation).

The research was carried out in two stages, beginning with the grouping of banks with similar corporate governance practises according to the 12 governance mechanisms, along with their country of origin for banks operating in both G7 and G20

countries. In the second stage, we aimed to statistically investigate the impact of the governance mechanisms on financial performance measured by the ROA, ROE, NIM, CAR, CTI, and AQ for each cluster of the G7 countries' banks. This was carried out via utilisation of the Auto-Numeric node to find the best fit regression model to enable the examination of the impact of each corporate governance cluster on each financial performance measure. The analysis of G20 countries was limited to cluster analysis only without further conducting regression analysis to investigate their impact on financial performance, unlike the work conducted for banks within the G7 countries. This was due to the constraints of the study in regard to time, word count and research focus. This analysis will allow future researchers to continue the work initiated by the researcher on G20 countries by utilising and further developing the study's framework.

The Auto Numeric node was performed for each of the six financial performance models whereby each financial performance measure was defined as the target and the Cluster Number Field is defined as the input field. The results suggested the Generalised Linear Model (GLM) to be the best fit regression model to explain the relationship between each financial performance measure and corporate governance cluster. The node automatically estimates and compares models for a continuous numeric range outcome, enabling the researcher to explore multiple approaches in a single modelling run.

3.5.6. G7 Cluster Analysis Results and Discussion

3.5.6.1. Descriptive Statistics

After cleansing the dataset, a final panel-data sample of 3,268 valid bank-year observations was produced, spanning 369 banks across nine years (2011–2019). Table 3:16 displays the descriptive statistics for the relevant research variables of G7 countries. The difference between the G7 banking data used for clustering (see Table 3:16) versus the G7 banking data described earlier (see Table 3:6) in the previous section is the sample size whereby the G7 data used for the cluster included a sample of 369 banks; the earlier data used a sample of 397 banks. Because the researcher included additional variables related to governance mechanisms (the environmental disclosure score, social disclosure score, governance disclosure score, independent chairperson, and unitary board), which required further elimination of 28 banks in the treatment process due to lack of data.

Table 3:16 below describes the dataset of G7 banks (post-statistical treatment) as a result of using the Data Audit node in the SPSS Modeler. The 369 banks operating in G7 countries have a median board size of 11 members who meet 12 times per year and are composed of eight independent members with a mid-range of one to two female directors. The majority of the banking sample was Tier 1 board type with a majority of non-independent chairpersons serving on their boards and exercising separate roles of leadership.

G7 banks' information flow regarding environmental, social, and governance aspects is relatively low based on their average scoring (EDS 11%, SDS 9.8%, GDS 13.6%, and the overall ESG disclosure score 8.8%). In regard to financial performance measures, during the period 2011–2019, the 369 G7 banks registered an average ROA of around 0.8% ROE of 8.2%, NIM of 3.1%, CAR of 15.1%, CTI of 66.2%, and AQ of 1.3%.

The 369 G7 banks registered an average P/E of around 14.5 multiples during the period 2011–2019, a P/BV of 1.15 multiples, and a dividend yield of 2.5%. Table 3:16 describes the dataset of G7 banks (post- statistical treatment) as a result of using the Data Audit node in the SPSS Modeler:

Table 3:16 *G7 Banking Sample: Descriptive Statistics*

Variable Type	Field	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Descriptive Variables	Ticker / Name	--	--	--	--	--		369	3,268
	Year	2011	2019	--	--	--	2019	9	3,268
	Country	--	--	--	--	--	USA	7	3,268
	Sub-Industry	--	--	--	--	--	Regional	2	3,268
	$T1-TwoStep	--	--	--	--	--	cluster 3	4	3,268
Financial Performance Indicators (Dependent Variables)	ROA	-0.008	0.026	0.008	0.005	0.008	--	--	3,139
	ROE	-0.074	0.264	0.082	0.048	0.084	--	--	3,138
	NIM	-0.029	0.095	0.031	0.013	0.034	--	--	3,135
	CAR	0.08	0.274	0.151	0.029	0.145	--	--	2,547
	CTI	0.192	1.036	0.662	0.119	0.657	--	--	3,180
	AQ	0.00	0.078	0.013	0.015	0.008	--	--	3,174
Market Performance Indicators (Dependent Variables)	P/E	0.402	32.894	14.46	5.808	13.344	32.89	--	3,022
	P/BV	0.069	2.7	1.148	0.541	1.13	2.7	--	3,102
	Div.Y	0.00	0.068	0.025	0.013	0.024	0.00	--	2,837
Corporate Governance Characteristics (Independent Variables)	BODS	4.00	33.00	11.43	3.19	11.00	11.00	--	3,268
	BODMF	2.00	57.00	12.01	4.751	12.00	12.00	--	3,268
	ACS	0.00	14.00	3.84	2.089	4.00	4.00	--	3,268
	ACMF	0.00	51.00	9.35	5.029	8.00	5.00	--	3,268
	BODCI	0.00	21.00	7.91	3.889	8.00	9.00	--	3,268
	BODGD%	0.00	0.562	0.128	0.11	0.111	0.00	--	3,268
	GDS	0.00	1.00	0.771	0.136	0.83	0.83	--	3,268
	SDS	0.00	0.656	0.081	0.098	0.066	0.00	--	3,268
	EDS	0.00	0.734	0.039	0.11	0.00	0.00	--	3,268
	CEOD	--	--	--	--	--	1	2	3,268
	UBOARD	--	--	--	--	--	1	2	3,268
	IND.CHAIR	--	--	--	--	--	1	2	3,268
Control Variable (log X)	LR	0.00	4.811	1.01	1.006	0.717	4.811	--	3,175

- *Author's Own*
- *$T1-Two-Step included in the table above as a descriptive variable is the data field resulting from the cluster analysis which contains the cluster number and was set to a measurement type of categorical field and used as a split variable in the regression modelling to generate estimates of the impact of each corporate governance practises cluster on each of the financial performance measures.*

- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

3.5.6.2. G7 Clustering Results and Discussions

The result was a model with 12 corporate governance variables and one variable describing the country of origin for each cross-section (bank). It included 3,268 observations, excluded 71 outlier observations, and four clusters were obtained for banks operating in the G7 countries. The silhouette measure of cohesion and separation was sufficiently high and stands at 0.6, which was ranked 'good' in accordance with the SPSS Modeler result as shown in Table 3:17 below:

Table 3:17 *Cluster Model Summary*

Algorithm *(Model Name)*	Two Step
Inputs	13 Variables *(12 Corporate Governance mechanisms + Country of origin)*
Clusters	4
Quality *SPSS Modeler includes 3 ranking for Silhouette measure (Poor/Good/ Excellent)*	Good
Silhouette Measure of Cohesion & Separation	60.0%
Size of Smallest Cluster	284 (8.7%)
Size of Largest Cluster	1,295 (39.6%)
Largest to Smallest Cluster	4.56

- *Author's Own*

However, the 71 outlier observations detected by the Two-Step cluster analysis were defined as null values by the model, which were then excluded from further analysis. It was noted that the identified outliers generated as null values by the cluster analysis belong to the below described observations:

Table 3:18 *Outliers Identified in the Cluster Analysis*

Country	Sub Industry	Number of Observations	Year Mid-Range
United States	100% Regional Banks	38 (8 banks)	2011-2014
Italy	100% Diversified	33 (4 banks)	2011 - 2019

- *Author's Own*

The Two-Step cluster analysis was used to identify homogenous groups of banks in terms of 13 corporate governance mechanisms including their country of origin. A comparative analysis of the solution with a maximum number of clusters was performed to examine the different groups of banks from 2011–2019. The optimal number of identified clusters was four, for which the silhouette measure of cohesion and separation was the highest at 0.6.

Table 3:19 *G7 Clusters Sizes*

	Cluster (1)	Cluster (2)	Cluster (3)	Cluster (4)	Outliers (Excluded)	Total Sample Included
Number of Observations	1,044	284	1,295	645	71	3,339
Percentage of Total Sample Size	31.90%	8.70%	39.60%	19.70%	0.10%	100.00%

- *Author's Own*

The first cluster (31.9% of the sample, the second-largest cluster) was a shareholder-oriented group presented with Tier 1 US regional banks which practise a separation of the leadership role with a majority of independent chairpersons and low information flow regarding their social impact (social disclosure) and almost no environmental disclosures.

The second cluster (8.7% of the sample, the smallest cluster) was a stakeholder-oriented cluster presented with a majority of banks operating in mainly in 7 countries practising a separation of control of the leadership/CEO role with the highest disclosure score for all types of disclosures, including environmental, social, and governance compared to the other three clusters, along with the highest percentage of female directors serving on boards and more than half of the banking sample having independent chairperson on the board.

The third cluster (39.6% of total sample, the first-largest cluster) was a shareholder-oriented group presented with Tier 1 banks mainly operating in the US, with a small number operating in the UK (below 1%). Almost two- third of these banks practise CEO duality, with the majority of banks having non-independent chairperson on the board.

The fourth cluster (19.7% of the total sample, the second-smallest cluster) was a stakeholder-oriented group presented with Tier 2 Japanese banks, the majority of which practise CEO duality and have a non-independent chairperson with almost no audit committee members due to the governance nature of their two-tier board, which replaces the audit committee with a supervisory board.

The results were verified by the machine learning algorithm in accordance with a silhouette measure of cohesion and separation, which confirmed the statistical significance of differences within the groups. Therefore, four different clusters for banks operating in G7 countries based on corporate governance practises were produced.

The SPSS Modeler provided the importance percentage for each variable (categorical or continuous). It was found that banks significantly differed from each other in regards to their governance practises concerning their audit committee size, number of independent directors, environmental disclosure, social disclosure, governance disclosure, independent chairperson, and unitary board, while board meeting frequency and board size were the least important variables in separating the four clusters. Table 3:20 shows the importance and power of the 12 corporate governance mechanisms in the separation analysis of the four clusters.

Table 3:20 *The Importance of Variables in Measuring the Cohesion and Separation of G7 Corporate Governance Practises Clusters*

Independent Variables	Importance according to the Two Step Cluster Analysis
ACS	1.000
BODCI	1.000
EDS	1.000
GDS	1.000
IND.CHAIR	1.000
SDS	1.000
U. BOARD	1.000
BODGD%	0.880
CEOD	0.870
ACMF	0.740
BODMF	0.340
BODS	0.190

- *Author's Own*
- *BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson.*

The cluster analysis results of G7 banks, using the 12 governance mechanisms, are presented in Table 3:21 below. Four clusters were identified, and the differences observed in the adoption of governance practise across the clusters. The characteristics of each cluster are outlined below CEO duality, an independent chairperson, and a unitary board contributed most to differentiating the first cluster, while the number of independent directors, CEO duality, environmental disclosure score, governance disclosure score, social disclosure score, independent chairperson, gender diversity, and board size differentiated the second cluster. Moreover, we note that Cluster 3 was differentiated by the top five variables, namely audit committee size, CEO duality, environmental disclosure score, independent chairperson, and unitary board. Cluster 4 was differentiated in relation to audit committee size, unitary board, number of independent directors, CEO duality, environmental disclosure score, governance disclosure score, independent chairperson, board gender diversity, audit committee meeting frequency, and board meeting frequency.

Table 3:21 *Summary of G7 Clustering Results*

Category	Field	Measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Clustering Analysis Results Corporate Governance Characteristics (Practises) *(descending order according to importance)*	ACS	Mean	4.7	4.9	4.4	0.8
		Median	4.0	5.0	9.0	0.0
	BODCI	Mean	9.6	10.8	8.8	2.1
		Median	9.0	11.0	9.0	2.0
	CEOD	Mode	100%.0 No	89.4% No	64.2% Yes	60.5% Yes
	EDS	Mean	0.0%	31.0%	1.0%	4.0%
	GDS	Mean	82.0%	86.0%	81.0%	58.0%
	IND.CHAIR	Mode	99.5% Yes	58.8% Yes	99.8% No	98.8% No
	SDS	Mean	5.0%	32.0%	6.0%	6.0%
	Uboard	Mode	100% Tier1	94.0% Tier1	100% Tier1	100% Tier2
	BODGD%	Mean	14.0%	29.0%	13.0%	4.0%
	ACMF	Mean	7.6	11.1	7.9	14.3
		Median	7.0	8.0	7.0	14.0
	BODMF	Mean	11.99	12.64	10.32	15.16
		Median	11	14	11	10
	BODS	Mean	11.1	14.2	11.4	10.8
		Median	11.0	14.0	11.0	10.0
Financial Performance Measures	ROA	Mean	0.92%	0.58%	0.99%	0.28%
	ROE	Mean	8.83%	8.42%	9.17%	5.28%
	NIM	Mean	3.77%	2.21%	3.71%	1.25%
	CAR	Mean	14.93%	15.83%	15.04%	15.02%
	CTI	Mean	64.82%	67.76%	63.99%	72.24%
	AQ	Mean	1.07%	2.66%	0.96%	1.73%
Market Performance Measures	PE	Mean	15.03	14.47	15.60	11.29
	PBV		1.27	1.15	1.37	0.53
	DIV.Y		2.53%	3.48%	2.41%	2.34%
Sub Industry	Diversified Banks	% Of total cluster sample	0.0%	89.44%	1.0%	7.91%
	Regional Banks	% Of total cluster sample	100.0%	10.56%	99.0%	92.09%
Geolocations	Country	Mode	100% USA	26.76% UK	99.61% USA	100% Japan
	Region	Mode	100% North America	56.34% Europe	99.61% North America	100% Asia
Year	2011	Count	109	27	152	72
	2012	Count	110	28	150	72
	2013	Count	117	28	143	72
	2014	Count	116	29	144	72
	2015	Count	115	29	146	72
	2016	Count	114	31	146	72
	2017	Count	119	33	142	72
	2018	Count	121	38	137	71
	2019	Count	123	41	135	70
Country	USA	% Of Total Cluster Sample	100.00%	17.25%	99.61%	-
	ITALY		-	16.90%	-	-
	UK		-	26.76%	0.39%	-
	CANADA		-	25.35%	-	-

Category	Field	Measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	FRANCE		-	9.51%	-	-
	GERMANY		-	3.17%	-	-
	JAPAN		-	1.06%	-	100%

- *Author's Own*
- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

The board structure of Cluster 1 banks was characterised by an average of 11 board members who met 12 times per year, of which 14% were female directors, nine were independent, and 99.5% of whose chairpersons were independent directors. All the banking observations in Cluster 1 had a one-tier board and none had a dual CEO/chairperson role. The cluster median of their audit committee size was the second lowest with a committee of four members who met seven times per year.

Cluster 1 was highly distinctive from the remaining three clusters in that the banks did not practise CEO duality and their chairpersons were independent directors. Furthermore, their environmental disclosure score was lowest among the cluster and averaged 0%. The corporate governance characteristics of Cluster 1 clearly endorsed the agency theory while contradicting the stewardship and stakeholder theories. This could also be seen from the financial performance measures, as Cluster 1 registered the highest NIM and the second highest in terms of the ROA and ROE while having the lowest CAR and the second lowest CTI and AQ.

Cluster 2 was the smallest cluster, consisting of 284 banking observations and banks spanning all G7 countries, whereof banks from the UK and Canada represent around 51% of the cluster. This cluster appeared to be a modern market-oriented corporate governance cluster in which banks were growingly adopting Cluster 2 practises. This was proven by the growing number of observations belonging to the cluster over the period of years. As further evidenced in Table 3:22

below, the outcomes for the banks that are segmented into more than one cluster due to the transitioning of their governance practises to Cluster 2 over a period of years. The banking group in Cluster 2 clearly supported the stakeholder and resource dependence theories while generating a mixed position regarding the agency and stewardship theory. This could also be seen from the financial performance measures, as Cluster 2 registered the second lowest profitability ratios measured by the ROA, ROE and NIM while having the highest CAR and AQ and the second highest CTI.

Table 3:22 *Transformation of Banks' Governance Practises Across Clusters*

Country	Number of Banks	Action
JAPAN	6	Two banks transitioned from cluster 4 in 2011 to cluster 2 in 2014, followed by a further two banks in 2017 and the remaining two in 2019
UK	1	Transitioned from cluster 3 in 2011 to cluster 1 in 2015 then to Cluster 4 in 2018 and onwards
USA	4	From cluster 1 in 2011 to cluster 3 in 2013 to cluster 4 in 2018

- *Author's Own*

The main distinctive characteristics of the banking group in Cluster 2 were the highest disclosure scores across all three ESG pillars (governance 86%, environmental 31%, and social 32%), the greatest board gender diversity averaged at 29%, the largest number of independent directors averaged at 11 members, and the prevalence of mixed practises regarding the independence of the chairperson. This cluster was also distinctive in regard to its CEO duality practises and its board system whereby a small proportion of banks practised dual control for the leadership role had a two-tiered board structure.

Cluster 3 is the largest cluster, comprising 39.6% of the entire sample. This cluster was characterised and differentiated by having a median largest audit committee size of nine members. 64.2% of the sample practises CEO duality, while 99.8% of the chairpersons on their boards were not independent directors. Their environmental and social disclosure scores were recorded as the second lowest among the other clusters, averaging 1% and 6% respectively. The entire banking group in this cluster has a Tier 1 board structure. It can be deduced that the banks in this cluster adopt typical shareholder-oriented corporate governance practises. Although Cluster 3 and Cluster 1 both contained US banks, they supported the difference governance theories, Cluster 3 advocates stewardship theory while Cluster 1 only advocates the agency theory. This could also be seen from the financial performance measures, as Cluster 3 registered the highest

profitability ratios measured by the ROA and ROE (in terms of the NIM, Cluster 3 was the second highest among clusters) while having the lowest CTI and AQ.

Cluster 4 was characterised by an invariably two-tiered board structure with almost no audit committee members and the lowest number of independent directors, an average of 2, with the majority of chairpersons being non-independent at around 98.8%. This was due to the nature of the corporate governance structure which operates by means of a supervisory board where the BOD's executives are led by the CEO. This banking group had the lowest gender diversity, averaging 4% female directors, with the highest board and audit committee activity, averaging 15 and 14 meetings respectively. Although the cluster followed a Japanese (market-oriented) corporate governance system, it ranked the lowest for governance disclosure score, which averaged 58%. The environmental and social disclosure scores were also considered very low relative to a market-oriented system, averaging 4% and 6% respectively. Therefore, it can be concluded that Cluster 4 endorsed the stewardship theory in terms of governance practises and the stakeholder theory in regard to financial data while contradicting the agency and resource dependence theories.

Overall, the results showed a substantial variation in the choice of governance practises for the sampled G7 banks and portray the presence of two key systems as stated in the previous literature (shareholder-oriented system and market-oriented system). However, this study further revealed the presence of four differing ideologies in the practise of corporate governance within the two systems whereby Clusters 1 and 3 were shareholder-oriented systems in which Cluster 1 endorsed the agency theory while Cluster 3 the stewardship theory.

Clusters 2 and 4 were both considered to follow stakeholder theory (market oriented). Furthermore, Cluster 2 supported the resource dependence theory, while Cluster 4 endorsed the stewardship theory. However, it is noteworthy that we can assume that the Japanese cluster's (number 4) endorsement of the stakeholder theory did not stem from the ESG disclosures which were inputted in the cluster analysis but from the banking corporate structure and ownership of Clusters 2 and 4, composed mainly of institutional investors, as stated in our Literature Review in previous sections. This was also evident in the descriptive data of financial performance measures which is resulted to be on average the lowest

values and other financial data (such as the highest NPLs relative to the net loans) that was produced in Cluster 4, which also registered the lowest ROA, ROE and NIM while having the highest CTI and the second highest AQ after Cluster 3.

3.5.6.3. Comparison between banks country-specific and cluster-specific Corporate Governance Practises and related financial and market performance indicators

In order to clarify the relationship between cluster-specific (Table 3.21) and country-specific (Table 3.23) in terms of corporate governance practises, market, and financial performance of G7 banks, the following table presents the relative country-specific:

Table 3:23 *Country-Specific Corporate Governance Practises, Market, and Financial Performance of G7 Banks.*

Variable	Ticker	United States	United Kingdom	Canada	France	Italy	Germany	Japan
# Of Banks		269	9	8	3	7	1	72
Corporate Governance Mechanisms	U.BOD	100% One-Tiered	100% One-Tiered	100% One-Tiered	100% One-Tiered	90.0% One-Tiered	100% Two-Tiered	100% Two-Tiered
	BODS	11.0	12.0	14.0	16.0	15.0	20.0	10.0
	BODMF	11.0	10.0	11.0	10.0	19.0	9.0	14.0
	BODCI	9.0	10.0	13.0	9.0	10.0	10.0	2.0
	IND.CHAIR	55.0% Independent	69.0% Independent	100.0% Independent	19.0% Independent	6.0% Independent	100.0% Independent	2.0% Independent
	CEOD	64% Separation	100.0% Separation	100.0% Separation	85.0% Separation	100.0% Separation	100.0% Separation	40.0% Separation
	BODGD	14.92%	22.17%	32.24%	40.20%	28.03%	31.67%	4.02%
	ACS	4.0	4.0	6.0	5.0	4.0	5.0	1.0
	ACMF	8.0	7.0	7.0	7.0	18.0	7.0	14.0
	ESGDS	31.33%	43.13%	48.42%	52.72%	49.56%	42.45%	22.93%
	EDS	3.53%	20.95%	25.65%	33.79%	33.62%	39.49%	4.25%
	SDS	8.41%	29.96%	31.55%	32.13%	33.24%	28.47%	6.37%
	GDS	81.86%	78.04%	87.90%	92.08%	81.70%	59.30%	58.09%
Market Performance Measures	P/E	15.2	19.4	11.2	13.2	15.9	21.2	11.3
	P/BV	1.3	1.2	1.7	0.6	0.8	0.4	0.5
	Div.Y	2.57%	3.40%	3.97%	4.77%	3.62%	2.94%	2.35%
Financial Performance Measures:	ROA	0.92%	0.46%	0.81%	0.22%	0.16%	0.08%	0.28%
	ROE	9.00%	4.30%	15.22%	5.07%	5.76%	1.73%	5.28%
	NIM	3.58%	2.91%	2.03%	1.21%	1.44%	1.23%	1.25%
	CAR	15.07%	18.20%	14.40%	15.65%	15.56%	16.88%	15.09%
	CTI	64.68%	77.63%	59.85%	68.78%	68.89%	80.06%	72.24%
	AQ	1.17%	2.05%	0.61%	5.32%	6.55%	4.48%	1.73%
Control Variable:	Leverage Ratio	99.93%	233.59%	235.45%	449.00%	414.02%	474.21%	97.34%

- *Author's Own*

- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

As mentioned in Chapter 2 Section 2.5, the corporate governance systems of the US, UK, and Canada are shareholder-oriented, meaning they prioritise maximising shareholders' wealth through short-term investments. France, Italy, Germany, and Japan adhere to a stakeholder-oriented system, known as the German-Japanese system, which aims to benefit all stakeholders by prioritising long-term investments.

- British, Canadian, French, Italian, and German banks have the largest Board of Directors (BOD) size, the highest percentage of female directors, the largest audit committee size, the highest percentage of independent chairperson, and the highest quality of ESG (Environmental, Social, and Governance) disclosures among the G7 countries. In addition, the practise of separating the roles of CEO and chairperson is followed by most banks, with only a few French banks practising CEO duality. These practises align with the theoretical framework of a stakeholder-oriented system, while adhering to stakeholder and resource dependence theories. Furthermore, this is further supported by the cluster analysis, which reveals that British, Canadian, French, Italian, and German banks are grouped together based on their governance behaviours from 2011-2019 (Cluster 2: multinational banks with a stakeholder-oriented approach that combines various theories).

Japanese banks adhere to a two-tiered board model, with the majority of them practicing CEO duality. Only 2% of banking observations appoint an independent chairperson. These banks have the lowest gender diversity, the lowest number of independent directors on their boards, the smallest audit committee size, and the lowest levels of combined and standalone ESG disclosures. The governance practises of banks in Japan are inconsistent with the stakeholder-oriented system. When comparing the results of cluster analysis, it is evident that Japanese banks are distinctly separated from other banking groups in the G7 countries, as they are grouped together in cluster 4. It is

worth mentioning that only a small number of Japanese banks are included in the cluster of multinational stakeholder-oriented banks, which consists of European, British, and Canadian banks (cluster 2).

According to the specific practises in the US, the practises of US banks were perplexing because they adhere to a one-tiered board model and have mixed practises regarding CEO duality and independent chairperson. This creates confusion in relation to agency and stewardship theories, as combining both practises are considered contradictory to the theory. Moreover, US banks exhibited the lowest overall quality of disclosing environmental, social, and governance (ESG) information, as well as the second lowest representation of female directors on their boards. This contradicts the principles of the stakeholder theory. US banks have been categorised into three groups based on their governance behaviours, as opposed to the clustering results. Cluster 1 and 3 consist exclusively of US banks, with only a few British banks in Cluster 3. Both clusters are characterised as shareholder-oriented banking groups, as they have the lowest representation of women on their boards and the lowest quality of environmental and social disclosures. However, they rank second highest in terms of governance disclosure quality among all banking groups. It is important to observe that the two clusters in the US can be distinguished from each other based on their CEO duality and independent chairperson practises. Cluster 1 adheres to the agency theory by separating the roles of CEO and chairperson, and having a majority of independent chairpersons. On the other hand, cluster 3 follows the stewardship theory, as most banks in this cluster practise CEO duality and have non-independent chairpersons.

- According to the market performance measures, as can be seen from Table 3:23 above, European banks along with British and Canadian banks that are considered stakeholder-oriented banking system according to their governance practices both in the descriptive analysis in Table 3:23 and the Cluster analysis results in Table 3:21, registered the highest P/E and dividend yields indicating that their market performance measured by their dividend policy metric is biased towards the shareholders. Specifically, when looking at the dividend yields of French, Italian, and German banks due to their highly leveraged nature implying the dependency on debtholders' sources of funds as indicated by having the lowest P/BV and the highest leverage ratios (customers' deposits relative to shareholders' equity) among other G7 countries. However, in comparison with the cluster 2 that group

stakeholder-oriented banks from all G7 countries according to their governance behaviors, it registered the highest dividend yield among the banking clusters.

Also, it's worth mentioning that high P/E ratio (that may indicate increased shareholders' demand on stocks based on a positive outlook) and high dividend yield of European banks in parallel with considering their diffused ownership structure with mainly institutional shareholders might be in alignment with the theoretical perspective of stakeholder-oriented system as shareholders of these countries focus more on long-term investments as opposed to the shareholder-oriented system that is characterised by speculative stock market due to their focus on short-term capital gains.

In the case of market performance and financial of Japanese banks as presented in Table 3:23, they registered the lowest P/E (price-to-earnings ratio), P/BV (price-to-book value ratio), and dividend yield among G7 countries. Additionally, Japanese banks are positioned at the bottom of the profitability rankings and have one of the highest cost-to-income ratios and credit risks. This suggests that Japanese banks prioritise supporting social aspects visa increased expenses towards their employees and suppliers. This can be rationalised by taking into account the ownership structure of Japanese banks, which is primarily composed of institutional investors who hold large blocks of shares as mandated by market regulations (external governance mechanisms) and have balanced corporate structure registering the lowest leverage ratio among countries due to the fact that those institutional block shareholders also lend banks and considered debtholders, This justification is supported by the theoretical background and previous literature discussed in Section 2.5 of Chapter 2.

- Based on the financial performance metrics, as per the descriptive statistics for each of the G7 countries in Table 3:23, US and Canadian banks registered the highest profitability measures of ROA, ROE, and NIM in in parallel with having lowest CAR, CTI, and AQ ratios. This imply that US and Canadian banks support the shareholder-oriented system. This is due to the fact that high NIM indicates the increased wealth shift towards shareholders from debtholders, low CAR indicates shifting the risk from shareholders towards debtholders, low CTI means controlling spending towards the society through mainly controlling employees' and suppliers' expenses, and low AQ (below average) indicates a conservative credit risk appetite towards low-income segments within the society.

however, in comparison with the cluster analysis results in Table 3:21, although Canadian banks are classified within the stakeholder-oriented banking cluster 2, their financial performance metrics indicate that their alignment with the shareholder-oriented system. In case of US clusters 1 and 3 characteristics along with the country-specific are alignment with the shareholder-oriented system except for few US banking observations that were classified as a stakeholder-oriented banks according to their corporate governance practices within Cluster 2.

- As for British banks financial performance metrics in Table 3:23, the profitability measures of ROA and ROE are considered within the average market of G7 countries. As for the stability measures British banks registered the highest CAR indicating the increased protection towards debtholders, second highest CTI implying the increased spending towards the society in terms of employees and suppliers' expenses, while also registering AQ ratio within the average G7 market. Furthermore, country-specific practices of British banks in Table 3:23 and the classification of British banks according to the cluster analysis results in Table 3:21 which were grouped within cluster 2 the multinational stakeholder-oriented banking group, it is seen that British banks' corporate governance practices are aligned in both country-specific and cluster-specific supporting the stakeholder-oriented system as opposed to the quoted corporate governance literature and regulations that consider UK banks' governance practices as part of the Anglo-Saxon system (except few British banking observations that were classified within Cluster 3 that is composed of majority of US shareholder-oriented banks following stewardship theory). This is evident from both British banks' cluster and country-specific corporate governance characteristics including their country-specific financial performance that balances the interest among stakeholders including shareholders.

3.5.7. Results and Discussion of G20 Countries' Banking Groups with Similar Governance Practises

3.5.7.1. Descriptive Statistics

A final panel-data sample of 4,968 valid bank-year observations was produced (from a total of 11,700 observations extracted from the Bloomberg Online database), spanning 552 banks across a nine-year period (2011–2019). Table 3.24 below displays the descriptive statistics for the relevant research variables of G20 countries whereby 423 banks in G20 countries were excluded due to data quality issues mainly including null values, where the majority had 100% null values across the nine-year period of the study.

The 552 banks operating in G20 countries had a median board size of 11 members who met 12 times per year and are composed of seven independent members with an average of 13% female directors serving on G20 banks' BOD. The majority of the banking sample were Tier-1 board type with a majority of non-independent chairperson serving on their boards and around one third of the banking sample practising dual control of their leadership role. G20 banks' information flow regarding environmental, social, and governance aspects were relatively low based on their average scoring, as shown in Table 3:24 (EDS 7%, SDS 12%, GDS 74%).

In regard to financial performance measures, the 522 G20 banks registered an average ROA of around 0.9% during the period 2011–2019, with the ROE averaging 9.3%, NIM 3.2%, CAR 15.2%, CTI 61.5% and AQ 2%. The market performance measures for G20 banks are determined by calculating the market multiples of their share closing price relative to earnings per share (P/E) and shareholders' equity per share (P/BV). On average, the P/E ratio is 13.6 and the P/BV ratio is 1.16. Furthermore, the average dividend yield of G20 banks, which is the ratio of dividends distributed per share to the closing market price per share, stood at 1.6% during the period from 2011 to 2019.

When comparing G7 and G20 corporate governance practises, we found that board size and their meeting frequency mechanisms were similar based on their median. The number of independents in G20 countries was lower by an average of one member compared to G7 practises female directors serving on BODs in G20 were relatively higher by 0.2%. It was noted that banks' average score for SDS and EDS disclosures in G20 countries were higher by around 3% and 4.1% respectively while the GDS score was higher for G7 countries by 3%.

Table 3:24 *G20 Banking Sample: Descriptive Statistics*

Variable Type	Field	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Descriptive Variables	Ticker	--	--	--	--	--	--	552	4968
	Year	2011	2019	--	--	--	--	9	4968
	Country	--	--	--	--	--	USA	38	4968
	Sub.Ind	--	--	--	--	--	Regional Banks	2	4968
	$T2-TwoStep	1	4	--	--	--	2	4	4636
Financial Performance Variables (Dependent Variables)	ROA	-0.008	0.026	0.009	0.006	0.009		--	4773
	ROE	-0.074	0.264	0.093	0.062	0.091		--	4758
	NIM	-0.029	0.095	0.032	0.015	0.033		--	4684
	CAR	0.031	0.274	0.152	0.032	0.146		--	4069
	CTI	0.192	1.036	0.615	0.147	0.622		--	4799
	AQ	0.00	0.078	0.02	0.022	0.011		--	4795
Market Performance Variables (Dependent Variables)	P/E	0.402	3.894	13.601	6.308	12.595	32.894	--	4,416
	P/BV	0.005	2.7	1.164	0.582	1.114	2.7	--	4,616
	DIV.Y	0.068	0.028	0.016	0.717	0.068	--	--	4,114
Corporate Governance Variables (Independent Variables)	BODS	2.00	33.00	11.25	3.30	11.00	11.00	--	4968
	BODMF	2.00	92.00	12.41	6.83	12.00	12.00	--	4828
	ACS	0.00	14.00	3.91	1.93	4.00	4.00	--	4968
	ACMF	0.00	191.00	9.15	6.84	8.00	5.00	--	4806
	BODCI	0.00	21.00	7.06	3.71	7.00	8.00	--	4959
	BODGD%	0.00	0.60	0.13	0.11	0.11	0.00	--	4968
	GDS	0.01	1.00	0.74	0.16	0.81	0.83	--	4896
	SDS	0.0103	0.656	0.12	0.13	0.08	0.00	--	4880
	EDS	0.0109	0.734	0.07	0.14	0.00	0.00	--	4968
	CEOD	--	--	--	--	--	1	2	4968
	UBOARD	0.00	1.00	--	--	--	1	2	4968
	IND.CHAIR	--	--	--	--	--	1	2	4968
Control Variable	LR	0.00	4.80	1.40	1.30	0.90	4.80	--	4828

- *Author's Own*
- *$ Two-Step included as a descriptive variable is the data field resulting from the cluster analysis which contains the cluster number and was set to a measurement type of categorical field and used as a split variable in the regression modelling to generate estimates of the impact of each corporate governance practises cluster for each of the financial performance measures.*
- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score;*

SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.

3.5.7.2. G20 Cluster Analysis Results and Discussion

The result is a model with 12 corporate governance variables and one variable describing the country of origin for each cross-section (bank). It includes 4,636 observations, excludes 332 outlier observations, and four clusters were obtained for banks operating in G20 countries. The silhouette measure of cohesion and separation is sufficiently high and stands at 0.54, which is ranked 'good' as per the SPSS Modeler result, as shown in Table 3:25 below:

Table 3:25 *G20 Cluster Model Summary*

Algorithm (Model Name)	Two-Step
Inputs	13 *(12 Corporate Governance Variables + Country of origin)*
Clusters	4
Quality	Good
Silhouette Measure of Cohesion & Separation	0.537
Size of Smallest Cluster	888 (19.2%)
Size of Largest Cluster	1,613 (34.8%)
Largest to Smallest Cluster	1.82

- Author's Own

However, the 332 outlier observations as detected by the Two-Step cluster analysis are defined as null values by the model, which were then excluded from further analysis. The identified outliers which are generated as null values by the cluster analysis as shown in Table 3:26 below:

Table 3:26 *G20 Banking Clusters: Outliers Identified in the Cluster Analysis*

Country	Sub-Industry	Number of Observations	Year Mid-Range
USA	8 Regional	38	2011–2016
Turkey	1 Diversified	9	2011 –2019
Cyprus	1 Diversified	4	2011–2014
Argentina	3 Diversified	27	2011–2019
Mexico	3 Diversified & 1 Regional	36	2011 –2019
Italy	5 Diversified	33	2011 –2019
Greece	1 Diversified	7	2011–2017
Indonesia	1 Diversified	5	2011–2015
Poland	3 Diversified	27	2011–2019
Slovakia	1 Diversified	9	2011–2019
Slovenia	1 Diversified	3	2011–2013
Lithuania	1 Diversified	7	2011–2017
Austria	1 Diversified	4	2011–2014
Netherlands	1 Diversified	3	2011–2013
Brazil	5 Diversified & 2 Regional	63 *(Including 18 for regional)*	2011–2019
Chine	1 Diversified & 3 Regional	29 *(Including 5 for diversified)*	2011–2016
India	1 Diversified	7	2011–2015
Croatia	1 Diversified	9	2011–2019
South Korea	2 Diversified	12	2011–2019

- Author's Own

A Two-Step cluster analysis was utilised to identify homogenous groups of banks in terms of 12 corporate governance mechanisms and their country of origin. A comparative analysis of the solution with a maximum number of clusters was performed, examining the different groups of banks during the period from 2011–2019. The optimal number of identified clusters was four, for which the silhouette measure of cohesion and separation was at 0.54.

Table 3:27 *G20 Cluster Sizes*

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Outliers Excluded	Total Sample Included
Number of Observations	1,245	890	1,613	888	332	4,636
Percentage of Total Sample Size	25.06%	17.91%	32.47%	17.87%	6.68%	93.32%

- *Author's Own*

The SPSS Modeler provided the importance percentage for each variable (categorical or continuous). It was found that banks in G20 countries significantly differed from each other in regards to the governance practises of audit committee size, number of independent directors, CEO duality, environmental disclosure, social disclosure, governance disclosure, independent chairperson, and unitary board, while the board meeting frequency, audit committee meeting frequency, and board size were the least important variables in separating the four clusters. Table 3:28 shows the importance and power of the 12 corporate governance mechanisms in the separation analysis of the four clusters.

In comparing G7 and G20 variables importance, it was found that both G7 and G20 banks had similar results, except for the practise of CEO duality, which was found to be more important in separating G20 banking clusters to the power of 100% and 87% for G7 countries, in addition to the slight difference in the importance level of audit committee and board meetings, which was found to be less important in separating G20 banks compared to the G7 banking sample.

Table 3:28 *The Importance of Variables in Measuring the Cohesion and Separation of G20 Corporate Governance Practises Clusters*

Independent Variables	Importance According to the Two-Step Cluster Analysis
ACS	1.000
BODCI	1.000
CEOD	1.000
EDS	1.000
GDS	1.000
IND.CHAIR	1.000
SDS	1.000
Uboard	1.000
BODGD%	0.630
ACMF	0.220
BODMF	0.210
BODS	0.210

- *Author's Own*
- *BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

The cluster analysis results of G20 banks, using the 12 governance mechanisms, is presented in Table 3:29. Four clusters were identified, and the differences observed in the adoption of governance practise across the clusters. The characteristics of each cluster are outlined below. It is noted that CEO duality, environmental disclosure score, independent chairperson, and unitary board contributed most significantly to the differentiation in the first cluster, while the number of independent directors, CEO duality, environmental disclosure score, governance disclosure score, social disclosure score, independent chairperson, gender diversity, unitary board type, and board size differentiated the second cluster. Furthermore, it was noted the gender diversity of the board is moderately important in separating banking groups.

As can be seen from Table 3:29 below, the first banking group in G20 (consisting of 25.06% of the sample and the second largest cluster) showed similar corporate governance behaviours compared to the first cluster in G7. Both clusters were led by the US and considered a shareholder-oriented group presented mainly with Tier-1 US regional banks which practise a separation of leadership role with a majority of independent chairperson and low information flow regarding their social impact (social disclosure) and almost no environmental disclosures.

Cluster 1 in G7 was entirely composed of US regional banks, while the G20 cluster included banks from multiple countries, with the US banks standing at a majority of 83.45%, India at 4.26%, Saudi Arabia at 3.21%, Malta at 1.77%, Ireland at 1.45%, Austria at 1.45%, Canada at 1.45%, Belgium at 0.96%, South Korea at 0.64%, Denmark at 0.56%, the UK at 0.56%, South Africa at 0.16% and Sweden at 0.08% respectively. Slight differences were noted between the two clusters' disclosure scores, with the governance disclosure practises scoring 1% higher in G7 countries compared to G20 countries. The social disclosure score ranked 1% higher in G20 countries.

The corporate governance characteristics of Cluster 1 in both G7 and G20 countries were clearly similar and endorse the agency theory while contradicting the stewardship and stakeholder theories. The second cluster in G20 countries (17.91% of the sample and the second smallest cluster) was found to have similar governance practises when compared to cluster 4 in G7 countries. Both samples of G7 and G20 banks in the two clusters were led by Japan, following the Japanese market-oriented governance model and presented mainly with a two-tiered board structure with mixed practises of dual leadership control of the CEO/chairperson roles and the majority having a non-independent chairperson

on their boards. It is also noted that both clusters were operating under two-tiered board structures (with the exception of observations found in G20 countries, whereby two banks followed a Tier 1 structure during 2011 and 2013). The banks in G7 countries were 100% Japanese, 92% regional and 7.9% diversified; the G20 banks on the other hand originated from 16 countries, with the majority in Japan (70.1%), followed by China (10.8%), Indonesia (7.6%), Russia (1.9%), the Middle East (Saudi Arabia and Turkey) (0.56%), with the remaining banks coming from Eastern Europe.

In regards board composition, 37% of G7 countries practised dual control, compared to 29.4% in G20 countries. 99% of board chairpersons were non-independent in G7 countries, while 93.5% non-independent in G20. Regarding gender diversity, it was found that countries in G20 had 2% more females serving on boards, while the audit committees met more frequently in G7 countries, with an average of 1 to 2 more meetings per year.

Environmental and governance scores were ranked the same, but the social disclosure score was around 1% higher in G20 countries due to the inclusion of European banks. It is worth noting that the Japanese governance model banking group in Cluster 2 of the G20 countries was found to be declining throughout the years and transitioning towards Cluster 4. The banks in G7 countries in Cluster 4 were found to remain mostly constant, with just two observations exiting the cluster from 2018.

Table 3:29 *Summary of G20 Clustering Results*

Category	Field	Measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Clustering Analysis Results Corporate Governance Characteristics (Practises) *(descending order according to importance)*	ACS	Mean	4.6	1.7	4.4	4.6
		Median	4.0	0.0	4.0	5.0
	BODCI	Mean	9.1	2.7	8.0	7.5
		Median	9.0	2.0	8.0	6.0
	CEOD	Mode	100% No	56.29% No	57.59% Yes	95.16% No
	EDS	Mean	0.0%	4.0%	1.0%	30.0%
	GDS	Mean	81.0%	58.0%	77.0%	82.0%
	IND.CHAIR	Mode	100% Yes	93.48% No	99.63% No	59.69% No
	SDS	Mean	6.0%	7.0%	7.0%	31.0%
	Uboard	Mode	100% Tier1	99.8% Tier2	100% Tier1	60.7% Tier1
	BODGD%	Mean	14.0%	6.0%	12.0%	21.0%
	ACMF	Mean	7.6	12.2	8.2	10.5
		Median	7.0	13.0	7.0	8.0
	BODMF	Mean	11.93	13.91	10.49	14.91
		Median	12	13	10	12
	BODS	Mean	11.0	10.5	11.1	12.9
		Median	11.0	10.0	11.0	13.0

Category	Field	Measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Financial Performance	ROA	Mean	0.96%	0.94%	0.57%	0.80%
	ROE		9.33%	8.96%	7.72%	10.37%
	NIM		3.63%	3.64%	2.10%	2.70%
	CAR		14.95%	15.08%	15.46%	15.63%
	CTI		61.76%	63.26%	64.86%	55.63%
	AQ		1.47%	1.32%	2.11%	3.04%
Market Performance	P/E	Mean	14.99	11.38	14.99	11.79
	P/BV		1.28	0.73	1.33	1.08
	DIV.Y		2.67%	2.47%	2.46%	3.82%
Sub Industry	Diversified Banks	% of total cluster sample	13.57%	26.07%	19.09%	90.43%
	Regional Banks	% of total cluster sample	86.43%	73.93%	80.91%	9.57%
Geolocations	Country	Mode	Includes 13 countries 83.45% US	Includes 16 countries 70.11% Japan	Includes 18 countries 79.79% US	Includes 34 countries 18.36% China
Year	2011	Count	132	114	198	61
	2012		136	109	194	66
	2013		145	109	182	69
	2014		142	109	183	76
	2015		137	99	184	94
	2016		136	95	176	112
	2017		138	90	172	124
	2018		140	84	165	137
	2019		139	81	159	149
Countries	US	% of Total Cluster Sample	83.45%	0.11%	79.79%	6.31%
	INDIA		4.26%	-	9.86%	2.70%
	SAUDI ARABIA		3.21%	0.45%	2.11%	0.34%
	SOUTH KOREA		0.64%	-	1.67%	3.83%
	TURKEY		-	0.11%	1.36%	5.52%
	ROMANIA		-	-	1.05%	1.13%
	ITALY		-	-	0.62%	4.28%
	MALTA		0.56%	-	0.62%	0.11%
	UK		1.77%	-	0.56%	5.63%
	SPAIN		-	-	0.43%	5.29%
	SOUTH AFRICA		0.16%	-	0.37%	3.15%
	CYPRUS		-	-	0.31%	-
	INDONESIA		-	7.64%	0.31%	4.39%
	MEXICO		-	-	0.25%	0.56%
	GREECE		-	-	0.19%	3.94%
	POLAND		-	3.93%	0.19%	1.80%
	SWEDEN		0.08%	-	0.19%	2.59%
	DENMARK		0.56%	0.45%	0.12%	1.58%
	AUSTRALIA		1.45%	-	-	4.05%
	AUSTRIA		-	0.67%	-	2.93%
	BELGIUM		0.96%	-	-	0.68%
	BRAZIL		-	0.24%	-	1.80%

Category	Field	Measure	Cluster 1	Cluster 2	Cluster 3	Cluster 4
	CANADA		1.45%	-	-	6.08%
	CHINA		-	10.79%	-	18.36%
	CZECH		-	1.57%	-	0.45%
	FRANCE		-	-	-	3.05%
	GERMANY		-	-	-	1.01%
	HUNGARY		-	0.45%	-	0.56%
	IRELAND		1.45%	-	-	1.01%
	JAPAN		-	70.11%	-	2.70%
	LITHUANIA		-	0.22%	-	-
	NETHERLANDS		-	-	-	1.69%
	PORTUGAL		-	-	-	1.01%
	RUSSIA		-	1.91%	-	1.13%
	SLOVAKIA		-	0.90%	-	0.11%
	SLOVENIA		-	0.45%	-	0.23%
	ARGENTINA	**4 banks in both countries were detected as outliers, not grouped within any cluster**				
	CROATIA					

- *Author's Own*
- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

In regard to Cluster 3 of G7 countries and Cluster 3 of G20, both were one-tiered and followed a shareholder-oriented structure while practising the stewardship theory. Both clusters had a majority of US banks, with 99.6% in G7 and 79.8% in G20. The remaining countries in G20 included Saudi Arabia, India, South Korea, Turkey, Romania, Italy, Malta, the UK, Spain, South Africa, Cyprus, Indonesia, Mexico, Greece, Poland, Sweden and Denmark. 99% of the banks in G7 countries were regional, while 80.9% were regional in G20 and 0.87% of banks were Islamic. In terms of board composition, both had a majority of non-independent chairpersons, and gender diversity was 1% higher in G7 countries. The governance disclosure score was 4% higher on average in G7 countries, while the social disclosure score was found to be 1% higher in G20. Both clusters followed the Anglo-American shareholder-oriented governance model, supported by the stewardship theory, but most banks appeared to be transforming to the similar banking groups within Cluster 4 in

G20 and Cluster 2 in G7. The fourth banking group (Cluster 4) in G20, consisting of 17.87% of banking sample with the smallest size, exhibited similar governance behaviours when compared to the second cluster in G7 countries. Both were composed of multinational banks and followed a market-oriented corporate governance system.

Slight differences were evidenced between the clusters. In terms of board size and structure, G7 countries were found to have one additional member on average, four to five more independent directors, and around 8% more females served on their boards. 59% of the banks' chairmen in G7 countries were independent, while the same percentage of the chairpersons in G20 countries were non-independent. CEO duality practises were higher in G7 countries, where around 6% more CEOs were found to have dual control. In regard to disclosures, environmental, social and governance disclosures were found to be 3%, 1% and 4% higher in G7 compared to G20. In regard to governance structures, 94% of the banks in G7, while 64.7% in G20 were Tier 1. The banking groups in both Cluster 2 in G7 and Cluster 4 in G20 clearly adhered to the modern international market-oriented governance model. This supports the stakeholder and resource dependence theories while generating a mixed position regarding the agency and stewardship theories.

Table 3:30 shows the observations that were prevalent in more than one cluster, suggesting the transformation of their governance practises from one bank group to the next across different time periods.

Table 3:30 *Transformation of Banks' Governance Practises across G20 Clusters*

Country	Number of Banks	Action
AUSTRIA	1	Transformed from Cluster 2 in 2011 to Cluster 4 in 2012 and onwards
CHINA	1	Transformed from Cluster 2 in 2012 to Cluster 4 in 2013 and onwards
CZECHIA	1	Transformed from Cluster 2 in 2011 to Cluster 4 in 2016 and onwards
DENMARK	1	Transformed from Cluster 2 in 2011 to Cluster 4 in 2014 and onwards
HUNGARY	1	Transformed from Cluster 2 in 2011 to Cluster 4 in 2015 and onwards
INDONESIA	6	The 6 banks were following the Japanese governance model in 2011, whereby one of them transformed to the multinational market-oriented governance model in 2011 followed by another in 2014, three further banks in 2015 and one in 2018
JAPAN	6	Transformed from Cluster 2 in 2011 to Cluster 4 in 2014 for two banks followed by a further two banks in 2017 and the other two in 2019
MALTA	1	Transformed from Cluster 3 in 2011 to Cluster 1 in 2012 and onwards
POLAND	5	Transformed from Cluster 2 in 2011 to Cluster 4 in 2015 for one bank followed by another bank in 2016, another one in 2017 and the other two in 2019
RUSSIA	2	Transformed from Cluster 2 in 2011 to Cluster 4 in 2014 and onwards while the other changed from Cluster 2 in 2011 to Cluster 4 in 2018
SAUDI ARABIA	1	Transformed from Cluster 1 in 2011 to Cluster 3 in 2014 to Cluster 4 in 2017 and onwards
SLOVAKIA	2	Transformed their governance practises to follow Cluster 4 in 2018
SOUTH KOREA	1	Transformed from Cluster 1 in 2011 to Cluster 3 in 2012, then to Cluster 4 in 2014 and onwards
SWEDEN	1	Transformed from Cluster 1 in 2011 to Cluster 3 in 2012, to Cluster 4 in 2015 and onwards
TURKEY	1	Transformed from Cluster 2 in 2011 to Cluster 4 in 2014 and onwards
UK	1	Transformed from Cluster 3 in 2011 to Cluster 1 in 2015, then to Cluster 4 in 2018 and onwards
US	4	Transformed from Cluster 1 In 2011 to Cluster 3 in 2013, to Cluster 4 in 2018

- *Author's Own*

3.5.8. Results of the Impact of G7 Countries' Banking Groups with Similar Governance Practises on Financial Performance Measures

Following the analytic approach conducted previously in this study, and to illustrate the impact of implementing inappropriate econometric techniques when modelling the governance–performance relationship, a baseline approach must be selected against which to compare alternative methodologies. More specifically, given its widespread use in the early governance–performance literature, the pooled OLS method of estimation was used as our baseline analysis, despite its strict exogeneity assumptions. The results of the panel assumptions-pooled OLS estimation suggest violations of estimates for all models. Therefore, we applied panel modelling techniques since it was important to decide the type of model between fixed effects or random effects. Consequently, it had to be ascertained whether these effects were treated as fixed or random, which required the

application of the Hausman test as previously discussed in the Methodology section in this essay. Our findings suggested that panel estimation based on fixed effects was more appropriate. In the case of a relatively low value of the test (accompanied by a high p-value above 0.05), it determined the approach of the random effects models. In the analysis based on panel data, homoskedasticity was a basic hypothesis, which had to be verified. The White's test was used to test the homoskedasticity hypothesis while the autocorrelation of errors in the model estimation was tested by applying the Durbin–Watson and Wooldridge test. The absence of collinearity violations was noted.

The Generalised Linear Model node was utilised for each model to uncover the nature of the relationship between corporate governance clusters and financial performance measures as the best-fit model based on the output of the auto-numeric node previously mentioned. The expert mode in the GLM node was activated to determine the distribution type for each model, link function, parameter estimation function method, scaling method, covariance matrix, chi-square statistics type, and confidence interval type.

The GLM model accommodates a non-normal distribution for the dependent variable. Its definition describes various commonly used statistical models that can be deployed to represent various kinds of data, such as linear regression models for normally distributed responses, logistic models for binary data, loglinear models for count data, and complementary log-log models for interval censored survival data. The GLM node estimates of relations for the corporate governance practises of each banking group and financial performance measures are presented in Table 3:31, which shows the main functions utilised in the expert mode of the GLM node prior to running the regression analysis.

Table 3:31 *Expert Mode GLM Estimations Functions*

		ROA Model	ROE Model	NIM Model	CAR Model	CTI Model	AQ Model
Probability Distribution (Target Field)		Normal					
Link Function		Log				Identity	
Parameter Estimation	Method	Hybrid					
	Scale Parameter Method	Maximum Likelihood					
	Covariance Matrix	Robust Estimator					
Chi-square Statistics		Likelihood Ratio					
Confidence Interval Type		Profile Likelihood					

- *Author's Own*

To ensure that the best probability distribution along with its link function were used in the expert mode of the GLM node, we utilised the Simulation Fitting node after running the GLM analysis in order to assist in determining the best-fit distribution type. The Simulation Fitting Node fitted a set of candidate statistical distributions to each field in the data. The fit of each distribution to a target field was assessed using a goodness-of-fit criterion whereby models with the lowest criterion values were chosen. When a Simulation Fitting node was executed, a Simulation Generate node was built. Each field was assigned its best fitting distribution. The Simulation Generate node could then be used to generate simulated data for each field. Although the Simulation Fitting node is a terminal node, it does not add a model to the generated model's palette, an output or chart to the outputs tab, or export data (IBM, 2018).

Table 3:32 *Summary of Results: Cluster 1 Corporate Governance Practises and Financial Performance Measures*

(Cluster 1 – US Regional Banks – Shareholder-Oriented System Teir 1 Board Structure Advocates Agency Theory)

Cluster 1	**ROA**	**ROE**	**NIM**	**CAR**	**CTI**	**AQ**
(Intercept)	0.0120	0.1100	0.0430	-1.6160	0.6390	0.0270
	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****
BODS	0.000n	-0.0030	0.000n	-0.0300	0.0060	0.000n
	*0.091**	*0.1530*	*0.3660*	*0.000****	*0.1820*	*0.6050*
BODMF	0.000n	-0.0010	0.000n	0.0020	0.0040	0.000n
	*0.000****	*0.000****	*0.000****	*0.023***	*0.000****	*0.007****
ACS	0.000027	0.000n	0.0000	0.014000	0.000n	0.000n
	0.7850	*0.6150*	*0.8010*	*0.002****	*0.8870*	*0.1750*
ACMF	0.0000043	-0.0010	0.000n	0.0050	0.0030	0.000n
	0.9260	*0.2240*	*0.03***	*0.004****	*0.007****	*0.1050*
BODCI	0.000n	0.000n	0.000n	0.0110	-0.0030	-0.0010
	0.5390	*0.9350*	*0.6160*	*0.1310*	*0.5390*	*0.1050*
BODGD%	0.0010	-0.0120	-0.0030	0.2170	0.0160	-0.0090
	0.3230	*0.3530*	*0.2690*	*0.000****	*0.6830*	*0.004****
GDS	0.0020	0.0130	0.000n	-0.3010	-0.1310	-0.0140
	0.3450	*0.5070*	*0.9230*	*0.000****	*0.013***	*0.007****
SDS	0.0100	0.0930	-0.0030	-0.8750	-0.1570	-0.0570
	*0.000****	*0.000****	*0.6040*	*0.000****	*0.035***	*0.000****
EDS	0.0010	-0.0380	0.0070	-1.2060	0.4820	0.0260
	0.9420	*0.8530*	*0.6980*	*0.3450*	*0.1750*	*0.3010*
LR	-0.0010	0.0030	-0.0040	-0.0510	-0.0030	0.000n
	*0.000****	*0.091**	*0.000****	*0.000****	*0.5890*	*0.5210*
CEOD=0	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]
	.	.	.	.	.	.
UBOARD=0	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]
	.	.	.	.	.	.
IND.CHAIR=0	0.000n	0.0040	-0.0010	0.1190	0.0170	-0.0020
	0.8200	*0.7400*	*0.4230*	*0.1850*	*0.4280*	*0.4940*
Goodness of Fit						
Akaike's Information Criterion (AIC)	*-8,362.30*	*-3,671.76*	*-7,017.65*	*-4,434.12*	*-1,571.52*	*1,902.58*
Bayesian Information Criterion (BIC)	*-8,293.43*	*-3,602.91*	*-6,948.79*	*-4,365.50*	*-1,502.52*	*1,966.65*
Omnibus Test						
Likelihood Ratio Chi-Square	*100.893*	*58.583*	*124.137*	*192.936*	*82.601*	*158.448*
Df	*12*	*12*	*12*	*12*	*12*	*12*
Sig.	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****

- *Author's Own*
- *a: set to zero because this parameter is redundant.*
- *n: independent variable has no impact on financial performance measure.*

- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

The banking group in Cluster 1 comprised regional US banks and followed a shareholder-oriented corporate governance system while advocating the agency theory, operating with a Tier1 system, where board chairperson is the director, with no dual control. They typically had a low focus on disclosure practises regarding social and environmental aspects yet have decent scores for governance disclosure. The points below highlight the relationship between corporate governance mechanisms and financial performance measures, showing the key generated results:

Board size was found to be important in relation to ROA and CAR only while other financial measures were affected statistically insignificantly at a level of above 10%. The larger BOD size in Cluster 1 was found to have no impact on financial performance measured by the ROA and to be statistically significant at a level of below 10%. This indicates that an additional board member will have a zero impact on ROA, while the larger BOD size in Cluster 1 affected capital adequacy ratio negatively by 3% and statistically significantly at a level of below 1%.

The number of board meetings was found to be an important governance mechanism in relation to all financial measures. The number of BOD meetings had a neutral relationship with the ROA, NIM and AQ and was statistically significant at a level of below 1% across the three models. However, the higher the BOD activity, the lower the ROE by 0.1% (significance level of below 15), and the higher the CAR and CTI by 0.2% (significance level of below 5%) and 0.4 (significance level of below 1%) respectively.

The ACS was found to have a positive marginal impact on CAR only and statistically significantly at a level of below 1%. The larger the audit committee size, the higher the CAR by 1.4%. The number of audit committee members was found to be unimportant for the remaining financial performance measures with no statistical significance.

Audit committee meetings were found to have a statistically significant (below 1%) and positive relationship with only three financial performances measured by CAR and CTI, while the higher meeting frequency was found to have a neutral impact on NIM at a statistically significant level of below 5%.

In respect to the number of independent directors serving on the board, the practise was found to be unimportant (statistically insignificant) in relation to financial performance across all models.

The number of female directors was found to be an important governance mechanism in relation to the performance-risk measures of the CAR and AQ. The higher the BOD composition of women, the higher the CAR by 21.7% and the lower the non-performing loans relative to the loan portfolio (higher quality) by 0.9%, both being statistically significant at a level of below 1%.

Information flow regarding banks' governance data negatively and statistically significantly impacted the CAR by 30.1%, CTI by 13.1%, and AQ by 1.4% at levels of below 1%, 5%, and 1% respectively.

The social disclosure score, which was the most significantly impactful ESG reporting mechanism in Cluster 1, affected all financial performance measures statistically significantly except the NIM. The social score had a positive impact on the ROA by 1.0%, ROE by 9.3%, CAR by 87.5%, CTI by 15.7%, and AQ by 5.7% respectively, all at a level of below 1%, except for CTI at below 5%.

The environmental score was found to be an unimportant mechanism relative to all financial performance measures, with no statistical significance across all models.

No results were obtained for the independence of the board's chairperson and CEO duality as Cluster 1 practised a 100% chair-independence and separation of leadership roles.

In regard to the control variable, banks with a higher leverage ratio were found to be negatively and statistically significant in impacting on their financial performance, measured by the ROA, NIM, and CAR and positively affecting ROE. The explanation behind these impacts is that shareholders are benefiting from the returns generated by the attracted funds of debtholders.

Table 3:33 *Summary of Results: Cluster 2 Corporate Governance Practises and Financial Performance Measures*

(Cluster 2, the multinational banking group – market-oriented system - combination of board structure & CEO Duality advocates mixture of stakeholder, stewardship, and resource dependence theories)

Cluster 2	**ROA**	**ROE**	**NIM**	**CAR**	**CTI**	**AQ**
(Intercept)	0.0050	0.0250	0.0480	-1.5700	1.0030	0.0380
	0.1070	*0.5730*	*0.000****	*0.000****	*0.000****	*0.000****
BODS	0.0001	-0.0030	0.000n	0.000n	-0.0080	0.0010
	0.8030	*0.1750*	*0.5640*	*0.9500*	*0.001****	*0.071**
BODMF	0.0001	0.000n	0.000n	-0.0010	0.0010	0.000n
	0.8170	*0.8510*	*0.1400*	*0.7070*	*0.5730*	*0.3920*
ACS	0.000200	0.0090	-0.0010	-0.0090	-0.0160	-0.0020
	*0.003****	*0.000****	*0.1730*	*0.1820*	*0.000****	*0.001****
ACMF	0.0000510	0.000n	0.000n	0.0050	-0.0040	0.0010
	0.1460	*0.6610*	*0.075**	*0.009****	*0.000****	*0.000****
BODCI	0.0001	0.0040	-0.0010	-0.0290	-0.0070	-0.0010
	0.1720	*0.016***	*0.001****	*0.000****	*0.001****	*0.02***
BODGD%	0.0029	0.2270	0.0020	0.0020	-0.2120	0.0020
	*0.000****	*0.000****	*0.7720*	*0.9860*	*0.001****	*0.8120*
GDS	0.0026	0.1100	0.0040	-0.1260	-0.2630	-0.0420
	*0.001****	*0.002****	*0.3700*	*0.08**	*0.000****	*0.000****
SDS	0.0023	-0.0660	-0.0010	0.2850	0.0340	-0.0050
	0.7680	*0.074**	*0.8950*	*0.003****	*0.4880*	*0.6170*
EDS	0.0031	-0.1430	-0.0190	-0.0470	0.3500	0.0290
	*0.000****	*0.000****	*0.005****	*0.6570*	*0.000****	*0.005****
LR	0.0003	-0.0260	-0.0060	-0.0410	0.0390	0.0080
	*0.000****	*0.000****	*0.000****	*0.003****	*0.000****	*0.000****
CEOD=0	0.0009	-0.0250	0.0050	-0.1110	0.0090	-0.0130
	*0.01****	*0.041***	*0.016***	*0.011***	*0.6770*	*0.002****
UBOARD=0	0.0012	0.0230	0.0040	-0.0160	-0.0070	-0.0150
	*0.08**	*0.2280*	*0.2300*	*0.7160*	*0.7940*	*0.015***
IND.CHAIR=0	0.0009	-0.0230	0.0050	0.0560	0.0560	-0.0130
	0.5490	*0.054**	*0.033***	*0.096**	*0.001****	*0.000****
Goodness of Fit						
Akaike's Information Criterion (AIC)	*-2,242.79*	*-734.59*	*-1,747.94*	*-1,231.11*	*-506.08*	*550.19*
Bayesian Information Criterion (BIC)	*-2,184.52*	*-732.54*	*-1,689.67*	*-1,228.97*	*-504.03*	*604.87*
Omnibus Test						
Likelihood Ratio Chi-Square	*241.109*	*158.155*	*205.977*	*103.028*	*172.422*	*599.828*
Df	*14*	*14*	*14*	*14*	*14*	*14*
Sig.	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****

- *Author's Own*

- *a: set to zero because this parameter is redundant.*

- *n: independent variable has no impact on financial performance measure.*
- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

Board size had a weak negative and statistically significant impact on CTI of 0.8% at a level of below 1% and statistically significantly positively affects AQ by 0.1% at level of below 10%. However, their meeting frequency was found to be unimportant governance relative to banks' financial performance measures in Cluster 2.

In regard to larger audit committee size in Cluster 2, the mechanism minimally statistically significantly positively impacted profitability ratios measured by the ROA by 0.02% and ROE by 0.9%, both at a level below 1%, while negatively and statistically significantly affecting CTI by 1.6% and AQ by 0.2%.

The number of meetings held by the audit committee was found to have a neutral relationship with the NIM and statistically significant at a level below 10%, while higher meetings frequency had a weak positive relationship with CAR at 0.5% and negative with CTI at 0.4%, and AQ by 0.1%, all at a level below 1%.

Boards composed of a large number of independent directors statistically significantly affected five of the six financial performances, and positively affected ROE by 0.4% while negatively impacting NIM by 0.1%, CAR by 2.9%, CTI by 0.7%, and AQ by 0.1%.

Boards with a high percentage of female directors had a significant positive impact on both the ROA of 2.9% and ROE by 22.7%, and a negative impact on CTI by 21.2%, all at a level of below 1%.

In regard to information disclosure, governance disclosure was found to have a negative impact on ROA and ROE at 0.26% and 11% at a level of below 1% respectively while impacting negatively and statistically significantly CAR by 12.6%, CTI by 26.3%, and AQ by 4.2%.

Disclosures related to social aspects of banks in Cluster 2 were found to have a negative relationship with ROE at 6.6% and a positive at 28.5% for CAR, both being statistically significant at a level below 10% and 1% respectively.

The environment disclosure score impacted ROA, CTI, and AQ positively and statistically significantly by 0.31%, 35%, and 2.9% respectively while negatively impacting ROE and NIM by 14.3% and 1.9% respectively, all at a level below 1%.

As the banking group in this cluster used a mixture of practises regarding CEO duality, it was found that the 10% of banks within this cluster positively and statistically significantly impacted ROA by 0.09% and NIM by 0.5%, at a level of below 1% and 5% respectively while the dual control of leadership roles was found to have a negative relationship with ROE at 2.5%, CAR at 11.1%, and AQ at 1.3%, statistically significantly at a level below 5%, 5%, and 1% respectively. This indicated that banks with dual roles of CEO and chairperson had higher profitability and management efficiency in parallel with lower credit risk (higher quality of loan portfolios).

The financial performance measures of banks with two-tiered boards in Cluster 2 were affected positively and statistically significantly as measured by ROA at 0.12% at a level below 10% while having a lower credit risk by 1.5%, as measured by the AQ at a level of below 5%.

Chairperson independence and a unitary board were found to be important governance mechanisms for the financial performance measures in the banking group in Cluster 2. As banks with independent chairmen on their BODs, their performance was affected positively and statistically significantly, as measured by the NIM, CAR, and CTI by 0.5%, 5.6%, and 5.6% at a level of below 5%, 10%, and 1% respectively, while ROE and AQ were impacted negatively by 2.3% and 1.3% at a level below 10% and 1% respectively.

In regard to the control variable, banks with a high dependency on customer deposits had a statistically significant and positive effect on ROA, CTI and AQ. However, higher leveraged banks' ROE, NIM, and CAR were affected negatively and statistically significantly.

Table 3:34 *Summary of Results: Cluster 3 Corporate Governance Practises and Financial Performance Measures*

(Cluster 3 – US Regional & Diversified Banks – Shareholders-Oriented System Advocates Stewardship Theory)

Cluster 3	ROA	ROE	NIM	CAR	CTI	AQ
(Intercept)	0.0060	0.0480	0.0340	-1.6720	0.6990	0.0090
	*0.003****	*0.012***	*0.000****	*0.000****	*0.000****	*0.002****
BODS	0.000n	0.0010	-0.0000286	-0.0010	0.000085	0.000077
	*0.099**	*0.098**	*0.8370*	*0.8270*	*0.9710*	*0.6470*
BODMF	-0.000068	-0.000036	-0.0000004	-0.0010	0.0020	0.000078
	*0.05***	*0.9170*	*0.9940*	*0.4550*	*0.03***	*0.3260*
ACS	0.000n	-0.0020	0.000n	0.007000	0.0040	0.0010
	*0.013***	*0.1060*	*0.2080*	*0.2160*	*0.1810*	*0.004****
ACMF	-0.000090	-0.0010	0.000055	0.0020	0.0020	0.0000131
	*0.006****	*0.001****	*0.3380*	*0.2190*	*0.041***	*0.8530*
BODCI	0.000047	0.000n	0.000n	-0.0130	-0.0030	-0.0010
	0.6760	*0.6500*	*0.5800*	*0.013***	*0.3830*	*0.009****
BODGD%	0.0050	0.0840	-0.0080	0.0780	-0.1590	-0.0140
	*0.000****	*0.000****	*0.000****	*0.2830*	*0.000****	*0.000****
GDS	0.0040	0.0450	0.0090	-0.1420	-0.0720	0.0040
	*0.065**	*0.027***	*0.003****	*0.2960*	*0.1630*	*0.1410*
SDS	0.0080	0.0140	-0.0080	-0.6120	-0.1990	-0.0330
	*0.001****	*0.5460*	*0.049***	*0.000****	*0.002****	*0.000****
EDS	-0.0050	-0.0130	-0.0080	-0.0870	0.2890	0.0200
	*0.052**	*0.6520*	*0.028***	*0.4320*	*0.000****	*0.000****
LR	-0.0010	0.000n	-0.0020	-0.0310	0.0130	0.0010
	*0.000****	*0.9320*	*0.000****	*0.008****	*0.032***	*0.031***
CEOD=0	0.0000	0.0000	-0.0010	0.0420	-0.0100	0.0010
	0.1860	*0.8730*	*0.2600*	*0.000****	*0.1920*	*0.3900*
UBOARD=0	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]
	.	.	.	.	.	.
IND.CHAIR=0	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]
	.	.	.	.	.	.
Goodness of Fit						
Akaike's Information Criterion (AIC)	*-9,761.18*	*-4,225.72*	*-8,575.66*	*-5,009.02*	*-1,744.45*	*2,303.25*
Bayesian Information Criterion (BIC)	*-9,689.68*	*-4,154.21*	*-8,504.18*	*-5,008.66*	*-1,672.73*	*2,369.84*
Omnibus Test						
Likelihood Ratio Chi-Square	*117.645*	*74.096*	*117.744*	*104.439*	*79.12*	*116.481*
Df	*12*	*12*	*12*	*12*	*12*	*12*
Sig.	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****

- *Author's Own*
- *a: set to zero because this parameter is redundant.*
- *n: independent variable has no impact on financial performance measure.*

- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

Board size was found to be an important measure affecting banks' performance measured by ROE at 0.1% at a level below 10%, while a larger size was found to have a neutral relationship with ROA and was statistically significant at a level of below 10%. However, BOD activity in Cluster 3 measured by the number of meetings was found to affect negatively and statistically significantly banks' ROA at a level of 5% while increasing operating expenses in relation to their operating revenues (CTI) by 0.2% at a level of below 5%.

The audit committee size was found to have a neutral and statistically significant relationship with ROA at a level of below 5%. In addition, an increased number of audit committee members positively and statistically significantly affected the credit risk (as measured by the NPLs divided by the total amount of loan) of banks in Cluster 3 at 0.1%.

The activity of the audit committee was found to affect banks' financial performance measured by ROA and ROE negatively and statistically significantly by 0.009% and 0.1%, both at levels of below 1%. Larger audit committee size was also found to have a positive relationship with cost to income ratio by 0.2% and statistically significantly at a level of below 5%.

The number of independent directors had a negative and statistically significant impact on CAR by 1.3% and AQ by 0.1%, at a level of below 5% and 1% respectively.

Gender diversity had a strong and statistically significant positive relationship with ROA and ROE of 0.5% and 8.4% respectively at a level below 1% while having a negative impact on NIM, CTI, and AQ of 0.8%, 15.9%, and 1.4%, all at a level of below 1% respectively.

In regard to ESG disclosures, governance information was found to have a positive impact on ROA, ROE, and NIM of 0.4%, 4.5%, and 0.9% at a level of below 5%, 5%, and 1% respectively, while the information regarding the social aspect was found to positively and statistically significantly impact financial performance measured by ROA by 0.8%, although governance

information affected negatively and statistically significantly NIM, CAR, CTI, and AQ negatively by 0.8%, 61.2%, 19.9%, and 3.3% respectively. The environmental disclosure score impacted ROA and NIM negatively and statistically significantly by 0.5% and 0.8% at a level below 10% and 5% respectively.

The presence of CEO duality in this cluster only affected CAR statistically significantly positively by 4.2%. Chairperson independence and a unitary board were set as redundant parameters by the model, as the entire banking group in Cluster 3 operated under a Tier 1 board structure while having a 99.8% non-independent chairperson.

Banks with higher leverage in Cluster 3 witnessed a marginal negative significant relationship with ROA, NIM and CAR while having a positive impact on CTI and AQ.

Table 3:35 *Summary of Results: Cluster 4 Corporate Governance Practises and Financial Performance Measures*

(Cluster 4 – Japanese Banking Group – Market-Oriented System - Two-Tiered Board Advocates Stewardship & Stakeholder Theories)

Cluster 4	ROA	ROE	NIM	CAR	CTI	AQ
(Intercept)	0.0010	0.0740	0.0250	-1.9700	0.6180	0.0480
	0.7340	*0.001***	*0.000***	*0.000***	*0.000***	*0.000***
BODS	-0.0001	-0.0020	0.0000	-0.0200	-0.0010	0.0000
	0.1420	0.000***	0.000***	0.000***	0.6020	0.4420
BODMF	*-0.000068*	*0.0010*	*-0.000011*	*-0.0090*	*0.0030*	*0.0000*
	*0.01****	*0.1640*	*0.7800*	*0.014***	*0.002****	*0.5220*
ACS	0.0000	-0.0020	-0.0001	-0.0180	0.0030	0.0000
	*0.001****	*0.2430*	*0.4850*	*0.09**	*0.3280*	*0.6400*
ACMF	0.000002	0.0000	-0.000030	0.0000	0.0010	0.0000
	0.9250	*0.4490*	*0.2680*	*0.9460*	*0.4810*	*0.034***
BODCI	0.0000	0.0050	0.0000	0.0220	-0.0070	0.0000
	*0.000****	*0.000****	*0.007****	*0.1560*	*0.094**	*0.7450*
BODGD%	0.0020	-0.0360	-0.0040	0.1080	0.0230	0.0090
	0.5460	*0.2320*	*0.1380*	*0.6850*	*0.7400*	*0.4030*
GDS	0.0050	-0.0290	-0.0140	0.7920	0.1080	-0.0570
	0.2400	*0.4120*	*0.001****	*0.001****	*0.1930*	*0.000****
SDS	0.0010	-0.0470	-0.0050	-1.9350	-0.0710	0.1340
	0.8130	*0.2230*	*0.1630*	*0.000****	*0.4380*	*0.000****
EDS	0.0150	0.1010	-0.0010	1.1270	-0.1440	-0.0030
	*0.000****	*0.001****	*0.6650*	*0.000****	*0.014***	*0.7550*
LR	0.0000	0.0040	-0.0010	0.0020	0.0040	0.0020
	*0.039***	*0.084**	*0.001****	*0.8730*	*0.5010*	*0.012***
CEOD=0	0.0010	0.0030	0.0000	-0.0110	0.0400	-0.0020
	*0.061**	*0.3190*	*0.2490*	*0.7610*	*0.000****	*0.1660*
UBOARD=0	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]
	.	.	.	.	.	.
IND.CHAIR=0	-0.0020	-0.0330	0.0030	-0.0420	-0.0220	0.0070
	*0.049***	*0.054**	*0.3710*	*0.2800*	*0.5940*	*0.4440*
Goodness of Fit						
Akaike's Information Criterion (AIC)	*-5,497.37*	*-2,439.99*	*-5,305.30*	*-541.12*	*-1,296.13*	*1,187.80*
Bayesian Information Criterion (BIC)	*-5,430.80*	*-2,373.43*	*-5,238.78*	*-501.02*	*-1,229.42*	*1,250.06*
Omnibus Test						
Likelihood Ratio Chi-Square	*119.878*	*107.76*	*135.612*	*78.876*	*116.721*	*126.314*
Df	*13*	*13*	*13*	*13*	*13*	*13*
Sig.	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****	*0.000****

- *Author's Own*
- *a: set to zero because this parameter is redundant.*
- *n: independent variable has no impact on financial performance measure.*

- *ROA: Return On Assets; ROE: Return On Equity; NIM: Net Interest Margin; CAR: Capital Adequacy Ratio; AQ: Asset Quality; CTI: Cost to Income Ratio; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

The number of directors serving on Cluster 4 banks' boards had a negative and statistically significant relationship with ROE and CAR of 0.2% and 2.0% respectively, both at a level below 1%. The BOD size also had a neutral relationship with banks' NIM. However, the frequency of their meetings had a negative impact on the ROA of 0.01% and CAR by 0.9% and was statistically significant at a level below 1% and 5% respectively, while higher meeting frequency was found to impact positively and statistically significantly banks' operating expenses relative to their operating income by 0.3%.

The larger the audit committee size, the lower was the CAR at 1.8% at a level of below 10%, while it had neutral impact on the ROA and was statistically significant at a level below 1%. Their meeting frequency was found to be an unimportant mechanism with no statistically significant impact on performance measures, although the ACS had a neutral relationship with AQ statistically significantly at a level of below 5%.

A board composed of a large number of independent directors in Cluster 4 positively impacted ROE by 0.5% while lowering the cost-to-income ratio by 0.7%, at a level of below 1% and 10% respectively.

The number of female directors was found to be an unimportant governance mechanism for banks' financial performance in Cluster 4 as none of the models recorded statistically significant values.

The governance disclosure score was found to affect the NIM marginally positively and statistically significantly and AQ by 1.4% and 5.7% respectively, both at a level of below 1%, while strongly positively affecting the CAR at 79.2% at a level of below 1%.

The information flow to the market regarding banks' social aspect was found to strongly negatively impact CAR, by a multiple of 1.94 and AQ by 13.4%, both at a level of below 1%.

The environmental disclosures were found to affect banks' financial performance positively and statistically significantly as measured by the ROA, ROE, and CAR at 1.5%, 10.1%, and 112.7% respectively, all at a level of below 1%, while more information flow regarding banks' environmental aspect is found to have a negative and statistically significant effect on CTI by 14.4% at a level below 5%.

Banks practicing dual control of their CEO/chairperson leadership roles within Cluster 4 were found to have a positive and statistically significant impact on their financial performance measured by the ROA and CTI by 0.1% and 4%, at a level of below 10% and 1% respectively.

Board chairpersons who were independent directors were found to negatively affect the ROA and ROE by 0.2% and 3.3% at a level of below 5% and 10% respectively.

The model resulted in redundant parameters for this mechanism as all banks within this cluster were operating within the two-tiered board structure.

3.5.9. Comparative Analysis: Similarities and Differences on the Assessment of the Influence of Corporate Governance Practises of G7 Banking Groups on Financial Performance

This section provides a comparative analysis between the banking groups segmented throughout the Two-Step clustering analysis while investigating their impact on financial performance metrics. Moreover, the discussion in this section will be connected to corporate governance theory and is supported by the previous literature and empirical evidence. The below descriptions in respect of each cluster were concluded as a result of the clustering analysis:

- Cluster 1: US regional shareholder-oriented banks following agency theory.
- Cluster 2: Multinational market-oriented banks following stakeholder theory with a mixture of stewardship and agency theories.
- Cluster 3: US shareholder-oriented banks following stewardship theory.
- Cluster 4: Japanese two-tiered market-oriented banks following stakeholder and stewardship theories.

The board size in the US shareholder-oriented banks that follow stewardship theory (Cluster 3) was found to affect minimally positively and statistically significantly profitability measured by the ROE, while larger boards in both Cluster 1

and Cluster 4 were found to have a weak negative and statistically significant relationship with banks' capital adequacy ratio. In regard to Cluster 2, it was found that additional members serving on banks' boards decrease management, efficiency and asset quality as the governance mechanism of the board size affected cost to income negatively while positively increasing the NPLs relative to the overall loan portfolio.

Based on the above comparative discussion in relation to the board-size governance mechanism's influence on banks' financial performance in G7 banking groups, it can be concluded that larger boards in Cluster 3 corroborate the resource dependence theory, supporting the view that boards are believed to not only facilitate effective management oversight but also act as a vital link for the business to important resources that enhance profitability, as they might strengthen the company's reputation and valuable commercial contacts and serve an important function by connecting a company to external stakeholders such as creditors, consumers, and rivals (Adams & Mehran, 2012; Aebi et al., 2012; De Andres & Vallelado, 2008; Haniffa & Cooke, 2005; Pfeffer, 1973; Schmidt, 2012). The positive result of this cluster is also in accordance with the findings of Aslam and Haron (2021). The literature outlines that a larger board will have greater knowledge and expertise, thus leading to optimised decision-making and bolder risk-taking to generate profits.

In regard to Clusters 1 and 4, additional members serving on banks' boards prompted a wealth shift from debtholders to equity holders between 2011–2019. Hunjra et al. (2020) showed that the size of the BOD has a significant negative effect on risk-taking behaviour. However, in Cluster 2, board size governance practises were found to be biased towards encouraging banks to provide efficient decision and stability in lending operations while helping to fund economic growth. It is clear from the results of the BOD size across all financial metrics that Cluster 1 could be seen to support the shareholder-oriented governance system following the agency theory. However, BOD size was also found to have a negative and statistically significant impact on capital adequacy ratio. This means that larger boards in this cluster were found to be biased towards shareholders' interest at the expense of debtholders. In addition, the results of the BOD size in Cluster 1 undermined the resource dependency theory as the mechanism did not affect positively and statistically significantly any of the performance measures. However, in regard to board meeting frequency, Cluster 1 reduced ROE by 0.1%, but raised equity capital in ratio to risk-weighted assets and increased bank spending in relation to operating income. The results of Cluster 1 pertaining frequent meetings indicated balanced practises between the interests of shareholders' and debtholders since an increase in

CAR and spending was witnessed. This also held true for Cluster 3 as BOD activity decreased the ROA and increased the cost-to-income ratio. This, however, contradicts the resource dependence theory, which proposes that BODs are believed to not only facilitate effective management oversight but also act as a vital connection, linking the business to important resources that enhances profitability (Pfeffer, 1973).

In Cluster 4, banks with (1) larger boards that (2) meet more regularly had a statistically significant negative impact on CAR of 2.0% and 0.9% respectively; hence, the practises of Cluster 4 proved biased action towards shareholders' interests, although a minimal negative impact from larger boards was seen on the ROE measure at 0.2% coefficient while their meetings were also found to affect the ROA statistically significantly and positively affect the CTI, which might be biased towards the sustainability of the overall business (management perspective). However, according to the ownership structure of the Japanese banking industry, and as stated previously in the literature, their Japanese funding is different from that of any other country as banks in Japan are owned by institutional investors and are mainly dependent on the main bank funding and their customers' deposits, including financial institutions relative to equity capital.

Cluster 2 was found to mostly have an impact on expenditure and spending in relation to banks' operating income by lowering the measure by 0.8%. This indicates that banks in Cluster 2 have less cash outflow to society, whether to employees, vendors, or other related stakeholders. However, the banking group in this cluster tends to balance out this effect by increasing its lending operations to society. This is evident in the positive impact on their asset quality measure, which increases the credit risk by 0.1%. This indicates that the cluster supports the stakeholder theory and society at large due to its lending behaviour. The results of Cluster 2 are supported by previous literature that states a business is a nexus of both implicit and explicit contracts among a diverse variety of stakeholders, including workers, consumers, suppliers, investors, banks, environmentalists, governments, and other groups that might support or harm the firm (Freeman, 1984). According to this view, the goals of a business are met by balancing the interests of all groups or people. According to Freeman et al. (2004), managers must cultivate connections, motivate stakeholders, and create communities in which everyone aspires to give their all-in order to provide the value that the business offers. As a result, it is seen to be better to empower managers to express and develop their firm's common mission.

On the other hand, board activity in Cluster 2 was found to be an unimportant mechanism in relation to banks' financial performance as none of the performance metrics resulted in a statistically significant impact. Cluster 3 was the only cluster that affected financial performance measured by the ROE positively and statistically significantly at 0.1%. This supports the results generated from the cluster analysis, which highlighted that banks' governance practises within this cluster endorse the stewardship theory while contradicting the agency theory, as opposed to Cluster 1, since both clusters were composed of US banks. This indicates that Cluster 3 was more biased towards the shareholders' interests at the expense of debtholders. The results support previous scholars who state executives are naturally trustworthy (Kiel & Nicholson, 2003). In addition, the stewardship theory claims that since top managers often spend their whole careers with the firm they control, they have a greater understanding of the company than outside directors and hence can make superior judgments. Second, senior managers have superior formal and informal information and understanding about the company they oversee, which enables them to make more informed decisions (Donaldson & Davis, 1991).

The larger number of audit committee members in Cluster 1 was found to have statistical importance in increasing the capital adequacy ratio, which indicates that audit committee members, who are mostly composed of independent directors in the US shareholder-oriented banks in Cluster 1, advocate the stakeholder and resource dependence theories. The findings concerning larger audit committees are supported by previous literature.

Audit committee size was found to affect the profitability measures of banks positively and statistically significantly, as was evident from the results of Cluster 2, while increasing management efficiency and lowering credit risk, as was evident from the negative impact on CTI and AQ respectively. This indicates that the practises of audit committee members in the market-oriented banks that follow a mixture of theories could be considered effective and in line with the agency, stakeholder, and resource dependence theories, which assert that the audit committee is considered imperative to the overall role of the board and is significantly responsible for monitoring and evaluation on behalf of the board.

In recent decades, audit committees have been globally identified as a common mechanism for corporate governance. The results showed for audit committee size in Cluster 2 also support the view that independence and board efficiency are the two key monitoring advantages gained from audit committees; independence occurs due to the presence of internal and

external auditors reporting to the audit committee. This method of reporting ensures that internal and external auditors remain uninfluenced by management and hence become more credible in properly practising their duties.

Moreover, this study found that audit committee size had a statistically significantly neutral impact on the ROA of banks within both Clusters 3 and 4. With regard to the activity of the audit committee as measured by its annual meeting frequency, this was found to be statistically important in affecting banks' performance in Clusters 1, 2 and 3, while the number of audit committee meetings was found to be an unimportant mechanism relative to the Japanese market-oriented banks in Cluster 4. This might be due to the fact that Cluster 4 was considered a two-tiered banking structure and supported the stewardship theory, which in turn suggests insiders are more effective than outsiders. The results of the audit committee meetings in Cluster 4 are supported by the previous literature. According to Hayes et al. (2004), the number of non-executives on an audit committee has no impact on performance, while Beasley (1996) found that the structure of an audit committee is not correlated to the number of fraud events in a company and Carcello & Neal (2000) found no correlation between improvements in financial performance and the existence of an audit committee.

The negative impact of higher audit committee meeting frequency, as evidenced by the results of Cluster 3, advocates the stewardship theory, as banks within this cluster practise a duality of CEO-chairperson roles and are supported by previous studies such as that of Krishnan and Visvanathan (2009), who revealed that businesses with a greater number of audit committee meetings pay a higher audit fee, implying that these firms seek a higher level of assurance and quality auditing from their auditors. The board composition of independents in the US shareholder-oriented banks following the agency theory was found to be an unimportant governance mechanism as none of the performance models was affected statistically significantly, although the asset quality was impacted minimally negatively at a level of significance of around 10%. This suggests that, although banks in Cluster 1 supported the agency theory, the results showed that their independent directors, who are considered a main pillar of the agency theory are unimportant to banking performance. This further suggests either one or both members lacking experience and knowledge regarding banking business have bias towards shareholders. More interestingly, the corporate governance mechanisms of the US shareholder-oriented banks following the stewardship theory (Cluster 3) were found to be important relative to the latter's performance and specifically their risk measures, as more independent directors were found to lower risks associated with their credit portfolio, which is beneficial to both debtholders

and shareholders while lowering CAR, and which in turn suggests the utilisation of excess capital into projects that might generate revenues to shareholders at the expense of debtholders.

The number of independent directors serving on boards in both the multinational and the Japanese market-oriented clusters (Clusters 2 and 4) that follow a mixture of the stakeholder and stewardship theories was found to be an important governance mechanism impacting both profitability and risk measures. This suggests that the governance practises followed by Clusters 2 and 4 and the role of their independent directors are in line with the objectives of their responsibilities, as stated by regulators and best practise. The findings of both clusters were consistent with the agency and stakeholder theories, although they support the stewardship theory via the practise of dual leadership roles. The results suggested that the independent directors in Clusters 2 and 4 were balanced and in line with stakeholder interests, as the ROE suggests a positive impact for both the majority and minority. The lower NIM in Cluster 2 indicated a positive influence on borrowers and wider society, while the lower CTI ratio in Cluster 2 indicated higher management efficiency and lower credit risk, which would be positively reflected on both debtholders and shareholders. These results are supported by scholars such as Erickson et al. (2005), who suggested that the presence of independent directors leads to reduced agency problems. On the basis of Erickson's argument, it can be similarly deduced that independent audit committee members will yield the same result; in other words, a positive relationship between audit committee independence and firm performance will be evidenced. In corroboration, Assenga et al. (2018) demonstrated that a large proportion of independent directors in BOD protect owners' resources from conflicts of interest with management. Al-Najjar and Ding (2014) also state that independent directors will be more able to excel at their role in monitoring the firm, thus positively impacting the company's performance. Additional studies have found a positive relationship between board independence and performance, suggesting that independent directors will bring forth their external experiences and utilise their knowledge in ways that will boost a firm's performance (Duru et al., 2016; Liang et al., 2013; Liu et al., 2015; Zhu et al., 2016).

Board gender diversity in Cluster 1 was found to have an important influence on banks' risk measures, as more women serving on boards increases the capital adequacy ratio while decreasing risks related to the credit portfolio. This suggests that women in Cluster 1 were biased towards debtholders due to their nature, as stated by previous literature and empirical works

that argue that women are risk-averse by nature, thereby shaking market confidence as with greater risk mitigation growth will be limited.

Women also typically provide a collaborative environment and usually enhance consensus within a group, and their presence may lead to more disciplined behaviour in the boardroom, which may lead to improved decision-making (Pucheta-Martínez et al., 2016). Moreover, in their study, Andres et al. (2017) found that the higher the percentage of women on a board, the greater the bank's stability during the 2007–2008 financial crisis, as evidenced by the identified negative significant relationship between women on the board and non-performing loans, using a sample of 156 banks from Eastern and Central European countries during the crisis period between 2008 and 2012. Similarly, the findings are also consistent with a variety of psychological and sociological studies and approaches conducted on the effects of gender diversity which point to the beneficial role of women on a board of directors.

Regarding Clusters 2 and 3, female directors were found to positively affect financial performance measures. The practises of both shareholder- and market-oriented banking groups following the stewardship theory were found to be consistent with the stakeholder theory, which asserts that there are social benefits to placing women in positions of authority (Cabrera Fernández et al., 2016). Westphal and Milton (2000) point out that the representation on boards of minority groups such as women is valuable because they frequently offer a different and unique perspective that is useful in enhancing decision-making. Kramer et al. (2007) argued that when a company board includes three or more women, stakeholders' groups such as employees, customers, and the community will be represented, and thus governance improved. They added that women tend to confront difficult issues, which enhances a board's decision-making process. These results are also supported by previous empirical works and literature, such as the study by Campbell and Mínguez-Vera (2008), which argued that there is a positive impact when women are on boards of directors because the quality of management, and thus the financial performance, improves. Prihattiningtyas (2012) confirmed this conclusion by studying the positive impact of gender diversity on the profitability and financial position of the ROA, ROE and return on sales (ROS) indices. The positive correlation between financial performance and women's representation is also confirmed in studies by Carter et al. (2003), Simkins and Simpson (2003), and Smith et al. (2006), while Calabrò et al. (2011) suggested that transitioning of women from a minority to a majority on a BOD increases the degree of creativity in corporations.

The gender diversity mechanism in the Japanese two-tiered cluster (Cluster 4) was found to have no statistically significant impact on financial performance. These results are supported by a study conducted by Prihattiningtyas (2012) that showed that greater gender diversity in the workplace has both positive and negative impacts on a company's success and may or may not have a detrimental influence on overall performance. A study by Adams and Ferreira (2009) revealed that gender diversity has either a negative association or does not affect business performance. It is concluded that there is no general consensus on the effect of a BOD's gender diversity on financial performance.

The three ESG disclosures used in this research were found to have statistical importance in relation to banks' profitability measures among all clusters with mixed results. The financial performance measures of banks in Clusters 2 and 3 were affected positively by the high governance disclosure scores while lowering the risk measures of CAR, CTI, and AQ. This indicates that governance disclosure scores are considered vital and effective as governance information flow to the market was positively reflected in banks' profitability, optimised utilisation of funds, higher management efficiency, and lower risk associated with their credit portfolios. Governance disclosure scores in Cluster 1 impact negatively on the CAR, CTI, and AQ. Social disclosures are found to affect positively both shareholder-oriented banks in Cluster 1 and 3 while optimising the utilisation of funds, increasing management efficiency, and lowering credit risk. The results of both shareholder-oriented clusters contradicted the results of the market-oriented banks in Cluster 2.

Controversially, banks' profitability measured by ROE in Cluster 2 was affected negatively by the social disclosures while CAR was affected positively. However, the social disclosures in the Japanese banking Cluster 4 were found to impact risk measures via lowering the capital adequacy ratio in parallel with increasing the level of risk related to the credit portfolio. More interestingly, information flow regarding the environmental aspects of banks was found to be an unimportant mechanism related to the US shareholder-oriented banks following the agency theory in Cluster 1, as none of the models were affected statistically significantly, while the financial performance measures in Clusters 2 and 3 were affected negatively by the environmental reporting. (ESD affected the ROA of banks in Cluster 2 positively and negatively impacted on the ROE and NIM, as supported by the increase in spending and the higher credit risk which reduces the assets value.) The Japanese two-tiered market-oriented banks following the stewardship theory were the only banking group in the G7 countries that affected

profitability measures positively and statistically significantly in addition to increasing equity capital relative to the risk-weighted assets and management efficiency.

The findings of this essay relating the environmental, social and governance information flow to the market and their influence on financial performance via the utilisation of both risk and return metrics are supported by previous literature and empirical works. It is evident that greater disclosure offers more information about the firms' managerial and financial position, allowing proper assessment to be conducted by shareholders, potential investors, creditors, and depositors, thus affecting market discipline, and in turn impacts management behaviour and decision-making. The amount of information disclosed will enhance creditors and investors' ability to examine the banks' position and assess their future state in different ways, thereby influencing management's decisions and its operational behaviour (Bliss & Flannery, 2002; Flannery, 2001). Boolaky and Thomas (2010) showed that the number of non-executive directors on the board, the amount of cross-ownership, the capital adequacy ratio, and auditor quality all play a role in determining the level of corporate governance disclosure in Japanese banks. Non-executive directors are considered to have a greater influence on the overall performance of the bank than either its total assets or the number of external audit companies.

The implementation of the Basel I Accord in 1999 has brought to the forefront the topic of market discipline. Thus, the regulation of bank capital and disclosure arises as one approach for market discipline (Baumann & Nier, 2004; Hirtle, 2007). Hassan (2011) found that disclosure is negatively related to banks' performance. In a study of environmental reporting, Al-Tuwaijri et al. (2005) suggest that disclosure is positively associated with performance. Disclosure benefits lower risk and higher risk-adjusted returns (Baumann & Nier, 2004). Hirtle (2007) showed that efficient risk-taking and better risk return are positively associated with disclosures. Supporting the insignificant results of the US banks within Cluster 1, some studies have revealed mixed or neutral results regarding the relationship between disclosures and performance. Petitjean (2019), for example, compared the nature of the relationship between environmental and financial performance during the financial crisis. He concluded that changes in environmental policies in large US companies do not necessarily yield better performance.

The dual leadership role of CEO and chairperson was found to be an important mechanism relative to the financial performance of banks in Clusters 2, 3 and 4. The results suggested that banks within the multinational market-oriented group

that followed the stewardship theory via the practise of a duality of CEO-chairperson roles enjoyed a positive impact on their financial performance measures. The results showed that as ROA and NIM increase, CAR is optimised and credit risk is lowered, which is beneficial to the shareholders and debtholders respectively. The Japanese banking group duality practises impacted ROA positively while increasing spending relative to revenues which might be beneficial to their shareholders' employees and suppliers. However, in Cluster 3, dual roles were found to increase the capital adequacy ratio, which is considered beneficial to debtholders, although the practise of CEO duality itself is considered stewardship theory practise, indicating that the results of this study evident from the presence of duality in Cluster 3 contradicted the theory in that regard.

The unitary board type in Cluster 1, 3, and 4 was considered a redundant parameter in the regression model due to the inclusion of more than 95% of one response, as shown in the cluster analysis in Tables 3:33, 3:34, 3:35, and 3.36 respectively. Banks in Clusters 1 and 3 were consistent in having one-tier boards, while Cluster 4 consisted of two-tiered boards. However, due to the inclusion of mixed responses in Cluster 2 regarding the type of unitary board, it was found that a two-tiered board in accordance with the German-Japanese corporate governance model had a positive and statistically significant impact on performance measures, as the practise of having both supervisory and executive boards increase returns and relative assets while decreasing the level of risk associated with the credit portfolio. This endorses the theoretical framework of the outsider model and supports previous literature that asserts the German-Japanese model, which emphasises the maximisation of stakeholder benefits and interests and carries out investments on a long-term basis, as opposed to the short-term view in the US, UK, and Canada (Aguilera & Jackson, 2010). This system also consists of 'team production' as opposed to the principal-agent approach, implying that a corporation consists of multiple stakeholders who empower the board of directors with control over their resources (Aguilera & Jackson, 2010). In addition, the monitoring of top management by the main bank is a disciplinary mechanism that is a form of contingent governance, according to Miyajima et al. (2017), who explain that when undertaking monitoring and disciplinary roles, banks rely on the fact that shareholders are passive and have low interference in firm management, thus mitigating agency problems that occur with dispersed ownership. This encourages long-term and growth-oriented behaviour.

The positive results of the two-tiered boards evident from Cluster 2 support the views of previous scholars who suggest the cultivation of a strong relationship between equity holders and long-term debt allows access to finance at lower costs than

in the US and UK. This indicates that projects that may be rejected by American or British investors may be approved by German or Japanese financiers (Keasey et al., 1998). The Japanese model also favours employees, as reflected in its employment practises that include seniority-based pay and promotion as well as life-long employment (Becht et al., 2002).

Agency theory advocates the presence of independent directors on the board, as the supplemental skills, experience, expertise, and network they bring will prompt a board to become independent in its decisions (Baranchuk & Dybvig, 2009). The theory also states that the independence of non-executive directors qualifies them to carry out their monitoring function in a more professional manner, as independent directors are conscious of their reputations and will maintain a professional attitude in order to preserve them (Fama, 1980; Fama & Jensen, 1983). It is also argued that the assignment of independent directors gives the market a sign of the company's intention to apply good corporate governance practises, which will align the interests of the shareholders to those of stakeholders (Black et al., 2006).

The independence of the chairperson in the multinational market-oriented cluster was found to lower banks' returns relative to their ownership equity, lower risks associated with the credit facilities and increase NIM, CAR, and CTI. In Cluster 2, banks' practises of having an independent chairperson endorsee the agency and stakeholder theories. This result is confirmed by the positive impact on CAR which is beneficial to depositors, the positive impact on the cost to income ratio which is beneficial to employees and suppliers, and the negative impact on non-performing loans relative to net loans, which is beneficial for all stakeholders and specifically depositors. This suggests that the independent chairperson in Cluster 2 practises was in line with regulations and best practise. In addition, a high proportion of independent directors will improve performance and signal to the market that the control system is efficient (Fama & Jensen, 1983). Moreover, the findings about independent chairpersons are also supported by the empirical literature, such as Arellano and Bond (1991), who obtained similar results on the positive association between the outside chair and firm performance and concluded the former adds value to an organisation. In addition, an empirical study conducted by Balsam et al. (2016) shows a positive and significant correlation between outside chairs and firm performance.

The findings of Cluster 4 showed that an independent chairperson has a negative association with banks' performance as measured by both the ROE and ROA, corroborating the stewardship theory and the view that insiders are more effective than outsiders.

This essay has notably utilised alternative estimation techniques, including endogeneity corrections. However, the researcher entirely excluded the possibility that time-varying omitted variables may have been an influence on the results.

Based on the results and discussion of this essay, this section provides recommendations to banks, policy makers, investors, market practitioners and central banks in G7 countries, with the aim of boosting their financial performance (management perspective), thus reflecting positively on the investment climate and the overall G7 market.

1) The US shareholder-oriented banks following the agency theory (Cluster 1):
   - To reconsider the expertise of board members.
   - To reconsider the appointment of the independent directors and their expertise and financial background.
   - To maintain the gender diversity ratio of banks' boards.
   - To have more frequent audit committee meetings.
   - To increase the number of independent directors serving on the board.
   - To have higher transparency scores related to governance and social aspects.
   - To have better and more effective information flow related to the environmental aspect while examining the rationale for the insignificant impact attributed to environmental information disclosed to the market.
2) The multinational hybrid market-oriented banks following the stakeholder theory and a mixture of stewardship and agency theories (Cluster 2):
   - To maintain and optimise board size.
   - To assess the activity of the BOD as none of the performance measures are influenced by the meetings of the board.
   - To increase the number of audit committee members.
   - To increase the number of audit committee meetings.
   - To increase the representation of women on banks' boards.

- To have better information flow related to the environmental, social, and governance disclosures in parallel with investigating in depth the rationale for their market reactions towards their environmental disclosures influencing managerial aspects, as EDS is associated with higher risk and lower profitability within this cluster.
- To reconsider the duality of CEO-Chairperson roles due to its positive impact on returns while limiting the risk.
- To reconsider the practises of two-tiered board structures.
- To reconsider the appointment of an independent chairperson especially for banks that do not adopt effective and equity governance practises.

3) The US shareholder-oriented banks following the stewardship theory (Cluster 3):
   - To increase board size.
   - To decrease the frequency of board meetings.
   - To reconsider optimising their audit committee size.
   - To decrease and optimise the number of audit committee meetings.
   - To reconsider the roles and expertise of the independent directors as their influence is opposed to their objectives as stated by the theory and regulations.
   - To increase and maintain the number of women serving on banks' boards.
   - To increase transparency score related to banks' managerial governance and social aspects.
   - To take action related to market reactions towards banks' information flow related to the environmental disclosure in parallel with investigating in depth the rationale for the market reactions towards the EDS, as banks are considered one of the most important modern governance mechanisms t related to transparency.
   - To limit some banking practises related to the duality of roles of their CEO-chairperson.
4) The Japanese market-oriented banks following the stakeholder and stewardship theories (Cluster 4):
   - To decrease the number of BOD members.
   - To lower the frequency of board meetings.
   - To decrease the number of audit committee members.

- To reconsider the roles and expertise of their audit committee members as none of the performance measures impacted statistically significantly as a result of their activity.
- To consider increasing and optimising the number of independent directors serving on the board.
- To reconsider the roles and expertise of female directors serving on the boards while experimenting with the impact of increasing or decreasing the number of female directors to validate their influence on financial performance while determining an optimal gender balance.
- To enhance and enforce managerial actions regarding market reactions that occur due to the disclosure of information related to both governance and social aspects while ensuring the actions of management are in line with stakeholders' interests.
- To increase the environmental disclosure score.
- To continue practicing the dual leadership roles of CEO-chairperson.
- To reconsider having a non-independent chairperson of the board.

3.6. Conclusion

The intention of this research has been to offer a clearer understanding of key issues related to the banking industry in G7 countries by examining the impact of corporate governance on financial performance with respect to 397 diversified and regional banks operating in the G7 countries from 2011 to 2019, using the Generalised Linear Mixed Models (GLMM) as the appropriate panel regression modelling technique due to its predictive power that combines both alternative panel regression modelling of random and fixed effects in a single modelling run. Therefore, a robust model capable of analyzing complex covariance matrices is necessary to produce valid, reliable, and consistent results. This is supported by the empirical literature on the international banking industry and other non-financial firms.

The research analyses the impact of various corporate governance mechanisms on financial performance metrics, using data extracted from the Bloomberg online database, to investigate the governance practises and financial data of various banking corporations. Whereby all G7 banks' financial performance was statistically significantly affected by five of eight corporate governance mechanisms: board size, gender diversity, independent directors, board meeting frequency, and governance disclosure score. The remaining corporate governance mechanisms, audit committee size and meeting frequency, statistically affected ROA, while CEO duality affected NIM. To Summarize:

- Board size negatively and statistically significantly affected financial performance, making it an important corporate governance mechanism. This implies that larger boards slightly affect G7 banks' financial performance. This supports previous claims that boards and committees with more skills, business contacts, and experience (BOD members bring more experience) will better guide and monitor banks' activities and improve their performance. This diverse experience helps board members evaluate management, oversee operations, and neutralise a dominant CEO. The results contradict the resource dependence theory and support previous empirical works and literature that larger board sizes are ineffective due to communication and coordination issues that cause management conflicts.
- Board of directors’ meetings are crucial for financial performance governance in G7 countries’ banks. Results show that board meetings negatively impact ROA, ROE, and NIM. Since board members are paid for their work and meetings, G7 banks' more frequent board meetings slightly impacted financial performance. An excessive number of

meetings during the fiscal year causes coordination and communication issues, conflicts, and distractions for management, which may lower productivity.

- The size of audit committees in G7 countries is a significant governance mechanism affecting banks' ROA. Other studies have shown that smaller committees with more exposure and knowledge perform better. Larger audit committees in G7 countries performed badly on financial performance, contradicting agency, resource dependency, and stewardship theories. Our results contradict previous beliefs that larger audit committees provide more reliable monitoring because they have more members with different experiences, knowledge, and opinions, which improves bank performance.
- Audit committee meeting frequncy affect banks due to miscommunication, coordination, and conflict. Thus, inefficiency and delays may slow decision-making and performance. Best corporate governance practises must be tailored to each bank.
- Female board representation in the G7 countries is a corporate governance mechanism that affects bank performance. Women on boards positively and significantly affect banks' ROA and ROE, but negatively affect NIM. These findings support stakeholder theory.
- Our research supports the resource dependence theory because more outside directors provide valuable resources to the bank, contrary to the stewardship theory, which holds that outsiders are less effective than internal directors because they lack awareness and are not involved in daily operations. The positive significant impact on NIM may also contradict stakeholder theory that suggest independent directors' role is to ensure effective monitoring while maintaining a bank's risk level to protect minority shareholders and debtholders which might indicate that independent directors may also struggle due to their social ties to major shareholders and management.

The results show that outsider representation on boards and audit committees should be carefully reviewed because outsiders protect stakeholders' interests, including depositors and minority shareholders, which can lead to inefficient governance.

- High governance disclosure scores improve financial performance for G7 banks by positively and statistically significantly affecting ROA, ROE, and NIM. The results show that governance disclosure is crucial to G7 bank financial performance. This means that banks with more governance information are more attractive, trustworthy, and credible to stakeholders,

which boosts performance. The results are consistent with other empirical studies that show banks and non-financial firms that disclose more information allow investors and creditors to properly assess their condition, causing markets to react immediately and significantly and influencing management's behaviour and decisions, lowering funding costs and increasing the number of suitable investments with a positive net present value.

- This study suggests banks practise good corporate governance to attract investors and depositors. The governance disclosure score is the strongest mechanism, positively and significantly affecting financial performance measures. Banks should promote transparency because it gives shareholders and depositors confidence. Thus, proper disclosure requires banks to inform all stakeholder groups and the market of their current condition and plans and limits their ability to adjust their risk profile in a way that may disadvantage creditors or investors, improving shareholder performance.
- CEO duality positively and statistically significantly impacts banks' financial performance measured by the NIM. These findings support the stewardship theory, which states that managers spend their entire careers with the company they manage and understand it better than outside directors, allowing them to make better decisions. However, the result contradicts agency and stakeholder theory, which suggest a board's monitoring function becomes less effective and compromised, causing information flow issues. Our findings contradict regulators' recommendations and corporate governance codes of most countries to separate leadership roles. Therefore, G7 banks must reconsider CEO duality due to its positive impact on performance and sustainable future growth at both micro and macro levels. The data also suggest that banks and regulators should rethink CEO/chairperson roles to improve financial performance and meet stakeholder goals. If the CEO is transparent and ethical, a bank may perform better as CEO/chairperson

This essay also suggests that G7 banks and regulators carefully and slightly increase the number of board members and their activity, as well as their audit committees, to improve financial performance by optimising governance mechanisms and reconsidering dual leadership control. It is argued that ensuring diverse knowledge, skills, and experiences will boost banks' financial performance by improving efficiency and decision-making. Audit committees serve shareholders, and the right size and frequency of meetings can make boards more accountable. This essay shows that well-trained board audit committee members can boost a bank's performance.

The additional investigations conducted by the researcher, using advanced statistical analytics via the utilisation of machine learning and AI tools, suggest that G7 and G20 banks governance practises result in perfectly similar segmentation and are in accordance with the corporate governance theoretical framework, since the segmentation algorithmic analysis resulted in four banking groups for both nations as the four groups were differentiated in terms of their governance practises while banks within the same cluster adopted similar governance practises. The results suggest the existence of four banking groups with the following characteristics:

- One US-led banking group supported the agency theory with no CEO duality and an independent chairperson, while the other supported the stewardship theory with dual leadership roles and a non-independent chairperson.
- A market-oriented governance system was observed in two banking groups: one led by Japan and the other by a multinational segment of 34 countries, dominated by Chinese banks. The two banking groups differed mostly in ESG disclosures, board structure, audit committee size, and independent BOD composition. The multinational group had the highest ESG disclosure scores, while the Japanese group had fewer independent directors and audit committee members due to its two-tiered board structure. As shown by their CEO duality, both banking groups followed the stakeholder theory and allowed banks to follow the stewardship theory.

The cluster analysis of corporate governance practises revealed a mix of German-Japanese and Anglo-American behaviours. Few Japanese, Middle Eastern, Oceania, and Northern American banks followed this practise, but most Chinese and European banks did. These banks used a hybrid mechanism, contrary to traditional practises that choose a best model based on economic or social factors. A hybrid approach suggests using an innovative mix of practises and traits to suit each bank.

The results show that banks are adopting a hybrid governance model (Table 3:21 and 3:29 above), which may be a step towards market-oriented corporate governance like the US model.

Corporate governance mechanisms affected financial performance differently in each G7 banking cluster. The G7 banking group's comprehensive financial performance supports the researcher's view. The findings suggest that adapting to different situations, eras, and contexts requires a flexible corporate governance framework and dynamic governance practises that match the bank's culture.

In sum, and based on all the results that were generated for overall governance practises in G7 countries as well as the segmentation of governance mechanisms and their effect on financial performance, it is clear that corporate governance practises are deemed important and significant in relation to financial performance. That said, their degree of importance and impact varies based on time, space and culture. Hence, to guarantee efficacy, it is necessary to implement adaptable governance methods derived from a flexible framework, with the objective of fostering economic growth and development at both the individual and societal levels. Creating a favorable investment climate is crucial for achieving sustainability. This leads to a cyclical environment that directly and indirectly benefits institutions that follow these frameworks, even if these practises have a negative impact on short-term organisational performance.

To facilitate the adoption of dynamic and flexible governance frameworks by regulators and underlying institutions, all relevant stakeholders must adopt best-fit practises based on an organisational strategy and architecture that focus on growth and financial sustainability from a holistic ESG perspective while effectively monitoring corporate performance to achieve desired goals.

Chapter Four

4. Essay Two: The Impact of Corporate Governance Characteristics on Market Performance of Banks in G7 Countries

4.1. Introduction

Continuous changes and instability in the economic environment cause corporations to strive for excellence both in order to face corporate issues and to maintain an overall competitive edge in the market. Because of this, it is essential that corporate management teams work towards enhancing their corporate identity and image. After the financial crises in the 1990s in East Asia and South America, and a succession of corporate scandals in developed nations (such as those of Enron and WorldCom in the US), corporate governance concepts reaped considerable attention. Indeed, corporate governance is becoming crucial for both developing and developed countries as a tool to enhance the sustainable growth of businesses and economies. In their study, Iskander & Chamlou (2000) discussed the growing importance of corporate governance in the era of globalisation for nations to gain financial access on domestic and international levels. On the other hand, the implementation of corporate governance mechanisms has increased the private sector's positive impact on social and economic development. Overall, corporate governance seems to be an important component for controlling corporate risk and thus for banks' performance (FSA, 2009; Marcinkowska, 2012).

Due to their importance in the commercial and economic realms, corporate governance systems are relevant to industry as they attempt to mitigate business risks and fraudulent actions that might adversely impact a company's image. Studies have shown that having a strong corporate governance structure and effective practises may enhance a company's financial soundness and performance, resulting in increased value for shareholders (Adams & Mehran, 2012; Aebi et al., 2012; Brick & Chidambaran, 2010; De Andres & Vallelado, 2008; FSA, 2009; Iskander & Chamlou, 2000; Marcinkowska, 2012; Minton et al., 2014). This essay aims to explore the relevance of corporate governance in G7 nations and its impact on their markets. It also attempts to analyse how various banks' market performance is related to their corporate governance.

Additionally, ESG transparency metrics information is becoming of growing interest to researchers, institutions, market practitioners, policymakers, regulators, and the public interest at large, and more specifically in regard to the assessment of their

influence on corporate performance and sustainable growth. The banking industry was chosen as a focus since banks play an important role in providing external financing to other industries and individuals in order to help stimulate economies and generate new jobs, mainly because they are in charge of allocating funds and have substantial influence on the overall corporate governance structures across all industries (Avgouleas & Cullen, 2014).

As the stability and strength of the banking sector plays a crucial role in strengthening and enhancing the world economy, this essay is orientated towards G7 nations (comprising the US, UK, Canada, France, Italy, Germany, and Japan), which represent the world's primary advanced economies and have a very significant impact on the global economy. Banks in the G7 nations follow a well-defined corporate governance framework and related codes to limit and prevent transgressions against shareholders and stakeholders while conforming with legal and ethical parameters. The corporate governance of banks operating in the G7 nations is considered unique and vital due to its profound impact on the global operations of financial institutions (Weil & Manges, 2014). A G7 nation's banking sector collapse might cause financial instability around the globe. The G7 banking industry contributes significantly to both GDP and the international economy: the share of bank assets of UK GDP is 145%; 135% in France, 113.5% in Italy; 99.8% in Germany, and 58.8% in the US (Gugler & Peev, 2018). This essay investigates the effects of corporate governance on market performance whereby dividend yield, market multiples (P/BV, P/E), and price risk are all evaluated in connection to banks' market performance.

It is critical to examine the relationship between corporate governance and bank performance during the 2011–2019 period from shareholders' (market) point of view. Although there is a great deal of literature and empirical research on this topic, the association of such relationship has not been confirmed. While several studies focus on the subject of corporate governance and its function and influence on corporate performance and risk, they tend to concentrate more on the ownership and control of companies. As a result, there is a vacuum of information concerning those elements that influence both performance and risk.

The essay further intends to increase broad awareness of business models in the banking sector, particularly in terms of such institutions' market performance, by providing well-structured econometric models that consider the role of corporate governance in the process of market value generation. Fiordelisi and Molyneux (2010) have noted that a substantial body of research has examined performance and corporate governance procedures, primarily through the lens of empirical data. In

comparison, this essay will investigate novel strategies for improving banks' market performance via enhanced governance standards. It will also strengthen the case for governance by using knowledge-based resources and provide verifiable critical insight into how to improve banks' overall administrative skills and market performance via corporate governance. Econometric modelling is used to examine the relationship between corporate governance and bank market performance metrics.

In considering the preceding debate, the fundamental objective of this essay is to explore and comprehend corporate governance effect on the performance of banks in the G7 nations. Our primary objectives are to determine (i) the relationship between corporate governance and banks' market performance in the G7 countries in relation to the price-to-earnings ratio (P/E); (ii) the effect of corporate governance on the market performance of G7 banks in the context of the price-to-book-value ratio (P/BV); (iii) the relationship between corporate governance and banks' market performance in the G7 countries in relation to dividend yield; and (iv) G7 banks' market performance as a result of corporate governance in relation to price risk. This essay will also examine the link between corporate governance characteristics (the size, CEO duality, composition, meeting frequency, gender of a given BOD; the audit committee's organisational practises, namely the size and frequency of its meetings; the sufficiency of the disclosure flow of information as judged by a credible and specified disclosure quality score) and market performance measured by P/E, P/BV, dividend yield, and stock price risk.

Within the framework of the selected market performance metrics, the following research questions (RQ) will be addressed in order to assess the influence of corporate governance:

- RQ1: To what extent does corporate governance have an influence on the P/E ratio of banks in G7 countries?
- RQ2: What is the impact of corporate governance on the P/BV of banks in G7 countries?
- RQ3: To what extent does corporate governance have an impact on the dividend yield of banks in G7 countries?
- RQ4: Does corporate governance mechanisms have an impact on stock market price risk of banks in G7 countries?

Based on the details offered, it was necessary to analyse the data in relation to the general topic of this research. This analysis included important additional measures related to corporate governance. Additionally, there was an unintentional sampling bias issue in the G7 banking sample population. This bias was caused by the inclusion of regional banks in the United States, which resulted in biased estimates. An empirical analysis conducted by the researcher in Section 3.4.4.9 supports this

finding. To address these issues, a modern advanced analytics tool supported by machine learning, artificial intelligence, and pattern-matching was introduced. This tool is based on a combination of computer science, statistics, and an understanding of the research problem. In this way, this essay endeavours to draw hidden insights from the process of transforming the dataset into a body of useful and applicable knowledge.

Accordingly, the researcher has utilised unsupervised machine-learning techniques (clustering/segmentation analysis) followed by (supervised) regression modelling. Therefore, this study is unique because it incorporates advanced data analytics techniques into the field of corporate governance. Additionally, sampling bias is addressed through clustering analysis that is conducted in Chapter 1 Section 3.4 to this thesis, which segments homogeneous banking groups based on their corporate governance practises and uncovers hidden insights. Consequently, the researcher conducted additional investigations using machine learning and AI analytical tools to address the following research questions:

- RQ5: How can G7 banks be classified by their corporate governance practises and ESG reporting behaviour?
- RQ6: How can G20 banks be classified by their corporate governance practises and ESG reporting behaviour?
- RQ7: To what extent do corporate governance practises impact different banks groups' market performance in G7 countries?

In conclusion, this essay aims to add to the existing body of research and literature on the importance of corporate governance in financial institutions. Specifically, it offers evidence and insights in regard to the segmentation of homogenous banking groups with similar governance practises and explores their impact on market success. By making this material available, the importance of corporate governance to the banking industry can be better emphasised in a way that, it is hoped, will encourage the implementation of ideal corporate governance internal mechanisms. In addition, this essay will attempt to introduce measures that might lead to more stability in the banking system and, it is intended, assist investors, investment professionals, legislators, and capital markets in streamlining the operation within their organisations, thus limiting both inter- and intra-agency conflict. Additionally, it seeks to monitor the role of corporate governance and its characteristics in relation to the impact of corporate governance frameworks and practises on the banking sector of G7 countries.

4.2. Literature Review

4.2.1. Introduction

Corporate governance may be defined as the rules and regulations that help organisations to achieve their goals and objectives and that significantly affect the overall performance of firms. Generally, the rules and regulations formed under the corporate governance code help to preserve the overall transparency and efficiency of business activities whereby all stakeholders are given equal importance. The major advantage of corporate governance is the high-quality management it makes possible, which not only improves the overall performance of the company but also enhances the level of innovative activities in the business, thus contributing to its profitability and growth (Asensio-López et al., 2019). Corporate governance can also be understood as the process through which organisations attempt to reduce internal and external conflicts between stakeholders. It further assists in the distribution of responsibilities between the members of the company, such as managers, the BODs, and stakeholders, to ensure the efficient functioning of the entire organisation. While the responsibilities of board members may vary, the CEO manages the company's daily operations, while the chairperson is assigned the responsibility of managing the entire board of the company (Abbadi et al., 2016). The focus of this literature review is to critically evaluate the impact of corporate governance on the market performance parameters of the banks in G7 countries, namely the dividend yield, price risk, and market multipliers. This next section of the study is devoted to an evaluation of the existing literature in connection with the thesis topic.

4.2.2. The Relationship Between Corporate Governance Mechanisms and Market Multiples (P/E and P/BV)

In accordance with the views of Ibikunle et al. (2013), market multiples such as earnings significantly affect the overall corporate governance performance of banks and other organisations as the most important function of corporate governance is to ensure the transparent flow of information regarding earnings, which helps in improving the overall performance of firms and as a consequence engages a large number of investors and reduces internal conflicts in organisations. Swastika (2013) has also stated that board size, board independence, and the audit quality of a firm affect the revenue of banks and organisations.

In a similar context, and in accordance with the views of Škare & Hasić (2016), those organisations that have committed themselves to effective corporate governance codes have increased their overall growth, earnings, and enhanced their work performance. Effective corporate governance policies attract a large number of investors, which helps in increasing the competitive

advantage of the firm from different stakeholders' points of view. Moreover, an increased number of investors and the high growth of banks or companies contribute to shaping positive goodwill toward the organisation, which in turn increases overall prices of its assets and resources, thereby accelerating its profitability and growth. BODs have a crucial role to play in managing the prices and growth of firms insofar as they evaluate the most appropriate allocation of resources. In essence, corporate governance guarantees the efficient use of firms' resources, which helps in enhancing their overall revenue (Pham et al., 2020). Adawi and Rwegasira (2013) have stated that the P/E ratio plays a significant role in increasing the sustainability of firms and helps banks to improve their performance.

An organisation's transparency and frequent board meetings also help the organisation to improve this ratio, thereby contributing to improved market performance. On the other hand, Kuncoro and Agustina (2017) have asserted that banks that maintain a high price to book value ratio (P/BV) perform better as managers are motivated to provide the market with good information about their business whereby a convincing signal may impress the public, thus reflecting positively on market price, although their empirical findings have found no significant impact on the probability of financial distress.

H01: ***There is a positive and statistically significant relationship between corporate governance mechanisms and P/E ratios.***

H01.1: *There is a significantly positive relationship between larger board size and P/E ratio.*

H01.2: *There is a significantly positive relationship between higher board meeting frequency and P/E ratio.*

H01.3: *There is a significantly positive relationship between larger audit committee size and P/E ratio.*

H01.4: *There is a significantly positive relationship between higher audit committee meeting frequency and P/E ratio.*

H01.5: *There is a significantly positive relationship between larger number of independent directors and P/E ratio.*

H01.6: *There is a significantly positive relationship between higher board gender diversity of female directors and P/E ratio.*

H01.7: *There is a significantly positive relationship between higher governance disclosure score and P/E ratio.*

H01.8: *There is a significantly positive relationship between the absence of CEO duality practises and P/E ratio.*

H02: ***There is a positive and statistically significant relationship between corporate governance mechanisms and P/BV ratio.***

H02.1: *There is a significantly positive relationship between larger board size and P/BV ratio.*

H02.2: *There is a significantly positive relationship between higher board meeting frequency and P/BV ratio.*

H02.3: *There is a significantly positive relationship between larger audit committee size and P/BV ratio.*

H02.4: *There is a significantly positive relationship between higher audit committee meeting frequency and P/BV ratio.*

H02.5: *There is a significantly positive relationship between larger number of independent directors and P/BV ratio.*

H02.6: *There is a significantly positive relationship between higher board gender diversity of female directors and P/BV ratio.*

H02.7: *There is a significantly positive relationship between higher governance disclosure score and P/BV ratio.*

H02.8: *There is a significantly positive relationship between the absence of CEO duality practises and P/BV ratio.*

4.2.3. The Relationship Between Corporate Governance Mechanisms and Dividend Yield

The dividend yield is the benefit received by shareholders, paid annually. There are many factors on which the dividend yield of such organisations is dependent, such as the size of the board, leverage assets, and the size of the firm, all of which define the level of dividend yield (Prempeh & Odartei-Mills, 2015). According to Soni (2012), the dividend yield of a company affects its ownership structure and fluctuates with the prices of stocks, according to the company's specific dividend policies. It has also been observed that companies that have a large number of foreign promoters have a higher dividend yield. This positive association shows that banks with a wide range of ownership in the form of foreign investors increase their overall dividend yield and help to increase the overall market performance of firms (Soni, 2012).

In a similar context, Prempeh & Odartei-Mills (2015) have stated that there is a positive relationship between board size and the dividend yield of a firm. This positive association indicates that companies with large boards make extra efforts to increase their overall profitability for stakeholders. Similarly, larger boards also help to increase the wealth and status of stakeholders and a firm's overall performance (Prempeh & Odartei-Mills, 2015). In contrast, Ongore (2011) has argued that the ownership structure

of organisations can be seen as falling into two basic categories, namely ownership identity and ownership concentration, both of which affect company performance. Ownership identity relates to the names of the major stakeholders of a company, while concentration denotes the proportion of the total shares of the company owned by owners. The dividend yield of firms is negatively related to their ownership concentration, which highlights that if the concentration of the ownership is extended to stakeholders, the performance of the firm decreases. This is possibly due to the fact that stakeholders may not have sufficient knowledge about the business to the extent that the transfer of power to them may indeed result in decreasing the overall market performance of the firm (Ongore, 2011).

Choong et al. (2012) argued that foreign ownership benefits stakeholders and helps to raise the level of the dividend yield, which increases the overall market performance of companies. Those companies under foreign ownership exert more pressure on firms to increase the extent of the dividend yield so that the firm's resources are allocated efficiently, which further helps to provide powers and benefits to the minority shareholders associated with the company. On the other hand, and in accordance with the views of Soni (2012) the dividend yield of banks also depends upon the level of shareholdings with the non-promoters (minority shareholders). Banks with a large number of non-promoters have a negative effect on their dividend yield. Thus, it can be stated that the presence of a large number of non-promoters reduces the overall performance of banks and negatively affects their growth and profitability (Soni, 2012).

In addition, a study conducted by Al-Kahmisi and Hassan (2018) analyzed a sample of six publicly listed banks in Malaysia from 2011 to 2015. The study found that a larger board size has a moderate positive impact on dividend yield. This is because larger boards are able to effectively and efficiently manage resources, and they possess diverse knowledge and skills that help reduce agency problems. The presence of a CEO holding both the positions of CEO and chairman is proven to have a negative effect on the dividend yield. This contradicts the purpose of having independent directors on the board, which is to protect stakeholders and mitigate agency cost problems. Furthermore, their study reveals that CEO duality has a negative influence on dividend policy, specifically in terms of dividend yield. This is attributed to the absence of internal control over the performance of the system.

Using a sample of 482 non-financial and non-utility Indian listed firms, Pahi and Yadav (2019) suggest that firms having effective corporate governance tend to mitigate the agency problems and limit managers' opportunistic behaviour in dividend payout policy. They found that corporate governance mechanisms of board structure, audit committee and disclosures affect statistically significantly positively dividend payout while nomination committee and compensation committee have positive but insignificant relationship with dividend policy.

In accordance with the empirical work of Thompson and Adasi Manu (2021) using a sample of US firms from 2007 to 2018, suggest that boards have a more relevant role in dividend policy than managers. Their findings show that the presence of directors with financial expertise and the board size are the main influencers of dividend policy as measured by dividend yield. The results overall support the evidence on the monitoring role of boards on management.

Chen et al. (2017) and Ye et al. (2019) found a direct relationship between the gender diversity of a company's board and the dividends it distributes. They asserted that boards with a larger ratio of female directors demonstrate increased dividend payouts. In their 2008 study, Abdelsalam and El-Masry examined how ownership structure and board composition, which includes factors such as board size, dual role, and board independence, influence payout policy in a sample of 50 Egyptian companies. Their findings revealed that there is no significant association observed between boards and payout policies.

Using a sample of 1,438 firm-year observations for the period of 2005 to 2011, Farooque et al. (2021) found that dividend payout is significantly positively correlated with board size, board independence, institutional ownership and use of a Big-4 audit firm while negatively correlated with CEO duality and foreign ownership. These findings suggest that dividend policy and corporate governance mechanisms are complementary as firms paying higher dividends are more likely to engage in good governance practises as well as having strong monitoring and control systems in place and therefore both dividend policy and corporate governance are considered as effective tools in reducing agency costs.

In a study conducted by Abdul Nazar (2021), the Generalised Method of Moments (GMM) was used to analyze a sample of 198 non-financial enterprises listed on the Sri Lanka stock exchange from 2009 to 2016. The findings showed that management ownership had a statistically significant and beneficial effect on the dividend payment ratio. The size of the board has a notable and favorable impact on the dividend payout ratio. The dividend payout ratio was dramatically and adversely affected by board

independence. The presence of a CEO holding both the positions of CEO and chairman had a negligible adverse effect on the dividend payout ratio. According to Abdul Nazar's (2021) research, it is advisable for Sri Lankan listed companies to have a diverse ownership structure, a broad Board of Directors, and a separation of power and authority by having separate CEO and Chairperson roles. Additionally, Abdul Nazar recommends to have at least two independent directors.

Factors that influence a bank's financial performance include its profitability, size, and the amount of cash dividends it pays out. Similarly, the profitability, leverage, fluctuations in dividends, and collateral capacity exerted a strong positive influence on the dividend policies of banks in Ghana (Ekanayake & Paranthaman, 2016). Ekanayake and Paranthaman (2016) found that CEO duality has a favorable effect on a company's dividend policy, whereas ownership structure has an adverse effect on a company's dividend policy. The study revealed that the size of a company and its profitability are key factors in determining the company's dividend policy.

An inverse correlation between the size of a firm and its dividend payout ratio and dividend yield as found by a study by Bushra and Mishra (2016), they suggest that when the size of a company increases, it is more inclined to hold onto cash in order to settle its debts. Consequently, companies with greater managerial control prioritize accumulating internal money over distributing dividends, so utilizing these funds to support investments as managers exhibit a hesitancy to distribute dividends (Jensen, 1986). Similarly, Jensen et al. (1992) discovered an inverse correlation between leverage and dividends.

When a company takes on debt, it incurs fixed financial obligations such as interest payments and repayment of the principal amount. These obligations can ultimately result in the company going bankrupt. As a result, the company tends to distribute fewer dividends in order to preserve a favorable liquidity position and cash flow. The study conducted by Cavdar and Aydin, (2015) found a strong positive correlation between total foreign ownership and dividend policy, as well as a strong negative correlation between management ownership and dividend policy.

According to Kulathunga et al. (2017) there is a significant relationship between corporate governance variables and dividend policy. Board independence, CEO duality and return on assets have significant positive impact on dividend policy, and size of the board has a negative impact on dividend policy. Foreign investors with strong monitoring incentives lead firms to pay more dividends (Gong, 2015).

The independent and non-executive directors, board size, CEO, proportion of family members and ownership pattern in the organisations are interrelated (Shehu, 2015). Board size, board composition, CEO tenure and management equity have weak negative relationships with dividend payout (Ikunda, 2016). Further, the study found that board composition and managerial equity holding were found to have no statistically significant impact on the dividend payout. Board size, board independence, CEO duality, return on assets (ROA) and debt-to total assets variables align with the corporate governance and dividend policy (Ajanthan, 2013). The results of the study suggested that only CEO duality is negatively related to dividend payout whereas board size, board independence, ROA and debt-to-total assets do not appear to be significantly related to the dividend payout.

In the Nepalese context, (Pradhan, 2003) examined that a major motive for paying cash dividends is to convey information to shareholders about favorable prospects of the enterprise. Pradhan and Balampaki (2004) that the board size has a negative impact on dividend yield.

Based on the above discussion, the board is considered to be an important part of a firm's governance mechanism. It is regarded as the apex court of appeal for resolving various issues, including the agency problem. It acts as a monitor, and maintains discipline in the firm. It is believed that the decision of the board is supreme where Adelegan (2005) and Fama and Jensen (1983) showed that there is a positive and significant relationship between board size and dividend policy. Bokpin (2011) points out that there is a significant and positive relationship between board size and dividend paid. In contrast, Subramaniam et al. (2011) empirical analysis of effect of CG on dividend policy of over 300 listed companies in the Malaysian Stock Exchange supports a negative and significant relationship between board size and dividend policy. The analysis shows that board independence and dividend policy serve as substitutes in the principal-agency perspective.

H03: ***Corporate governance mechanisms affect positively and statistically significantly dividend policy as measured by dividend yield.***

H03.1: *There is a significantly positive relationship between larger board size and dividend yield.*

H03.2: *There is a significantly positive relationship between higher board meeting frequency and dividend yield.*

H03.3: *There is a significantly positive relationship between larger audit committee size and dividend yield.*

H03.4: *There is a significantly positive relationship between higher audit committee meeting frequency and dividend yield.*

H03.5: *There is a significantly positive relationship between larger number of independent directors and dividend yield.*

H03.6: *There is a significantly positive relationship between higher board gender diversity of female directors and dividend yield.*

H03.7: *There is a significantly positive relationship between higher governance disclosure score and dividend yield.*

H03.8: *There is a significantly positive relationship between the absence of CEO duality practises and dividend yield.*

4.2.4. The Relationship Between Corporate Governance Mechanisms and Price Risk

According to Hunjra et al. (2020), corporate governance practises benefit banks and organisations in managing their operations during times of market risk and recession, while banks with weak and inefficient corporate governance policies witness large fluctuations in their stock prices and face the risk of a price crash. It has been found that corporate governance practises help to reduce the risk of a stock price crash and increase the overall stability of firms. Since they face less conflict between board members, it has also been observed that organisations with small board sizes contribute to an enhancement of company performance by reducing price crash risk (Hunjra, Hanif, et al., 2020). The inadequate flow of information, as measured by the disclosure score and a low level of transparency in firms, also leads to price crashes which hamper company growth. Therefore, it becomes important for managers and directors to provide correct and updated information to stockholders in order to avoid such crashes in the economy. Corporate governance practises also highly influence transparency in business, which contributes to a low level of price crashes (Li & Cai, 2016).

In accordance with the views of Park and Song (2018), ownership of a firm or organisation also affects the risks associated with stock price crashes. These crashes occur when managers of a firm report negative information about a company that spreads widely in the public domain. Managerial ownership is negatively associated with overall price crash risk; higher managerial ownership reduces the flow of negative information about a company and helps to manage such a risk, which contributes to improving the market performance of the company (Park & Song, 2018). In a similar context, Hunjra et al. (2020) have stated that the quality of a firm’s internal control is maintained by effective corporate governance codes and practises. Low internal control

quality is the leading cause of price crashes, which highlights that inefficient corporate governance practises and monitoring can lead to serious price crashes and hinders the market performance of firms. Other factors, such as the size of firms, also contribute to reducing the risk of price crashes. Overall, the better the financial stability and performance of the firm, the lower the risk of a price crash (Hunjra, Hanif, et al., 2020).

According to Park and Song (2018), earning guidance (the voluntary flow of information about a company to its diverse groups of stakeholders) under corporate governance affects the level of price crash risk of the company. Thus, it can be inferred that good corporate governance practises reduce price crash risk and accelerate high growth of companies globally. However, in accordance with the views of Cao et al. (2019), BODs also influence the stock price risk of organisations. Those boards with good quality foreign experience contribute to improving the performance of their companies; they also implement and make use of advanced techniques to verify and monitor the performance and management of their organisations. Therefore, robust checks improve the working conditions of the firm and reduce the risk of a price crash.

Habib et al. (2018) found that the attributes of corporate governance perform a vital role in managing the quality of financial reporting as well as disclosures. Audit committee functions, board activities, and the efficiency and sophistication of all associated members impose vital restrictions on the propensity of managers to get involved in the management of firms' earnings. Their study identified that a large number of independent directors serving on the audit committee, auditors having industrial proficiency and expertise, as well as a properly determined policy of corporate governance, collectively contribute to the minimisation of the likelihood or probability of price crashes within an organisation. Apart from these factors, the external mechanism of corporate governance also has a crucial impact on price crash risk while managing market performance. While investigating French-based firms' cash flow rights and voting separation, the above study revealed a significant relationship between stock price crashes and excessive control by the BOD and audit committee. This aspect aligns with the notion that excessive control of shareholders induces negative news as a cover-up for neglecting the interests of minority shareholders. On the other hand, Habib et al. (2018) stated that, as effective earnings tend to minimise the risk of crashes, they also confirmed that the holding of institutions by transient or dedicated types of investors tends to minimise the risk of price crashes.

Jin and Myers (2006) document that internal management of the firm is involved in the collapse of stock prices and associated risk because of conflict of interest between stakeholders of the firm. An and Zhang (2013) examine and conclude that those investors of the sample firms who invest for the short aerm have significant negative interaction with stock prices' collapse risk. But there is a significant positive interaction between long-term investors and the stock price crash risk of the sample firms. Xu et al. (2014) conduct their research by using the state-owned firms listed in China's stock market to investigate the interaction of governance mechanism and stock price's collapse risk of sample firms. They find that there is negative interaction of centralized firms and risk associated with stock prices.

Liang and Zhang (2016) conduct their research on attributes of the corporate governance mechanism. They investigate the interaction between audit committee independence and stock price crash risk. They find and document that if auditors (internal and external) of the firm work with independence then stock price crash risk can be controlled to minimize. This is possible when the governance mechanism of the firm is effective and efficient.

Wang et al. (2015) examine the role of the largest shareholders of the firm in the collapse risk of stock prices. They examine and document that the largest shareholder has more influence on the stock prices collapse risk because of their shareholding ratio. The stock price crash risk has been decreased because of this supervision effect. Wang and Zhang (2015) examine the agency theory's prospects in their research by investigating the supervisory effect of the largest shareholders on the stock price crash risk. They find and conclude that internal control as an attribute of the governance mechanism of the firm decreases the positive interaction of the ratio of largest shareholders and stock price crash risk in case of agency issues. This argument is also documented by Chen et al. (2020).

Furthermore, many scholars find that companies with earnings management significantly increased the stock price crash risk (Francis et al., 2014; Khurana et al., 2018; Kim et al., 2014). Kim and Lu (2011) believe that an enterprise's high tax avoidance is an important reason for the increased risk of crash. In terms of corporate information disclosure, Kim et al. (2014) point out that companies with the sense of social responsibility can reduce stock price crash risk through higher information disclosure. Kim et al. (2016) find that accounting conservatism is negatively correlated with stock price crash risk. There is abundant research on the

characteristics of management, the degree of management conservatism (Kim et al., 2016), the personality characteristics of the CEO (Kim & Zhang, 2016) and the age of the CEO (Andreou et al., 2017) will all have an impact on the stock price crash risk.

According to the "Management Information Hiding Hypothesis" of Jin and Myers (2006), managers who have motivation for managerial incentives like pay and promotion may strategically withhold bad news or delay the release of bad news and accelerate the release of good news. Specifically, this behaviour either stems from a variety of managerial incentives, such as earnings- or equity-based compensation contracts, career and reputation concerns, and empire-building (Ball & Shivakumar, 2005), or to better serve their own interests and earnings management (Kothari et al., 2009). Empirically, Kothari et al. (2009) provide evidence showing that managers tend to delay the disclosure of bad news to outside investors. However, withholding or delaying the bad news is unsustainable for long periods and when the accumulated bad news reaches a certain tipping point or when the managerial incentive for hiding bad news collapses, the large amount of negative information will suddenly and immediately be released to the market, leading to an abrupt decline in stock price or a crash (Hutton et al., 2009).

Corporate governance applies several supervisory and managerial mechanisms to test the effectiveness and efficiency of financial information along with its source. An effective governance mechanism is necessary to control the conflict of interest and agency issues between internal management and external management of the firm, the largest shareholders and the smallest shareholders, managers, and investors, and their opportunistic behaviours. Thus, stock price collapse risk can be minimized.

Based on the above discussion, the following hypotheses have been developed:

H04: ***There is a statistically significant relationship between corporate governance mechanisms and stock price risk.***

H04.1: *There is a negative significant relationship between larger board size and stock price risk.*

H04.2: *There is a negative significant relationship between higher board meeting frequency and stock price risk.*

H04.3: *There is a negative significant relationship between larger audit committee size and stock price risk.*

H04.4: *There is a negative significant relationship between higher audit committee meeting frequency and stock price risk.*

H04.5: *There is a negative significant relationship between larger number of independent directors and stock price risk.*

H04.6: *There is a negative significant relationship between higher board gender diversity of female directors and stock price risk.*

H04.7: *There is a negative significant relationship between higher governance disclosure score and stock price risk.*

H04.8: *There is a negative significant relationship between separation of CEO/Chairperson roles and stock price risk.*

4.2.5. Summary

It can be summarised from the literature that corporate governance is an essential technique or strategy that helps firms to enhance their overall financial, social, and economic performance. Banks support and practise different types of corporate governance, all of which practises improve the overall work environment of the corporations and help manage good relations with the stakeholders. The three major parameters of market performance, namely the price crash factor, dividend yield, and market multipliers, are all highly influenced by corporate governance practises. In brief, a bank's ownership has a great impact on its dividend yield, while foreign ownership also benefits stakeholders and tends to increase the level of dividend yield of the company. A high dividend yield provides a large number of monetary benefits to stakeholders and effectively contributes to growth and performance. In addition, a large board size also helps to increase the level of the dividend yield, thereby contributing to increasing the financial stability of firms.

It can also be gleaned from the literature that P/E and P/BV ratios are very important measures for banks to manage in order to achieve sustainability. Effective corporate governance practises help banks to increase these ratios, which in turn enhances their overall stability. With this in mind, it can be concluded that price crash risks hamper the growth of banks. BODs with foreign experience improve the overall management of business operations and contribute to a reduction of this risk. A high level of transparency and the smooth flow of information also contribute to a lower level of price risk.

4.3. Data and Methodology

4.3.1. Research Philosophy and Approach

The increased availability of reliable online data has contributed to a surge in quantitative financial and non-financial data collection used in accounting and finance research, thus enabling the researcher to utilise scientific statistical techniques to reach logical and convincing conclusions (Frankfort-Nachmias & Nachmias, 1996). On this basis, this essay uses quantitative data collected from both primary and secondary sources from the audited yearly reports and online quantitative data extracted from the Bloomberg online database. The collected panel data is examined to ensure its use is suitable for linear regression analysis and to identify the appropriate model to be deployed in order to determine the relationship between corporate governance and the market performance of banks in G7 countries. The sample data is collected in conformity with the study population focus.

4.3.2. Data

The scope of this essay covers regional and diversified banks operating in G7 countries in accordance with the Global Industrial Classification Standards (GICS), which contains the complete data and information required between 2011–2019. The study utilized data for 397 banks from a total of 710 public shareholding banks, including both diversified and regional banks. In all, 3,573 bank-year observations were obtained for the dependent and independent variables. The sample of banks was chosen with the following data criterion in mind: any bank that provided nine years' worth of corporate governance and/or market performance data was included in the sample. As a result, 9 diversified banks and 304 regional banks (mainly in the US) were excluded due to the lack of availability of their market performance metrics and/or corporate governance characteristics covering at least 70% of the study period. Finally, the sample ends in 2019, the most recent year for which data was collected.

Table 4:1 *Cross-Section Data (Banks) Countries and Sub-Industry Allocations*

Country	Total Number of Banks			Number of Regional Banks			Number of Diversified Banks		
	Pre Treatment	*Included Sample*	*Excluded\sample*	*Pre Treatment*	*Included Sample*	*Excluded sample*	*Pre Treatment*	*Included Sample*	*Excluded sample*
Canada	9	8	-1	2	1	-1	7	7	0
US	571	285	-286	565	280	-285	6	5	-1
UK	11	8	-3	1	1	0	10	7	-3
France	15	3	-12	12	0	-12	3	3	0
Germany	4	3	-1	0	0	0	4	3	-1
Italy	14	10	-4	0	0	0	14	10	-4
Japan	86	80	-6	80	74	-6	6	6	0
Total	**710**	**397**	**-313**	**660**	**356**	**-304**	**50**	**41**	**-9**

- *Author's Own*

It is worth mentioning that both diversified and regional banks engage in significant business operations related to lending to small and medium-sized corporations and retail banking. Furthermore, both entities offer a diverse array of financial goods. However, the main distinction lies in the fact that diversified banks possess a transnational presence and reach, whilst regional banks operate within restricted geographic areas, as stated in the S&P global classification brochure (GICS, 2014).

Data collection was performed using the primary and secondary methods to meet the data requirements of the first-hand or new data along with the secondary data (Pajo, 2017). The data of banks operating in the G7 countries was retrieved in relation to the dependent (the dividend yield, P/E, P/BV, and price risk) and independent variables. To access the data for this essay, we exported the Bloomberg and Refinitiv database of banks to Microsoft Excel and then selected the sample of diversified and regional banks operating in G7 countries following the GICS, in accordance with the following GICS mapping specifications:

Table 4:2 *Global Industrial Classification Standards Sectoral Mapping Specifications*

Sector	Industry Group	Industry	Sub-Industry
Financials	Banks	Banks	Diversified banks
			Regional banks

- *Author's Own*

Additionally, in order to confirm the integrity of data extracted from Bloomberg, the data of 20 banks included in the sample was randomly chosen and cross-checked with the audited annual reports, which were found to reconcile with Bloomberg perfectly.

Table 4:3 *Banking Sample Total Assets' Share of GDP*

Country	Banking Sample Total Assets (Trillion USD)	GDP 2019 (Trillion USD)	Banking Sample Total Assets' Share of GDP
Canada	4.40	1.74	253%
France	5.94	2.73	218%
Germany	1.99	3.89	51%
Italy	2.52	2.01	125%
Japan	12.76	5.12	249%
UK	7.17	2.88	249%
US	13.74	21.37	64%
G7	**48.52**	**39.75**	**122%**
World	**87.54**		
G7 GDP Share of World GDP (Trillion USD)	**45.41%**		
Banking Sample Total Assets Share of World GDP (Trillion USD)	**55.42%**		

- *Author's Own*
- *Source of GDP: International Monetary Fund (IMF) Database (2019).*
- *Source of Banks' Assets: Bloomberg Online Database.*

Additionally, the researcher went further to rationalize the importance of G7 banking institutions by calculating the total assets in 2019 for G7 banking sample in relation to the G7 and World's GDP. Accordingly, it is noteworthy that the 379 banks in G7 countries included in this study sample registered total assets of USD 48.5 trillion in 2019, contributing 122% of G7 countries' GDP and 55.4% of the world's GDP on global level which indicates the extent of their economic impact This further amplifies the worldwide importance of an effective corporate governance structure, as the governance frameworks and practises in G7 countries may have a direct impact on economic activities on a global scale.

4.3.3. Unbalanced Sample Treatment Approach

It is noteworthy that the sample of regional banks is unbalanced on a country level as US regional banks constitute two-thirds of the G7 banking sample. Therefore, we conducted further statistical analysis using the sample of diversified and regional banks operating in G6 (excluding US banks) and an additional investigation of stand-alone US banking data. To validate the results of the G7 banks' sample, we cross-checked for any dissimilarities and inaccuracies in the relationship between corporate governance mechanisms and banks' market performance that may have occurred from an unbalanced sample.

4.3.4. Variables

This section describes the variables used in this study and defines the market performance parameters.

4.3.4.1. Price-to-Earnings (P/E)

The P/E ratio is calculated by dividing the share's closing market price by its earnings per share. It is considered a prime market valuation metric that measures the degree of confidence of investors in a business's future. The P/E assists investors in determining how much they should pay for a given stock based on its earnings (Lie & Lie, 2002) according to the following formula:

Equation (1):

P/Eit = closing market price per share it divided by earnings per share it

Whereby; i=bank and t= time.

4.3.4.2. Price-to-Book Value (P/BV)

The P/BV evaluates the closing market price of a firm relative to its shareholders' equity per share (book value) (Bagna & Ramusino, 2017), according to the following formula Equation (2):

P/BVit = closing market price per share it divided by shareholders' equity per share it

Whereby; i=bank and t= time.

4.3.4.3. Dividend Yield (Div.Y)

The dividend yield expresses the quantum of cash dividends paid by a firm to its shareholders on an annual basis over the previous 12 months relative to stock market closing price. This ratio is commonly used by investors to determine the expected annual rate of return on their investment based on its stock market price at a given point in time (Barbee et al., 2008), according to the following formula:

Equation (3):

Dividend yield it = (dividend amount distributed over 12 months per share it divided by closing market price per share it

Whereby; i=bank and t= time.

4.3.4.4. Price Risk

Two measures are typically used to determine the crash risk, by means of both of which the weekly returns are used to estimate firm-specific stock performance over a given fiscal year. First, the crash risk is measured by the negative conditional skewness of firm-specific weekly returns during the fiscal year. This is calculated by taking the negative of the third moment of firm-specific weekly returns and normalising it by the standard deviation of the returns raised to the third power (Kim et al., 2014). The second measure is the 'down-to-up' volatility measure of the crash possibility. For each firm over a fiscal-year period, firm-specific weekly returns are separated by (i) "down" weeks, where returns are below the annual mean; and (ii) "up" weeks, where returns are above the annual mean. The standard deviation of firm-specific weekly returns is calculated for each group separately, and the volatility measure is the natural logarithm of the ratio of the standard deviation in the "down" weeks to the standard deviation of the "up" weeks. In this essay, the standard deviation of the weekly returns is used, following the variance calculation of the returns (stock volatility) as a measure of the price risk throughout the fiscal year. The difference between our model and the related previous literature and empirical works is that our research uses the standard deviation of both "up" and "down" weeks jointly, as opposed to separating them, to measure the overall volatility. In this way, our research considers that the "up" and "down" weeks are related, as the high movement in "up" weeks will increase the probability of "down" weeks. This suggests that a high standard deviation is due to increased market volatility and indecisive traders, whereas a low standard deviation indicates low market volatility and maturing bull markets. Volatility indicates returns fluctuating above and below the annual mean.

Equation (4):

Weekly return (R) it = ((w1 /w0) – 1) * 100%

Variance σ^2 it = ∑▒ (Rit -Rμ)/(n-1)

Standard Deviation σ it = √(∑▒(Rit-Rμ)/(n-1))

Whereby:

- w0 indicates the base week.
- w1 indicates the following week.
- R represents the weekly return
- Rμ is the mean of weekly returns over the fiscal year
- n is the total number of observations
- i = bank
- t= time

In this research, the corporate governance factors examined include characteristics such as board size, board composition, board age, board meeting frequency, audit committee size, audit committee meeting frequency, CEO duality, and board gender diversity. Table 4:4 shows the meanings of these variables as defined by Bloomberg. The variables were constructed by using information acquired from the online Bloomberg environmental and social governance, and financial analysis stream database.

Table 4:4 *Description of Variables*

Variable Type	Variable	Ticker	Measurement / Definition	Literature Sources
Dependent	Price-to-Earnings	P/E	Closing market price per share divided by earnings per share as of year end	Adawi and Rwegasira (2013); Lie and Lie, (2002)
	Price-to-Book Value	P/BV	Closing market price per share divided by shareholders' equity per share as of year end	Bagna and Ramusino (2017); Kuncoro and Agustina (2017)
	Dividend Yield	Div.Y	Trailing 12 months dividend per share % (dividend amount/number of outstanding shares) divided by closing market price as of year end	Barbee et al. (2008); Prempeh and Odartei-Mills (2015); Soni (2012)
	Price Risk	PR	Annual standard deviation based on weekly stock closing market prices	Baker & Bloom (2013); Goetz et al. (2016); Song et al. (2021)
Independent	Governance Disclosure Score	GDS	Bloomberg score based on bank's governance disclosure as part of ESG data. Score ranges from 0.1 for banks disclosing a minimum amount of governance data to 100 for those disclosing every data point collected by Bloomberg	Akhtaruzzaman et al. (2021); Tunio et al. (2021); Xie, (2019)
	Board Size	BODS	Board of directors' total number of members	Adams and Mehran, (2012); Bhatia and Gulati (2021)
	Board Composition	BODC	Proportion of non-executive BOD members to total BOD members	De Andres and Vallelado (2008); El-Chaarani et al. (2022)
	Board Gender	BODGD	Proportion of women BOD members to total BOD members	Chen et al. (2019); Huang et al. (2021)
	CEO Duality	CEODY	Person holds both CEO and BOD chairperson position	Berger et al. (2016); Simpson and Gleason (1999)
	Board Meeting Frequency	BODMF	Total number of BOD meetings per year	(Adams, 2012)
	Size of Audit Committees	ACS	Total number of members of audit committee per year	Bosch (1995); Hermes et al. (2007)
	Audit Committee Meeting Frequency	ACMF	Total number of meetings of audit committee per year	Sun and Liu, 2014)

- *Author's Own*
- *P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; PR: Price Risk; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality;*

- *To clarify and distinguish between the governance disclosure score and the other corporate governance mechanisms used in this research. Please note that according to Bloomberg database the governance disclosure score is used to measure the transparency level for banks by measuring the amount of governance data and mechanisms a bank report publicly. Governance Disclosure score is a Bloomberg propriety disclosure score determined based on the extent of a company's Governance mechanisms disclosures. The score measures the extent to which a company publicly reports governance data and is set from 0 (for companies that have no disclosure of any governance data) to 100 (companies with a detailed disclosure for every governance data). While each of the other governance mechanisms was used as explanatory standalone variables whereby each is measured as per the description provided in Table 4:4.*

4.3.5. Data Analysis Methods and Hypotheses

Regarding undertaking data analysis, the relevant statistical-method multiple regression analysis has been deployed in this essay which adheres to a specific philosophical approach by conducting methodological processes in accordance with the deductive positivist approach to examine the impact of corporate governance characteristics on the market performance of G7 banks. The results of this empirical work reveal whether the research hypotheses can be rejected or accepted. In particular, a list of dependent variables that includes the dividend yield, P/BV, price risk and price/earnings ratio, and independent variables such as corporate governance characteristics, have been tested using multiple regression modelling to identify the particular impact of corporate governance on the market performance of banks operating in G7 countries. The multiple regression method is the basis for accurately determining the variables' mutual relationship to satisfy the assumptions and hypotheses considered in the essay (Cronk, 2019). In this essay, the panel data regression model is estimated in accordance with the following General Regression Model:

$$\Pi it = \alpha + \Sigma \beta j Xit + eit$$

Πit is the dependent variable that measures market performance and is estimated by the price/earnings, price/book value, dividend yield, and stock price risk for bank i at time t, with i =1…, j=1…, in which j signifies the number of cross-sectional observations and t signifies the length of the sample period. Scalar α measures the constant term and e is the residual. Because there are four dependent variables, four linear models are presented whereby each dependent variable represents a function of the

explanatory variables. On this basis, the analysis is conducted using multiple regression modelling via Gretl Statistical Software. The following equations summarise these research econometric formulas:

General Model (1) – P/E as dependent variable

$$P/E_{it} = \alpha + \beta 1GDSit + \beta 2BODSit + \beta 3BODCit + \beta 4BODGDit + \beta 5CEODYit + \beta 6ACMFit + \beta 7BODMFit + \beta 8ACSit + eit$$

General Model (2) – P/BV as dependent variable

$$P/BV_{it} = \alpha + \beta 1GDSit + \beta 2BODSit + \beta 3BODCit + \beta 4BODGDit + \beta 5CEODYit + \beta 6ACMFit + \beta 7BODMFit + \beta 8ACSit + eit$$

General Model (3) – Dividend yield as dependent variable

$$DIV.Y_{it} = \alpha + \beta 1GDSit + \beta 2BODSit + \beta 3BODCit + \beta 4BODGDit + \beta 5CEODYit + \beta 6ACMFit + \beta 7BODMFit + \beta 8ACSit + eit$$

General Model (4) – PR as dependent variable

$$PR_{it} = \alpha + \beta 1GDSit + \beta 2BODSit + \beta 3BODCit + \beta 4BODGDit + \beta 5CEODYit + \beta 6ACMFit + \beta 7BODMFit + \beta 8ACSit + eit$$

Multiple regression analysis, which is thought to be the best method for examining the relationship between a dependent variable and several independent variables, was used to examine the research hypotheses. Regression lines were algebraically described to express the relationship between various variables (Hair et al., 2009). Multiple regression is a tool for forecasting a single outcome from a number of factors (Field, 2009). Therefore, the multiple regression analysis technique tests the strength of the association between the dependent market performance variables (P/E, P/BV, dividend yield, and price risk) and the independent corporate governance variables, board size, board composition, board gender, CEO duality, board average age, board meeting frequency and audit committee size.

In order to establish the significance and confidence levels for the coefficients of the independent variables in predicting the dependent variable, p-value is employed in this research.

- A p-value less than or equal to 1.0% is indicated by three asterisks (***).
- A p-value greater than 1.0%, but less or equal to 5.0% is indicated by two asterisks (**).
- A p-value greater than 5.0%, but less than or equal to 10.0% is indicated by one asterisk (*).

Econometricians have stated that, in order to predict the suitability of linear regression models in relation to the dataset, models must be assessed in accordance with five pre-defined diagnostic tests, namely linearity, heteroskedasticity, multicollinearity, autocorrelation, and normality, to confirm alignment with validation requirements. Testing the assumptions of regression models plays a vital role in contributing to the validity of estimates. A failure to test these assumptions leads to over-/under-estimation of the research findings and generate insignificant outcomes (Greene, 1993; Gujarati, 2009). To determine the most reliable and adequate estimation model in analysing the dataset used in this essay, the diagnostic tests and specifications of the panel regression assumptions were conducted. The decision to determine the appropriate regression model between OLS and alternative fixed and random effects was based on the results of both the Breusch-Pagan multiplier test and the Hausman test. While the Breusch-Pagan null hypothesis states that the pooled OLS model is adequate (in favour of the random effects), it was rejected if the p-value was below 0.05; otherwise, the pooled OLS model was adequate. The Hausman test was utilised to determine the appropriate regression model between fixed effects and random effects, and the null hypothesis that the random-effects model is consistent was rejected if the p-value was equal or below the 0.05 level. Finally, the statistical analysis in this essay was conducted using Gretl software as it is considered a powerful visual and command-line interface statistical package for econometrics used to build variety of regression applications.

4.3.6. Ethics

The data for this essay was gathered from public sources in the form of quantitative data and information.

4.3.7. Limitations

The use of secondary data in this research restricted the data's uniqueness. The relationship between variables that affect performance is not publicly included in financial reports. This research, by studying the data, has found correlations that can be defended. As this essay is limited to a nine-year span and studies only eight corporate governance traits, however, it does not discount the importance of traits not tackled here, such as bank size and ownership structure. However, the statistical analysis of this study examines only the outlined relations; it does not seek to deny the possible importance of other variables.

4.3.8. Summary

This section concludes with an overview of the strategy employed in this research to conduct data analysis. Using the existing theoretical base, this essay has been able to identify and draw on the pre-existing theories on which its hypothesis was based while adhering to the positivist deductive paradigm. The method of analysis employed in this research is multiple regression. Accordingly, the data sample, selection criteria, and dependent and independent variables are described in this chapter. This essay relies primarily on the Bloomberg online database, coupled with banks' annual reports. A number of measurement approaches is used in order to evaluate the boards' corporate governance characteristics. In order to assess banks' market performance, the P/E, P/BV, dividend yield, and price risk are used due to their effectiveness in measuring management efficiency and the overall market performance of banks.

4.4. Findings and Discussion

4.4.1. Introduction

To answer the research questions stated in the first section of this essay, the researcher assessed the assumptions of panel linear regression analysis and the related models and statistically described the sample and variables used in the essay to discuss the impact of each of the corporate governance mechanisms on four market performance metrics of banks in G7 countries (P/E, P/BV, dividend yield, and stock price risk). The sample consists of 397 local banks listed in accordance with the GICS and selected from the UK, US, Germany, France, Italy, Canada, and Japan for the period 2011–2019.

4.4.2. Descriptive Statistics

A series of descriptive statistics was presented on the data sample in order to present an indication of the variables and their distribution. The statistics consist of the minimum, maximum, mean, median, and standard deviation, and the number of valid observations. The data sample in the current study, comprising 397 diversified and regional banks listed in the G7 countries, was collected for the nine years from 2011 to 2019. Four market performance measures are used in the study: P/E, P/BV, dividend yield, and price risk. Table 4:5 provided descriptive statistics for the dependent and independent variables, and indicates that local listed banks operating in the major advanced economies have a mean P/E, P/BV, dividend yield, and price risk of 15.82x, 1.14x, 2.26%, and 36.07% respectively, with a minimum value of 0 to a maximum of 1.358x, 25.16x, 18.0%, and 8.42x respectively.

Table 4:5 *Summary Statistics for Sample of G7 Banks (2011–2019)*

Variable Type	Field	Min	Max	Mean	Median	Standard Deviation	Valid Rows
Descriptive Variables	Ticker	--	--	--	--	--	3,573
	Country	--	--	--	--	--	3,573
	Year	2011	2019	2015	2015	--	3,573
Market Performance Indicators (Dependent Variables)	P/E	0.00	1358.00	15.82	13.00	36.998	3,573
	P/BV	0.00	25.15	1.14	1.10	0.9902	3,573
	DIV.Y	0.00	0.1800	0.0226	0.0219	0.0156	3,573
	P. R	0.00	8.4200	0.3607	0.0188	0.8999	3,573
Corporate Governance Characteristics (Independent Variables)	BODS	4.000	33.00	11.52	11.00	3.24	3,573
	ACS	0.000	14.00	3.78	4.00	2.10	3,573
	BODGD	0.000	0.56	0.12	0.10	0.11	3,573
	ACMF	0.000	51.00	9.25	8.00	4.93	3,573
	BODC	0.000	21.00	7.90	8.00	3.89	3,573
	BODMF	2.000	57.00	11.96	12.00	4.77	3,573
	GDS	0.01	0.88	0.47	0.48	0.15	3,573
	CEODY	0.000	1.00	0.37	1.00	0.48	3,573

- *Author's Own*
- *P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; PR: Price Risk; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

As can be seen from Table 4:5 above, the average bank has 11 members on its board, of whom eight are independent directors and 12% are women, who meet an average 12 times a year, while the audit committee consists of four members on average and meets nine times a year. CEO duality is set as a dummy variable in each of the models due to its categorical components of two values (no/yes). It can be seen that 63.1% (2,255 observations) of the bank-year observations assume a separation of roles between the CEO and chairperson, while 36.8% (1,318 observations) integrate the two roles.

4.4.3. Diagnostic Tests Results

After the pooled OLS regression analysis were run, five diagnostic tests were conducted to predict the validity of the dataset for OLS multiple regression analysis namely linearity, normality, multicollinearity, autocorrelation, and endogeneity. According to the test results, and as shown in Tables 4:7, 4:8 and 4:9, the panel assumption of the pooled OLS model was violated. Normality and autocorrelation were detected across all four models according to the Jarque-Bera and Wooldridge results

respectively. Heteroskedasticity via the White's test was also detected in three models (P/BV, dividend yield, and price risk). In regard to multicollinearity, the test results show an absence of collinearity issues.

Table 4:6 *Pearson Correlation Matrix*

	CEODY	GDS	BODMF	BODC	ACMF	BODGD	ACS	BODS
BODS	0.134	0.131	-0.041	0.575	0.013	0.241	0.283	1.000
ACS	0.196	0.212	-0.237	0.709	-0.299	0.355	1.000	
BODGD	0.151	0.383	-0.101	0.460	-0.121	1.000		
ACMF	-0.169	0.053	0.356	-0.318	1.000			
BODC	0.255	0.232	-0.234	1.000				
BODMF	0.022	-0.009	1.000					
GDS	0.043	1.000						
CEODY	1.000							

- *Author's Own*
- *BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

The correlation coefficients in Table 4:6 show that the results ranged from a minimum of -31.76% between the audit committee meeting frequency (ACMF) and the number of independent directors serving on the board (BODC), to a maximum of 70.89% between the audit committee size and percentage of independent directors serving on the BOD. It is also noted that the two independent variables (audit committee size, and the number of independent directors) are highly intercorrelated but below the critical value of 80%. This is because the audit committee members consist mainly of independent directors who typically represent more than one third of the committee and more than half of the BOD.

To strengthen the results of the Pearson correlation matrix for the multicollinearity problem, we used the Variance Inflation Factor (VIF). The results of the VIF across all independent variables included in the four models are shown in Table 4:7. The results are consistent with the correlation matrix, suggesting no collinearity issues.

Table 4:7 *Variance-Inflation-Factor (VIF)*

Independent Variables	VIF
BODS	1.663
ACS	2.140
BODGD	1.430
ACMF	1.341
BODC	3.445
BODMF	1.193
GDS	1.205
CEODY	1.099

- *Author's Own*
- *BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

The results of the remaining diagnostic tests used in this study and covered in the methodology chapter are shown in Table 4:8. These tests, the Wooldridge test for autocorrelation, the T-statistic for normality, and the White's test to check for heteroskedasticity, all reveal a violation of the OLS assumptions for normality, autocorrelation, and endogeneity across all models, with a p-value less than 0.05 rejecting the null hypothesis. Furthermore, the p-value below the 0.05 level in the White's test indicates the existence of heteroskedasticity across the four market performance models. There were three issues in the dataset that needed to be considered: normality, endogeneity, and serial correlation, given that the former issues cause the pooled OLS estimates to be biased and inconsistent. Accordingly, the pooled OLS model as an estimation method for the panel dataset was considered inadequate to conduct the analysis as it would generate biased results. Therefore, the Hausman test was used to select between the fixed and random effects for their ability to capture specific heterogeneities in cross-section (banks) and time (years).

Table 4:8 *Diagnostic Tests for Panel Linear Regression Assumptions*

	Result	(1) P/E	(2) P/BV	(3) Div.Y	(4) PR
Autocorrelation *Wooldridge*	t-statistic	15.43	44.08	56.76	44.45
	P-value	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
Normality *Test Statistic*	Chi-square	336.48	352.17	41.33	382.12
	P-value	*<.0001****	*0.000****	*0.000****	*0.000****
Heteroskedasticity White's	LM	197.99	261.32	288.73	1294.71
	P-value	*0.000****	*0.000****	*0.000****	*0.000****
Cross Sectional Dependence *Pearson*	Z	121.64	153.71	107.42	56.17
	P-value	*0.000****	*<0.0001****	*0.000****	*0.000****
Time Dummies Wald Joint Asymptotic	Chi-square	254.28	463.69	213.41	90.33
	P-value	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
OLS Or Fixed Effects *Joint Asymptotic*	F	3.45	14.22	14.11	39.799
	P-value	*<0.0001****	*0.0000****	*0.000****	*0.000****
OLS or Random Effects *Breusch-Pagan*	LM	596.84	4578.46	4347.53	7322.01
	P-value	*<0.0001****	*0.0000****	*0.0000****	*0.000****
Random or Fixed Effects *Hausman*	H	35.87	116.73	102.95	529.03
	P-value	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****

- *Author's Own*
- **: Significant at 10%, **: significant at 5%, ***: significant at 1%*
- *Wooldridge test for autocorrelation in panel data: Null hypothesis: No first-order autocorrelation.*
- *Test for normality of residual: Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity: Null hypothesis: heteroskedasticity not present.*
- *Cross-Sectional Dependence: Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies: Null hypothesis: No time effects.*
- *Joint Asymptotic test: A low p-value counts against the null hypothesis that the pooled OLS model is adequate in favour of the fixed effects alternative.*
- *Breusch-Pagan Test: A low p-value counts against the null hypothesis that the pooled OLS model is adequate in favour of the random effects alternative.*
- *Hausman Test: A low p-value counts against the null hypothesis that the random effects model is consistent in favour of the fixed effects model.*

- *P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; PR: Price Risk.*

Table 4:8 shows that the significance of the Hausman test is below 1.0% across all models. Accordingly, the results of this test suggest that the random effects model should be rejected, and the fixed effects model is the appropriate estimation method for assessing the impact of corporate governance on market performance of banks in G7 countries, as measured by the P/E, P/BV, dividend yield, and price risk. This further suggests there is no correlation between the unique errors and the independent variable.

Despite the aforementioned test assumptions, we further diagnosed the fixed effects model's reliability and validity utilised in this research and ran a fixed effects model with time dummies, concluding the existence of a statistically significant impact in relation to time, as can be seen from the results of the Wald Joint Asymptotic test shown in Table 4:8. Therefore, the fixed effect was deemed unreliable for our research purposes. Accordingly, the data were exported into the SPSS Modeler (data mining and text analytics software) where machine learning nodes were used to conduct the analysis via the utilisation of the GLMM, which is built on a series of complex covariance tables that combine the analysis techniques of both the fixed effects and random effects models, thereby producing conservative, reliable, and valid outputs regarding the research problem. IBM (2018) defines the GLMM as a complex multilevel model used for non-normal distributed longitudinal data and is considered an extension of the linear model whereby the GLMM assumes that the dependent variable is linearly correlated to the independent variables and covariates through a specific link distribution function while having non-normal distribution (IBM, 2018).

4.4.4. Results and Discussion

Table 4:8 shows the OLS, Fixed Effects, Random Effects, and The GLMM results for each of the corporate governance and banks' market performance as measured by P/E ratio P/BV, dividend yield, and price risk. According to the GLMM results as considered the most reliable results across all regression model types, show that three out of eight corporate governance characteristics namely; board meeting frequency, governance disclosure score, and the presence of CEO duality have statistically significant impacts on the P/E. Five of the eight governance characteristics, the board size, audit committee meeting frequency, board composition of independent directors, board meeting frequency, and governance disclosure score, statistically significantly affect the P/BV. Moreover, three governance characteristics, the audit committee size and meetings, and governance disclosure score, were found to have a statistically significant impact on banks' dividend yield. As for the price risk model, only three of

eight governance characteristics, namely the board size, audit committee meetings, and number of independent directors had a statistically significant relationship with banks' stock price risk.

Table 4:9 Summary of Results – Dependent Variable: P/E

P/E Models	OLS	Fixed Effects	Random Effects	GLMM
Constant	10.990	7.070	9.990	2.203
	*<0.0001***	*<0.0001***	*<0.0001***	*0.000***
BODS	-0.100	0.380	-0.020	0.001
	0.1365	*0.0073***	*0.7709*	*0.7850*
ACS	0.140	-0.300	0.000	0.003
	0.2562	*0.0321***	*0.9823*	*0.7880*
BODGD	-2.300	-0.860	-1.940	-0.088
	0.251	*0.762*	*0.329*	*0.572*
ACMF	-0.067	-0.050	-0.090	-0.0060
	0.1374	*0.5060*	*0.0582**	*0.1370*
BODCI	0.110	-0.230	0.075	0.0030
	0.171	*0.159*	*0.389*	*0.653*
BODMF	-0.160	-0.080	-0.140	-0.001
	*0.0005****	*0.218*	*0.0013****	*0.016***
GDS	11.700	14.540	13.230	0.979
	*<0.0001****	*<0.0001****	*<0.0001****	*0.000****
CEODY	-0.720	-0.510	-0.610	-0.051
	*0.0376***	*0.235*	*0.050***	*0.029***
F (8, 397)	*12.71502*			*7.803*
P-value(F)	*<0.0001****			*<0.0001****
R-squared	*0.0842*	*0.3611*		
Adjusted R-squared	*0.0821*	*0.0585*		
Schwarz criterion	*23531.5*	*25484.9*	*23544.7*	*4675.9*
Akaike criterion	*23475.8*	*22981.5*	*23489.0*	*4651.2*

- *Author's Own*
- **: Significant at 10% **: significant at 5% ***: significant at 1%*
- *P/E: Price to Earnings; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*
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Table 4:10 *Summary of Results – Dependent Variable: P/BV*

P/BV Models	OLS	Fixed Effects	Random Effects	GLMM
Constant	0.982	0.687	0.814	0.827
	*<0.0001***	*<0.0001***	*<0.0001***	*0.000****
BODS	-0.045	0.015	-0.015	-0.021
	*<0.0001***	*0.0298***	*0.0095****	*0.000****
ACS	0.017	-0.015	-0.001	0.008
	0.1720	*0.0297***	*0.8850*	*0.2310*
BOGD	0.163	0.184	0.187	0.156
	0.489	*0.216*	*0.182*	*0.176*
ACMF	-0.009	-0.012	-0.016	-0.0120
	*0.0288***	*0.0032****	*<0.0001****	*0.000****
BODCI	0.054	-0.012	0.021	0.0270
	*<0.0001****	*0.144*	*0.0021****	*0.000****
BODMF	-0.020	-0.007	-0.012	-0.007
	*<0.0001****	*0.0926**	*0.0005****	*0.003****
GDS	0.951	1.163	1.132	0.800
	*<0.0001****	*<0.0001****	*<0.0001****	*0.000****
CEODY	-0.022	-0.007	-0.002	-0.020
	0.585	*0.801*	*0.947*	*0.250*
F (8, 397)	*52.738*			*20.362*
P-value(F)	*<0.0001****			*<0.0001****
R-squared	*0.2943*	*0.7457*		
Adjusted R-squared	*0.2927*	*0.1255*		
Schwarz criterion	*4964.7*	*4557.1*	*5215.4*	*1615.0*
Akaike criterion	*4909.1*	*2053.7*	*5159.8*	*1590.3*

- *Author's Own*
- **: Significant at 10% **: significant at 5% ***: significant at 1%*
- *P/BV: Price to Book Value; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

Table 4:11 *Summary of Results – Dependent Variable: Dividend Yield*

DIV.Y Models	OLS	Fixed Effects	Random Effects	GLMM
Constant	0.011	0.029	0.024	-3.778
	*0.0007***	*<0.0001***	*<0.0001***	*0.000***
BODS	0.001	0.000	0.000	0.004
	*0.0063***	*0.8057*	*0.4027*	*0.6920*
ACS	0.000	0.001	0.000	0.026
	0.3195	*0.0461***	*0.0577**	*0.005****
BOGD	0.017	-0.007	-0.001	-0.145
	*0.0033****	*0.217*	*0.880*	*0.584*
ACMF	0.000	0.000	0.000	-0.0090
	*0.0126***	*0.0373***	*0.0061****	*0.046***
BODCI	-0.001	0.000	0.000	-0.0130
	*0.0056****	*0.667*	*0.296*	*0.203*
BODMF	0.000	0.000	0.000	0.001
	0.202	*0.977*	*0.501*	*0.892*
GDS	0.014	-0.007	-0.004	-0.450
	*<0.0001****	*0.0285***	*0.201*	*0.048***
CEODY	0.001	0.000	0.000	0.019
	0.183	*0.789*	*0.765*	*0.595*
F (8, 397)	*5.729813*			*1.981*
P-value(F)	*<0.0001****			*0.045***
R-squared	*0.0578*	*0.6576*		
Adjusted R-squared	*0.0557*	*0.0147*		
Schwarz criterion	*-20430.6*	*-20807.2*	*-20201.2*	*5569.2*
Akaike criterion	*-20486.3*	*-23310.6*	*-20256.8*	*5507.5*

- *Author's Own*
- **: Significant at 10% **: significant at 5% ***: significant at 1%*
- *Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

Table 4:12 *Summary of Results – Dependent Variable: Price Risk*

PR Models	OLS	Fixed Effects	Random Effects	GLMM
Constant	0.132	0.206	0.157	0.177
	0.176	*<0.0001***	*0.001***	*0.000****
BODS	0.072	0.003	0.026	0.015
	*<0.0001****	*0.6370*	*<0.0001****	*0.012***
ACS	-0.033	0.006	-0.005	-0.001
	*0.0044****	*0.3420*	*0.5000*	*0.8730*
BOGD	-0.230	-0.085	-0.132	-0.128
	*0.0707**	*0.446*	*0.199*	*0.228*
ACMF	0.015	-0.002	0.006	0.0030
	*<0.0001****	*0.2190*	*0.0006****	*0.03***
BODCI	-0.100	0.001	-0.030	-0.0150
	*<0.0001****	*0.870*	*<0.0001****	*0.003****
BODMF	0.005	0.001	0.003	0.002
	0.132	*0.675*	*0.0451***	*0.134*
GDS	0.183	0.029	0.035	0.022
	*0.0627**	*0.134*	*0.114*	*0.253*
CEODY	-0.044	0.006	-0.014	-0.010
	0.157	*0.724*	*0.424*	*0.529*
F (8, 397)	*34.40565*			*3.415*
P-value(F)	*<0.0001****			*0.001****
R-squared	*0.5562*	*0.9246*		
Adjusted R-squared	*0.5552*	*0.0042*		
Schwarz criterion	*3230.0*	*1992.9*	*4946.9*	*-938.9*
Akaike criterion	*3387.0*	*2,365.5*	*4,891.2*	*-1,000.6*

- *Author's Own*
- **: Significant at 10% **: significant at 5% ***: significant at 1%*
- *Price Risk; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; GDS: Governance Disclosure Score; CEOD: CEO Duality.*

The results show that the only two corporate governance mechanisms that significantly impact three of four market performance metrics of banks in G7 countries are the audit committee meeting frequency and governance disclosure score. This is followed by another three governance mechanisms that were found to affect two out of four market performance measures, namely, board size and meetings, and the number of independent directors serving on the BOD. While the audit committee size

and presence of CEO duality were found to have a significant effect on only one market performance measure of banks, while the number of women serving on banks' BOD was found to have an insignificant impact across all market performance measures.

4.4.4.1. The Impact of Board Size on Market Performance of Banks

The results show that banks' corporate governance board size mechanism in G7 countries has a statistically significant impact on the P/BV and price risk measures only at a level of below 1% and 5% respectively while statistically insignificantly impacting the P/E and dividend yield. In view of the P/E being a measure used by investors to evaluate banks' stock prices relative to their earnings per share, we found that the corporate governance mechanism of BOD size affects the P/E positively but insignificantly; an increase in one additional board member will positively and insignificantly impact the market performance of banks in G7 countries, measured by the P/E ratio, by 0.1%. In regard to the P/BV, which measures market capitalisation relative to shareholders' equity, the BOD size affects the ratio statistically negatively significantly by 2.1%. This indicates that an additional board member will negatively impact market performance measured by stock prices relative to shareholders' equity by 2.1%.

The quantum of cash dividends distributed to shareholders relative to the market value of the stock (dividend yield) was found to have a weak positive insignificant relationship with the governance mechanism of board size, indicating that one additional board member affects the dividend yield by 0.4%. One additional board member will hence cause a minimal increase in the market performance of banks measured by the dividend distributed relative to stock prices. The positive impact on the dividend yield may be due to the decrease in the stock prices of banks, as the results reveal in the P/BV model, due to the fact that the denominator in the dividend yield decreases relative to the nominator (cash dividends distribution percentage).

In regard to the price risk, the BOD size has a positive influence and is statistically significant, indicating that an additional board member minimally increases G7 countries banks' stock price, as measured by the standard deviation of the weekly returns generated from the movements in market price, by 1.5%. The results indicate that the board size slightly and statistically negatively significantly affects the market performance of banks in G7 countries. Accordingly, we failed to reject the null hypothesis as the board size mechanism affects the P/BV negatively significantly and price risk positively significantly. These findings contradict previous studies which assessed the impact of board size on banks' performance

specifically according to the level of market performance, finding that performance is impacted positively by larger boards. Swastika (2013) stated that the number of members serving on a board affects a bank's performance positively, whose role in supporting managerial decisions while protecting stakeholders' interests positively benefits banks and increases their overall performance.

Our findings support the views and results of Lipton and Lorsch (1992) in suggesting that a board should not include more than eight or nine directors. However, according to Jensen (1993), when there are more than seven or eight individuals serving on the board, coordination and procedural issues tend to reduce the effectiveness of supervision. In addition, board members may have a lower sense of individual responsibility in the resolution of administrative issues, thus increasing bureaucracy in the firm. Sheikh and Wang (2012) indicate that in a sample of 68 US banks from 2005 to 2007, there was a negative link between board size and bank profitability. As the board size increases, agency issues emerge, leading to a decrease in the effectiveness of the board due to a lack of communication, disorganisation and lowered involvement, which in turn leads to worse financial reporting supervision and reduced company performance (Eisenberg et al., 1998; Mak & Kusnadi, 2005). However, it is important to note that, although the samples of previous studies and empirical works were taken from various countries of different economic sizes, none investigated G7 countries and market multiples jointly.

The generated results prove that larger boards in G7 countries marginally lower market performance. Thus, an optimal board size should be prescribed, while weighing the advantages of doing so, such as enhanced monitoring and greater competence to address problems, with the disadvantages, which include excessive control and coordination problems, in addition to bureaucratic issues that may cause higher market volatility and risk.

4.4.4.2. The Impact of Audit Committee Size and Meeting Frequency Attributes on Market Performance of Banks

The number of members serving on audit committees was found to impact banks' market performance statistically significantly, as measured by a dividend yield positively at a significance level below 1%. However, a larger audit committee size was found to affect banks' market performance statistically insignificantly, as measured by the P/E, P/BV, and price risk. Specifically, a larger audit committee size, deployed as a corporate governance mechanism of banks in G7 countries, was found to have a positive but insignificant impact on the market capitalisation of banks relative to their net

income. This indicates that an increase of one additional audit committee member will positively impact the P/E ratio insignificantly by a marginal 0.3% for banks in G7 countries relative to their net income. Based on the P/BV market performance measure, the size of the audit committee affects the ratio statistically positively significantly by 0.8%. This indicates that one additional audit committee member positively impacts market performance, measured by stock price relative to owners' equity book value per share.

In regard to the dividend yield, the measure was found to have a positive significant relationship to the number of audit committee members by 2.6% at a significance level of below 1%. In terms of the price risk, the size of the audit committee negatively insignificantly impacts market-risk performance, measured by the standard deviation of weekly returns, by 0.1%, thus decreasing the market volatility of banks' stock price in G7 financial markets, leading to more stability in the market value of banks.

On the other hand, the results revealed that the frequency of audit committee meetings was one of the most significant corporate governance mechanisms, having a statistically insignificantly effect on P/E and a significant impact across banks' three market performance measures in G7 countries with varying significance levels, at 1% for the P/BV and 5% for the dividend yield and price risk. These results show that a greater frequency of audit committee meetings has a negative impact on banks' market performance in G7 countries, as the enlargement of an audit committee by one member (i)) statistically insignificantly decreases the P/E ratio by 0.6%; (ii) significantly decreases the P/BV by 1.2%; (iii) significantly lowers the dividend yield by 1%; and (iv) slightly significantly increases market volatility and the risk of banks' stock price movements by 0.3%.

Generally, a larger audit committee size, deployed as a corporate governance mechanism of banks in G7 countries, was found to slightly improve their market performance. This indicates that larger audit committees may possibly have a beneficial effect on overall corporate market performance and is in line with both the agency and resource dependence theories. On the other hand, the results found the meeting frequency of the audit committee and market performance of banks in G7 countries had a negative statistically significant relationship with all market performance measures while significantly increasing minimally stock price volatility and risk. This may indicate that a higher frequency of audit

committee meetings may shake investor confidence in G7 countries due to the nature of the committee's duties, including internal control and risk management activities and disclosures that may signal pessimistic decisions relative to the banks' operations, projects, and outlook.

These outcomes support the empirical findings of prior international studies conducted on banks and firms operating in different countries. In their study, Raghunandan and Rama (2007) concluded that the frequency of audit committee meetings and the number of members of the audit committee are interrelated attributes, indicating that more frequent meetings and larger committees provide more effective monitoring, thus improving overall performance. Vafeas (1999), however, found that a larger audit committee may also lead to inefficient governance, yielding more frequent meetings.

Exploring the impact of the audit committee on a firm's performance, Abu Zraiq and Fadzil (2018) found that committee size has an important correlation to performance, and also revealed that smaller committees with greater exposure and higher knowledge are positively significant for performance. Other researchers suggest that organisations should define and establish an optimal committee size to ensure that it is not excessively sized yet large enough to guarantee the appropriate monitoring of operations (Allegrini & Greco, 2011). Bouaziz and Triki (2012), Nawafly et al. (2018), Osemene and Fakile (2018), and Zábojníková et al. (2016) conclude that there is a positive significant relationship between the number of audit committee members and a firm's market performance. Conversely, in their study, Salloum et al. (2014) show that banks' performance has a significantly negative relationship with the number of audit committee members. Abu Zraiq and Fadzil (2018), Armstrong and Gyimah (2019), Evans (2019), and Olayinka (2019) take the same view in revealing a significantly negative correlation between the performance of a firm and the size of an audit committee. Additionally, there is general agreement that in order for an audit committee to be effective, a majority of, if not all, members should be independent (A. Cadbury, 1992) and possess a strong understanding of auditing and control issues, as well as accounting practises (Krishnan, 2005) Effective audit monitoring requires a high-performing committee with highly qualified members to assess risk, internal control, information and communication, and control activities. An audit committee is expected to strengthen internal control and thus influence market performance.

Mixed relationships with the market performance measures of banks in G7 countries indicate that an audit committee is deemed an important corporate governance mechanism for monitoring effectiveness (J. W. Lin et al., 2006). Anderson et al. (2004) noted that the audit committee monitors internal control, thus providing credible and reliable information to shareholders, and reiterated that larger audit committees are more able to monitor the accounting process and financial reporting, which results in greater transparency and ultimately positively impacts performance. This finding is also confirmed by Bedard et al. (2004), which highlights the importance of a sufficiently large audit committee for the purpose of ensuring its effective role in the financial and accounting process. An audit committee also strengthens the internal auditing function and oversees management's assessment of business risk (Hsu, 2007). As such, an audit committee that meets more frequently with internal auditors is considered to be more informed on auditing and accounting issues. Thus, when urgent auditing or accounting issues surface, the audit committee can direct the internal audit function to promptly address and resolve the issue. Therefore, an audit committee that meets frequently can reduce the possibility of financial fraud (Abbott et al., 2003; Raghunandan & Rama, 2007).

Additionally, the role of the audit committee is important to stakeholders, as properly disclosed financial reporting leads to improved market performance (Wild, 1994). Over time, the role of the audit committee has progressively been transformed from a voluntary monitoring mechanism utilised in high agency-cost situations towards improving the quality of the information flow to shareholders (Pincus et al., 1989).

Based on the mixed results generated, and to achieve good governance that is linked to more sustainable growth, the optimal size and meeting frequency of an audit committee must be determined in a way that is appropriate to each situation. A bank may require a larger number of highly skilled and competent members with a higher meeting frequency if there is a weakness in management performance and multiple issues to address. On the other hand, a bank with stabilised operations and strong management performance requires highly skilled and competent members on its audit committee with reduced activity, in which case a higher meeting frequency may cause coordination issues and unnecessary conflict with executive management. It is also important to take the competencies and qualifications of the audit committee members into consideration when determining an optimal number of members, insofar as a highly qualified yet small committee is just as capable of effectively performing its duties. If the negative factors associated with large committees

are disregarded, an audit committee enhances banks' governance, monitoring, and associated disclosures, thereby enhancing their overall performance.

4.4.4.3. The Impact of Board Gender Diversity on Market Performance of Banks

In G7 countries, the presence of women on boards was found to impact market performance statistically insignificantly. This generally indicates that BOD gender diversity in G7 countries was an unimportant governance mechanism relative to the market performance of banks. The number of women serving on a board was also found to have a negative insignificant relationship to the P/E ratio by 8.8%.

In regard to the P/BV, one percent increase in BODGD was found to affect market performance positively insignificantly. This indicates that addition of one-woman member increases market performance as measured by the market capitalisation relative to shareholders' equity by 15.6%, with no significant association. The percentage of cash dividends distributed to shareholders relative to the market value of the stock was also affected negatively insignificantly by women serving on banks' boards. This result showed that a large number of women serving on a board slightly affected the dividend yield (–15 %). In regard to price risk, the presence of women negatively insignificantly impacts market-risk performance as measured by the standard deviation of weekly returns. This indicates a board composed of more women lead to reduced stock volatility and risk by 12.8%, thus stabilising the movement and growth of market capitalisation.

Sociological, psychological, and cognitive approaches have served as a basis for arguments concerning the impact of board diversity. Fondas (2000) and Pucheta-Martínez et al. (2016) stated that multiple benefits arise from gender diversity within a board; for example, a board may benefit from the differences between men and women in their decision-making styles. In regard to of monitoring, women may have an effective role in the board due to their skills and networks (Conyon & He, 2017). Similarly, Post and Byron (2014) argue that female directors generally offer deeper board discussions in seeking information from other board members, value different opinions, and offer diverse points of view. Women also typically provide a collaborative environment and usually enhance consensus within the group, and their presence may lead to more disciplined behaviour in the boardroom, leading to improved decision-making (Pucheta-Martínez et al., 2016). Conyon and He (2017) have argued that gender-diverse boards traditionally facilitate improved decisions and cognitive diversity, while Liu et al. (2014) highlights that gender diversity functions as a monitoring

mechanism to improve board resolutions, ultimately leading to enhanced firm performance. In a sample of 156 banks from Central and Eastern Europe studied by Andries et al. (2017) a statistically negatively significant association was identified between women on the board and non-performing ('bad') loans, who also explored the impact of board gender diversity on banks' performance during the 2008–2012 financial crisis and found that the higher the percentage of women on the board, the greater the stability of the bank during this period.

Studies of developed countries also reveal a positive relationship between gender diversity and firm performance. In their respective studies of a sample of US banks and 159 banks across nine countries, García-Meca et al. (2015) and Pathan & Faff (2013) found that gender diversity within a board improves bank performance. However, studies by Adams and Ferreira (2009) and Pucheta-Martínez et al. (2016) reveal that possible disadvantages may arise from a gender-diverse board. The higher the composition of women on the board, the greater the dissimilarity between board members' opinions, views, which can eventually cause a lack of cohesion and weaken communication. This may also generate conflicts among board members in a way that negatively impacts the quality of decision-making.

Many studies show a neutral or negative relationship between gender diversity and the financial performance of banks, as mainly measured by the ROA, ROE, and Tobin's Q. Among these studies, research conducted by Rashid and Sajjad (2015) found an inverse relationship between board gender diversity and banks' performance. Furthermore, Adams and Ferreira (2009) and Ahern and Dittmar (2012) found that firms actually perform worse when there is greater gender diversity, and these results were also confirmed by Boubaker et al. (2014) for French firms and Ali et al. (2014) for Australian firms (Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Ali et al., 2014; Boubaker et al., 2014). Liang et al. (2013) and Nguyen et al. (2015), however, were unable to determine any relationship between board gender diversity and performance, thus indicating a neutral association with no positive or negative impact.

Due to the contested results generated, the number of women serving on boards is considered unimportant for market performance. As women are risk mitigators, an optimal number of women serving on the board must be determined to ensure appropriate returns for the bank, as greater risk mitigation will eventually negatively impact market performance due to the fact that the level of returns is associated with the level of risk taken. Additionally, the competency and

experience level of women needs to be taken into account, as with all board members, to ensure an appropriate impact on risk and return.

4.4.4.4. The Impact of Board Composition of Independents on Banks' Market Performance

The number of independent directors on boards was found to impact the P/BV and price risk measures of banks in G7 countries statistically significantly. Thus, this essay failed to reject the null hypothesis that asserts a significant relationship between independent directors on boards and the market performance of banks in G7 countries. Independent directors representing debtholders and minority shareholders had a weak positive insignificant relationship with a P/E ratio of 0.3%. An additional independent director on a board boosts P/E by 0.3%. This means that more independent directors on the board may have a weak positive impact on market performance as measured by stock prices relative to banks' earnings per share. The number of independent directors serving on the board is further found to affect the P/BV positively significantly by 2.7% at a level of below 1%.

A larger number of independent directors on banks' BOD in G7 countries was found to have a marginal negative insignificant relationship with a dividend yield of 1.3%, indicating that when more independent directors serve on boards, the distributed dividends are slightly decreased relative to market capitalisation by 1.3%. This is consistent with the role that is expected of independent directors according to the corporate governance codes and theory discussed previously in the literature section whereby they are responsible for defending stakeholders' rights, including depositors and minority shareholders. In regard to price risk, a board composed of a higher number of independent directors negatively significantly impacts the market-risk performance of banks as measured by the standard deviation of weekly returns. This indicates that a higher board composition of independent directors leads to lower stock volatility and risk by 1.5% and thus decreases variations in stock price movements of banks in G7 countries.

The significant positive impact of more independent board members on G7 banks' P/BV, while reducing stock price volatility and risk, supports the agency, stakeholder and resource dependence theories. This may be due to the fact that the role of independent directors in G7 countries is to lower the risk level of a bank, with the aim of securing the interests of minority shareholders and debtholders (depositors) through extensive monitoring. Our findings contradict the stewardship theory, which suggested that outside directors (independents) were less effective in monitoring activities when

compared to inside directors (executive management), who hold more valuable information generated from their involvement in a firm's activities, enabling them to assess executive managers fairly and precisely.

Other studies, however, show contrasting results and a significant positive correlation between banks' market performance and board composition, as banks with a higher presence of independent directors will have an improved performance (Al-Sahafi et al., 2015; Staikouras et al., 2007). According to the aforementioned studies, it is concluded that a higher presence of independents will potentially enhance a board's independence, leading to more effective monitoring and improved decision-making in line with equity governance practises. Further empirical research also reveals a nonlinear relationship between a bank's performance and the number of independent directors serving on its board. De Andres and Vallelado (2008) analysed an international sample of banks that had a one-tier board structure between 1995 and 2005, showing an inverted U-shaped relationship between external directors and bank performance and claiming that the external inclusion improves performance, but that performance starts to decrease when the proportion of independent directors is too high. Moreover, previous empirical studies found that independent directors have no significant relationship with banks and other non-financial firms, according to Choi et al. (2007), Fernandes and Fich (2013), and Minton et al. (2010). Therefore, the nature of the relationship between market performance and banks in G7 countries supports the argument that outside directors' skills and the knowledge they offer to banks are of no importance for their market performance. Pathan and Faff (2013) suggested that the regulatory requirements may influence the appointment of independent directors in banks and that the market for qualified independent directors is limited. This indicated that the common recommendations for a larger number of independent directors should be carefully followed. Pathan and Skully (2010) also investigated the effect of independent directors on a sample of 212 US bank holding companies from 1997 to 2004 and indicated that banks benefit from a greater number of independent directors when the cost of monitoring managers was low.

Conversely, evidence for a negative relationship between board independence and a firm's performance has been confirmed by other researchers in a study conducted on a sample of US banks during the financial crisis (Minton et al., 2010). Moreover, on an international level, in an investigation of 296 large financial firms from 30 countries between 2007–2008, Erkens et al. (2012) showed that bank boards with a larger number of independent directors experienced worse

stock returns during the 2007–2008 crisis, whose results revealed that independent directors encouraged managers to raise equity capital during the crisis as the value of risky assets declined to ensure capital adequacy and reduce the risk of bankruptcy. Financial institutions were therefore unable to rely on utilising short-term loans against these declined assets and were accordingly forced to raise capital. Since raising equity capital was costly during that period, it led to worse stock returns while instigating a wealth transfer from existing equity holders to debtholders. However, these consequences may have been the result of different corporate governance systems and/or government interventions such as bailouts.

Based on the generated results of board composition and our readings of previous empirical evidence, the higher presence of independent directors on banks' boards in G7 countries will potentially enhance a board's independence, leading to more effective monitoring and improved decision-making. It must also be taken into consideration that a surplus of independent directors, or the presence of unskilled independents may have disadvantages that might lead to unbalanced governance practises and conflicts with management, as independent board directors have less knowledge about the banking industry due to the complexity of banking operations and their part-time status. Therefore, it is suggested that banks increase and optimise the number of independent directors serving on boards, as is judged appropriate to each situation, in order to balance the tradeoff between advantages and disadvantages and to safeguard board objectivity and independence. In addition, this ensures that independent directors have sufficient knowledge and experience to advise management regarding major investments and strategic plans and that there is no excessive monitoring exercised by them that may hold back managerial initiatives.

4.4.4.5. The Impact of Board Meetings on Market Performance of Banks

BOD meetings are found to have a weak negative significant impact on banks' market performance in G7 countries measured by the P/E and P/BV. The higher the meeting frequency, the lower the P/E, P/BV, and dividend yield, and the higher the stock volatility and risk. This indicates that more frequent board meetings lead to a decrease in the market value of banks in G7 countries relative to their net income and shareholder' equity by 0.09% and 0.7% respectively and significantly at a level of below 5% and 1% respectively, while the dividend yield has a positive insignificant relationship with the BOD number of meetings with a coefficient of 0.1%. However, BOD meetings insignificantly and minimally increase banks' stock price volatility and risk by 0.2%.

Several studies have investigated the impact of board meeting frequency on the market and financial performance of both financial and non-financial firms. Research has found that the frequency of board meetings is inversely related to institutions' value, and that boards that meet more frequently are less valued by the market (Vafeas, 1999). A study conducted on a sample of 328 listed companies in Malaysia from 2003 to 2007 reported that frequent board meetings resulted in diminished firm performance (Amran, 2011). Francis et al. (2012) used the financial crisis of 2007–2008 as a sample period and revealed that the frequency of board meetings, the attending directors' behaviour, and their ages all affect firm performance during a crisis.

Also, previous empirical works by Johl et al., (2015) and Kyereboah-Coleman (2008) found that board meeting intensity affect negatively and statistically significantly performance measures of firms, and suggest that too frequent meetings might lead to less productive activities. Additionally, Vafeas (1999) found that a high frequency of board meetings negatively affects a firm's performance as they are costly both financially and in terms of time. However, he also discovered that firm performance significantly improves during the following year. This finding shows that frequent board member discussions result in effective decisions and increase firm supervision over time.

In their study of South African-listed firms from 2002 to 2007, Ntim and Osei (2011) found a positive correlation between the frequency of board meetings and a firm's performance and that board members' capacity for consultation, supervision, and management improves with more frequent meetings, which results in enhanced market performance. Similarly, Irshad et al. (2015) discovered that independent directors, board meeting frequency and board size exert a positive effect on a firm's performance, as measured through coefficients of both market and financial performance, while Akpan (2015) obtained similar results in his study of 79 listed companies in Nigeria from 2010 to 2012.

Board meetings are also considered as opportunities for directors to participate in the monitoring of management and coordinating operations. Large corporations tend to have more complex operations, therefore requiring more active monitoring and supervision. Accordingly, the frequency of board meetings is expected to increase within larger firms in order to facilitate board decision-making and immediate resolution of complex financial issues (Jiraporn, et al., 2009). Frequent meetings also allow directors to become more informed and knowledgeable about important matters within the

organisation, which results in prompt problem-solving (Baccouche et al., 2014; Ntim & Kofi, 2011). Board meeting frequency is hence a key feature which can significantly influence a company and determine the extent of its effectiveness.

Unlike previous studies, Horváth and Spirollari (2012), who used a sample of 136 firms traded on the S&P 500 Index from 2005 to 2009, found a neutral relationship between a firm's performance and its board of directors' characteristics, including board meeting frequency. Jensen (1993), on the other hand, claims that board meetings are not necessarily useful, stating that the limited time that external directors meet is not used for efficient idea exchanges between themselves or with management. Results of the governance practises in G7 countries in connection to boards' meeting frequency mechanism show that decreasing the number of board meetings is a necessity for banks in G7 countries, in addition to determining an optimal number of board meetings, taking into consideration the competency of the members.

4.4.4.6. The Impact of Governance Disclosures on Market Performance of Banks

It was found that the corporate governance disclosure score was one of the most significant corporate governance mechanisms, impacting three of four market performance indicators of banks in G7 countries measured by the P/E, P/BV, and dividend yield. This highlights that transparency was one of the most effective corporate governance mechanisms to significantly affect the market performance of banks. Thus, it can be concluded that an efficient method of information disclosure to the public raises investor confidence and ultimately boosts market performance as measured by the P/E and P/BV while lowering the rate of return relative to the stock price.

The P/E ratio was found to have a positive significant relationship with governance disclosure scores, with a strong coefficient of 97.9%, at a significance level of below 1%. This indicates that an improved reporting mechanism boosts market capitalisation relative to net income by 97.9%, which may be caused by greater confidence at the investor level. The P/BV is positively significantly impacted by the governance disclosure score, with a strong coefficient of 80.0%, at a significance level of below 1%. Greater disclosure leads to enhanced credibility and boosts investor confidence, thus leading to improved market capitalisation relative to shareholder equity. A strong negative significant relationship exists between the dividend yield and governance disclosure, indicating that a higher quality score of governance disclosure affects the dividend yield negatively by 45.0%. This will therefore lower the rate of cash returns relative to the stock price. Moreover, the negative impact on the dividend yield may be due to the increase in stock prices of banks, as the results

reveal in the P/E and P/BV models, thus leading the denominator in the dividend yield to increase relative to its nominator (cash dividends distribution percentage). The price risk is positively insignificantly impacted by governance disclosure, indicating that greater disclosure insignificantly impacts stock price movements, thus minimally increasing volatility in the market by 2.2%. This might be due to the fact that more information disclosure in the market raises the sensitivity of market reactions and leads to higher movements in the market value of banks in G7 countries. Overall, the results show that as the level of disclosure and transparency in managerial governance affairs increases, the market performance of banks increases with a statistically significant effect.

Previous empirical works have generated mixed results regarding the correlation between corporate governance and market performance. For example, Klapper and Love (2004) found a highly positive association between a corporation's governance and its operating performance by assessing the firm-level data of 14 emerging stock markets and using the return on assets as a measure for operating performance. Likewise, other researchers such as Brown and Caylor (2004), Drobetz et al. (2004), and Gompers et al. (2001) reported a positive relationship between proper corporate governance and a firm's profitability. Additionally, international evidence suggests that this positive relationship also exists in certain developed markets. Selvaggi and Upton (2008) claimed that proper disclosure of corporate governance enhances a firm's performance in the UK and found a strong causal relationship between the two variables. In contrast, several research have shown no connection between operating success and corporate governance disclosure that is meaningfully positive. According to Bauer et al. (2004), a link that was previously reported as being inconsequential was later changed to be strongly and statistically negative. Nevertheless, Park and Shin (2004) and Prevost et al. (2002) failed to find any proof of a connection between the two variables in their investigations.

Multiple previous studies have examined the correlation between risk and disclosure in the banking industry, during which it has been found that the disclosure of banks' current and future operations creates a disciplined risk-taking behaviour. Bliss and Flannery (2005) and Flannery (2001) argued that market discipline first depends on the ability of investors and creditors to assess and monitor any changes in a bank's situation and, second, their ability to influence the behaviour and decisions of management. These aspects are both affected by the extent and amount of information disclosed. In theory, greater disclosure offers more information, allowing investors and creditors to properly assess a firm's

condition, which in turn causes a significant market reaction to changing conditions and generates an immediate and anticipatory response by management.

A key source of opacity for banks lies in their ability to alter their assets and risk positions (Myers & Rajan, 1998). Many studies have found substantial proof of ambiguity in banks with high allocations of liquid assets (Hirtle, 2007; Iannotta, 2006; Morgan, 2002). This underlies the fact that greater disclosure and market discipline will eventually reduce risks by banks. Risk-taking decisions will be constrained by enhanced market discipline, any additional costs associated with increased risk would be completely assumed by the bank. As market prices become more risk-sensitive, signals to regulators will be evident, thus influencing supervisory action (Flannery, 2001). It is noteworthy, however, that greater information disclosure reduces the likelihood of a bank facing an undeserved risk premium and reduces the likelihood of that market prices to overreact to a firm's news and events. This may lower funding costs and increase the options of suitable investments, such as those containing a positive NPV, some of which may increase the risk of its current portfolio.

Corporate governance disclosure and transparency have grown increasingly important since the 2007–2008 financial crisis, as multiple studies identify the lack of financial disclosure and weak supervision by directors as the main causes of the financial crash. This has led to a greater demand for regulation and stricter requirements for disclosure while complicating accounting standards to protect market performance. Companies are required to disclose accurate information to their shareholders and the public concerning their financial performance, assets, liabilities, corporate governance, and ownership (Kosack & Fung, 2014) to allow current and potential investors to accurately assess the risks and rewards associated with any investment decision (OECD, 2004). The relationship between corporate governance disclosure and a firm's performance makes clear that their correlation produces effective operations for internal and external mechanisms for governance (Chen & Lu, 2009). Disclosure not only benefits individual investors but also impacts the market at large. Access to an appropriate level of information enables markets to properly evaluate a company's governance to the extent to which it responds to the needs of shareholders, uncovering any potential risk and providing an accurate indication of the direction of future cash flows (UNCTAD, 2011).

4.4.4.7. The Impact of Leadership Duality (Chairperson-CEO) on Banks' Market Performance

The results showed that the presence of CEO duality affects only one G7 bank's market performance as measured by the P/E statistically negatively significantly at a level below 5%. The duality of roles of a chairperson who was also the CEO (CEO duality) was found to have a negative but significant relationship with the P/E. This indicates that when such dual control was operative, the P/E was negatively impacted by 5.1%. This means that the CEO duality reduced market returns measured by market capitalisation relative to net income. In regard to the P/BV, the presence of CEO duality was found to affect the ratio negatively insignificantly by 2.0%. This indicated that a duality may slightly decrease the market performance of banks as measured by market capitalisation relative to shareholders' equity by 2.0%, leading to a decrease in market performance. The percentage of cash dividends distributed to shareholders increases minimally insignificantly relative to the market value of the stock when banks practise CEO duality, with duality affecting dividend yield by 1.9%. In regard to price risk, the presence of CEO duality negatively insignificantly impacted market-risk performance, as measured by the standard deviation of weekly returns. This indicated that one person holding both positions lead to reduced stock volatility and risk by 1.00% and thus slightly stabilised the growth of market capitalisation movements/volatility above and below its mean. Several studies have been conducted on financial firms and banks that analyse and explore the impact of CEO duality on risk-taking, indicating that risk-averse CEOs typically have fewer incentives to take risks at banks. Pathan (2009) shows in a sample of US banks investigated during 1997–2004 that CEO duality negatively affected a bank's risk-taking measures, while Simpson and Gleason (1999) found that CEO duality actually lowered the probability of financial distress in their sample of 287 US banks investigated from 1989 to 1993.

CEOs who are also chairpersons of the board pursue their own interests, implying that they take less risk to ensure that their own benefits are protected. Berger et al. (2016) reported that CEO duality reduces the probability of bank default for up to two years prior to the expected default. The study included assessing market competition, corporate governance variables, state economic indicators, and regulatory variables as control variables, revealing that a board's structure was not decisive for its stability.

CEO duality practises and banks' performance in G7 countries are found to advocate the agency theory, according to BCBS (2006), Cadbury (1992) and OECD (2004), which suggests that absence of CEO duality (separation of roles) is

necessary to eliminate any secretive and opaque environments. The theory emerged in order to solve issues regarding the relationship between the agent (manager) and the principal (shareholder/BOD) because the theory considers the agent as egocentric (Jensen & Meckling, 1976). Thus, it can be concluded that an effective corporate governance mechanism will be exercised by monitoring the management's activities and having control over its decisions through an independent board composed of members who have diverse knowledge, skills, and expertise.

The results of combining the two leadership roles in the banking industry in G7 countries, from a market perspective, are inconsistent with the stewardship theory, which is based on the existence of a credible and trustworthy relationship between principals and agents, since agents should act for the benefit of the public interest and the shareholders in particular. Our results revealed a significant relationship between the duality of leadership roles and banks' P/E in G7 countries, although duality might have a weak negative impact across market performance metrics, which challenges the idea that CEO duality strengthens the effectiveness of corporate governance. This essay provides evidence that, although CEO duality might decrease the levels of financial distress, risk-taking, and defaults, it also decreases overall market performance. A separation of roles strengthens banks' governance in G7 countries and the overall market performance from the shareholders' perspective.

4.4.5. Unbalanced Sample Treatment Approach and Summary of Results

Sampling bias is a common form of bias which occurs when data is collected in a manner that over-samples from one community and under-samples from another. This was the case in our dataset, albeit unintentionally (accidentally because of), as the data was taken from the Bloomberg online database. This may reflect the behaviour of the cross-section observations (banks) regarding their disclosures and also reflects the real world, where the US has more regional banking institutions than Canada, France, Italy, Japan, Germany, and the UK.

The major challenge is that the distribution of the observed data is not the same as that of the target population (Heckman, 1976). Because of its nature, sampling bias leads to a systematic distortion of the estimate of the sampled probability distribution. A common cause of sampling bias lies in the design of a study or in the data collection procedure, both of which may favour or disfavour collecting data from certain classes or individuals or in certain conditions. Sampling bias is also particularly prominent

whenever researchers adopt sampling strategies based on judgment or convenience, and in which the criterion used to select samples is somehow related to the variables of interest. However, using a sampling frame does not necessarily prevent sampling bias. For example, a researcher may fail to correctly determine the target population or use outdated and incomplete information, thereby excluding sections of the target population. Furthermore, even when the sampling frame is selected properly, sampling bias can arise from non-responsive sampling units (e.g., certain classes of subjects might be more likely to refuse to participate or harder to contact etc.) Non-responses are particularly likely to cause bias whenever the reason for the non-response is related to the phenomenon under study (Panzeri et al., 2008).

Based on the above, the unintentional sampling bias in our data which reflects the real world, and to eliminate doubts regarding the existence of any sampling strategies that were adopted by the researcher based on either judgement or convenience in selecting samples related to his area of interest, this essay utilises separate and comparative examination of the influence of corporate governance mechanisms on banks' performance for the G6 countries (excluding the US) and the US alone. (See Appendix A for detailed findings.) Furthermore, the researcher utilised machine learning techniques, deploying a cluster analysis algorithm followed by regression modelling, as outlined in the upcoming section. The cluster analysis assisted in limiting the sampling bias by grouping banks with similar governance practises via the utilisation of unsupervised machine learning techniques in a way that was also helpful in dealing with endogeneity issues related to the sample, as recognised by empirical corporate governance works.

In conclusion, out of 32 coefficients representing the nature of relationship between eight corporate governance mechanisms and four market performance measures, only 7 coefficients were found to match in their relationship nature and statistical significance in comparison between G7 and G6 countries as shown in Tables 4:13 and 4:14.

Table 4:13 *Summary of GLMM Results – G7 vs. G6*

	P/E		P/BV	
	G6	**G7**	**G6**	**G7**
BODS	Positive Significant	Positive Insignificant	Positive Significant	Negative Significant
ACS	Negative Insignificant	Positive Insignificant	Negative Insignificant	Positive Insignificant
BODGD	Positive Insignificant	Negative Insignificant	Negative Significant	Positive Insignificant
ACMF	Positive Insignificant	Negative Insignificant	Negative Significant	
BODCI	Negative Significant	Positive Insignificant	Negative Significant	Positive Significant
BODMF	Negative Significant		Negative Insignificant	Negative Significant
GDS	Positive Insignificant	Positive Significant	Negative Insignificant	Positive Significant
CEODY	Positive Insignificant	Negative Significant	Negative Insignificant	

- *Author's Own*

Table 4:14 *Summary of Dividend Yield and Price Risk GLMM Results – G7 vs. G6*

	DIV.Y		PR	
	G6	**G7**	**G6**	**G7**
BODS	Negative Insignificant	Positive Insignificant	Positive Insignificant	Positive Significant
ACS	Positive Insignificant	Positive Significant	Positive Insignificant	Negative Insignificant
BODGD	Negative Significant	Negative Insignificant	Negative Significant	Negative Insignificant
ACMF	Negative Significant		Negative Insignificant	Positive Significant
BODCI	Positive Significant	Negative Insignificant	Negative Insignificant	Negative Significant
BODMF	Positive Insignificant		Positive Insignificant	
GDS	Positive Insignificant	Negative Significant	Positive Insignificant	
CEODY	Negative Insignificant	Positive Insignificant	Positive Insignificant	Negative Insignificant

- *Author's Own*

As for price risk model, the only two corporate governance mechanisms that were found to have similar results in both G7 and G6 countries are board meetings and governance disclosure score; both affect positively and statistically insignificantly.

In conclusion and based on the biased results towards the US banking sample, the researcher conducted additional investigations, whereby I used advanced analytics via machine learning techniques to treat the unbalanced sample issues in addition to the endogeneity of corporate governance by using clustering analysis (unsupervised machine learning nodes) to segment and differentiate G7 banking sample based on their corporate governance behaviours.

4.5. Additional Investigations - The Impact of G7 Countries' Banking Groups with Similar Governance Practises on Market Performance Measures

With reference to the first essay Chapter 3 of this thesis regarding the similarities and differences between G7 banks in relation to their corporate governance practises in which the researcher utilised cluster analysis using Data Mining and Machine Learning Techniques.

This section utilises the G7 banking groups' data generated in Section 3.5.6 in the first essay to examine the influence of different banking groups' corporate governance practises on Market Performance Measures. Accordingly, the additional research question has been developed:

- Q5: To what extent do corporate governance practises impact different banking groups with similar behaviours in regard to market performance in G7 countries?

Based on the above and following the analysis approach conducted previously in Essay One of this study section (3.4.4), and in order to illustrate the impact of implementing appropriate econometric techniques when modeling the governance–performance relationship, a baseline approach must be selected against which to compare alternative methodologies. More specifically, given its widespread use in the early governance–performance literature, the pooled OLS method of estimation was used as our baseline analysis, despite its strict exogeneity assumptions. The results of the panel assumptions-pooled OLS estimation for each cluster are reported in Table 4:8 and suggest violations of estimates for all models. Therefore, we applied panel modelling techniques, since it was important to decide the type of model between fixed effects or random effects. Consequently, it had to be ascertained whether these effects were treated as fixed or random, which required the application of the

Hausman test as previously discussed in the Methodology section in this essay. The Hausman test in the first phase involved estimating a model with random effects. A high value chi-square ($\chi 2$) statistic of the Hausman test, corresponding to a p-value probability (prob.) lower than the significance threshold α of 0.05, led to significant differences between the coefficients, which required the rejection of random effects as inconsistent, in which context our findings suggested that the panel estimation based on fixed effects was more reliable. A high Hausman test chi-square (2) statistic, corresponding to a p-value probability (prob.) lower than the significance threshold α of 0.05, led to significant coefficient differences, which required the rejection of random effects as inconsistent. Our findings suggested that panel estimation based on fixed effects was more appropriate. In the case of a relatively low value of the test (accompanied by a high p-value above 0.05), it determined the approach of the random effects models. In the analysis based on panel data, homoskedasticity was a basic hypothesis, which had to be verified. The White's test was used to test the homoskedasticity hypothesis while the autocorrelation of errors in the model estimation was tested by applying the Durbin-Watson and Wooldridge tests. The absence of collinearity violations was noted.

The Generalised Linear Model node was utilised for each model to uncover the nature of the relationship between corporate governance clusters and market performance measures as the best-fit model, based on the output of the auto-numeric node mentioned previously, while the expert mode in the GLM node was activated to determine the distribution type for each model, link function, parameter estimation function method, scaling method, covariance matrix, chi-square statistics type, and confidence interval type.

The GLM model accommodates a non-normal distribution for the dependent variable. Its definition describes various commonly used statistical models that can be used to represent various kinds of data, such as linear regression models for normally distributed responses, logistic models for binary data, log linear models for count data, and complementary log-log models for interval-censored survival data. The GLM node estimates of relations for the corporate governance practises of each banking group and market performance measures are presented in Tables 4:16, 4:17, 4:18, and 4:19.

Table 4:15 shows the main functions utilised in the expert mode of the GLM node prior to running the regression analysis.

Table 4:15 *Expert Mode GLM Estimations Functions*

		P/E Model	P/BV Model	Div. Y Model
Probability Distribution (Target Field)		Normal		
Link Function		Log		Normal
Parameter Estimation	Method	Hybrid		
	Scale Parameter Method	Maximum Likelihood Estimate		
	Covariance Matrix	Robust Estimator		
Chi-square Statistics		Likelihood Ratio		
Confidence Interval Type		Profile Likelihood		

- *Author's Own*

To ensure that the best probability distribution along with its link function were used in expert mode of the GLM node, we utilised the simulation fitting node after running the GLM analysis in order to assist in determining the best-fit distribution type. The simulation fitting node fits a set of candidate statistical distributions to each field in the data. The fit of each distribution to a field was assessed using a goodness-of-fit criterion. When a Simulation Fitting node was executed, a Simulation Generate node was built. Each field was assigned its best-fitting distribution. The Simulation Generate node could then be used to generate simulated data for each field (IBM, 2018).

Table 4:16 *Summary of Results: Cluster 1 Corporate Governance Practises and Market Performance Measures*

(Cluster 1 – US Regional Banks – Shareholders-Oriented System – 1-Tiered Board Structure Supports Agency Theory)

	P/E	P/BV	Div.Y
(Intercept)	2.45	-0.31	-3.444
	*0.000***	*0.117*	*0.000****
BODS	-0.031	-0.013	0.022
	*0.043***	*0.347*	*0.193*
BODMF	0.004	-0.005	0.012
	0.178	*0.019***	*0.000****
ACS	0.005	0.002	-0.017
	0.613	*0.805*	*0.273*
ACMF	0.006	0.003	-0.003
	*0.053**	*0.322*	*0.601*
BODCI	0.043	0.006	-0.009
	*0.007****	*0.626*	*0.617*
BODGD%	0.089	0.174	0.361
	0.447	*0.107*	*0.049***
GDS	-0.017	0.347	-0.47
	0.928	*0.094**	*0.023***
SDS	0.792	1.28	-1.155
	*0.005****	*0.000****	*0.002****
EDS	-6.1	-6.173	7.732
	*0.06**	*0.031***	*0.000****
LR	-0.027	-0.011	0.035
	0.156	*0.535*	*0.197*
CEOD=0	0[a]	0[a]	0[a]
	.	.	.
UBOARD=0	0[a]	0[a]	0[a]
	.	.	.
IND.CHAIR=0	0.07	0.278	-0.058
	0.695	*0.002****	*0.57*
Goodness of Fit			
Akaike's Information Criterion (AIC)	*6,087.50*	*1,064.00*	*-5,349.60*
Bayesian Information Criterion (BIC)	*6,155.90*	*1,132.80*	*-5,282.40*
Omnibus Test			
Likelihood Ratio Chi-Square	*43.2*	*75.4*	*48.9*
Df	*12*	*12*	*12*
Sig.	*0.000****	*0.000****	*0.000****

- *Author's Own*
- **: significant at 10%, **: significant at 5%, ***: significant at 1%*
- *a: Set to zero because this parameter is redundant.*
- *n: Independent variables have no impact on market performance measure.*

- *P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

The banking group in Cluster 1 was composed of regional US banks and followed a shareholder-oriented corporate governance system while endorsing the agency theory, operating with a Tier 1 system, whose board chairpersons were independent directors with no dual control. The banking groups typically had a low focus on disclosure practises regarding social and environmental aspects yet showed credible scores for governance disclosure. The points below highlight the relationship between corporate governance mechanisms and market performance measures, showing the key generated results:

Board size was found to significantly negatively only affect one market performance measured by the P/E at a level of below 5%. This indicated that an additional board-member impacts the P/E ratio negatively by 3.1%.

The number of board meetings was found to have a mixed impact whereby market value relative to shareholders' equity was negatively significantly affected by 0.5% at a level of below 5% while positively significantly impacting the dividend yield by 1.2% at a level of below 1%.

The ACS had no impact on market performance measures while their meeting frequency was found to have a minimal impact only on one performance measured by P/E significantly positively by 0.6% at a level of below 10%.

Regarding the number of independent directors serving on the board, the practise had a positive significant impact on the P/E by 4.3% at a level of below 1%.

The number of female directors had a strong significant positive impact on dividend yield by 36% at a level of below 5%. We can also assume that the gender mechanism may have had a significant impact on P/BV of 17.4%, which stood at a level of 10%.

Information flow regarding banks' governance data significantly impacted the P/BV by 34.7% while negatively impacting the dividend yield at -47% at levels of below 10% and 5% respectively.

The social and environmental disclosure scores, which were the two most significantly impactful mechanisms in Cluster 1, affected all market performance measures. Both disclosures impacted in perfect opposition. The social score had a strong positive impact on the P/E and P/BV of 79.2% and 128% respectively, both at a level of below 1%, and also negatively impacted the dividend yield by 116% at a level of below 1%. This type of impact affected the 'price' factor (numerator). The environmental score had a strong negative impact on the P/E and P/BV significantly by around six multiples at a level of below 10% and 5% respectively while positively significantly impacting the dividend yield at a level below 1%.

The independence of the board's chairperson was found to only have a significant positive on the P/BV impact by 27.8% at a level below 1%.

CEO duality and unitary board were set to zero, as this cluster did not practise CEO duality and operated under a Tier 1 board structure.

In regard to the control variables, the leverage ratio was found to have an irrelevant impact on market performance measures. Bank size (in terms of assets) was found to have a very minimal significant impact on dividend yield at a level of below 1%.

Table 4:17 *Summary of Results: Cluster 2 Corporate Governance Practises and Market Performance Measures*

(Cluster 2 – Multinational Banks – Market Oriented System - Combination of Board Structure & CEO Duality Supports Stakeholder, Stewardship, and Resource Dependence Theories)

	P/E	P/BV	Div.Y
(Intercept)	3.962	1.431	-3.879
	*0.000****	*0.000****	*0.000****
BODS	0.015	-0.086	0.012
	0.388	*0.000****	*0.419*
BODMF	-0.01	0.006	-0.023
	0.272	*0.428*	*0.007****
ACS	-0.070	0.02	0.007
	*0.006****	*0.241*	*0.758*
ACMF	0.017	0.005	-0.003
	*0.02***	*0.512*	*0.66*
BODCI	-0.046	0.068	0.009
	*0.003****	*0.000****	*0.512*
BODGD%	-0.432	0.717	0.803
	0.17	*0.036***	*0.038***
GDS	-7.789	-0.49	-4.033
	*0.024***	*0.112*	*0.622*
SDS	-6.897	-0.396	-3.085
	*0.047***	*0.13*	*0.703*
EDS	-7.507	-0.859	-4.51
	*0.027***	*0.003****	*0.577*
LR	-0.061	-0.209	0.077
	*0.081**	*0.000****	*0.01****
CEOD	0.077	0.0912	-0.287
	0.566	*0.016***	*0.045***
UBOARD	0.026	-0.108	-0.126
	0.904	*0.555*	*0.483*
Ind.Chair	0.115	-0.105	-0.124
	0.308	*0.206*	*0.143*
Goodness of Fit			
Akaike's Information Criterion (AIC)	*1,628.10*	*373.50*	*-1,335.20*
Bayesian Information Criterion (BIC)	*1,687.40*	*431.50*	*-1,275.60*
Omnibus Test			
Likelihood Ratio Chi-Square	*67*	*205.8*	*66.5*
Df	*15*	*14*	*15*
Sig.	*0.000****	*0.000****	*0.000****

- *Author's Own*
- **: significant at 10%, **: significant at 5%, ***: significant at 1%*
- *a: Set to zero because this parameter is redundant.*

- *n: Independent variables have no impact on market performance measure.*
- *P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

Board size had a negative significant impact on the P/BV of 8.6% at a level of below 1%, while BOD meeting frequency negatively significantly impacted the dividend yield by 2.3% at a level of below 1%.

The audit committee size significantly negatively impacted the P/E by 7% at a level below 1% while its meeting frequency positively significantly affected the P/E by 1.7% at a level below 5%.

Boards composed of a large number of independent directors negatively affected the P/E by 4.6% while positively impacting the P/BV by 6.8% statistically significantly at a level of below 1% for both measures.

Boards with a high percentage of female directors had a strong significant positive impact on both the P/BV and dividend yield of 71.7% and 80.3% respectively, both at a level of below 5%.

Regarding information disclosure, it was found that all ESG disclosures had a strong and negative impact on the P/E ratio averaging around 7.4 multiples, at a level of below 5%. The environment disclosure score additionally impacted the P/BV negatively and significantly by 85.9% at a level below 1%. As the banking group in this cluster practised CEO duality, it was found that this system positively significantly impacted the P/BV by 9.12%; however, the dividend yield was negatively significantly impacted by 28.7%, at a level of below 5%. The chairperson independence and unitary board was found to be unimportant governance mechanisms for the market performance measures in the banking group in Cluster 2, as none had a significant impact. In regard to the control variables, banks with a high dependency on customer deposits relative to shareholders' equity had a significant effect on all measures, with a positive impact on the dividend yield and a negative impact on the P/E and P/BV. Larger banks had a positive minimal significant impact on the P/E while negatively impacting other market performance measures.

Table 4:18 *Summary of Results: Cluster 3 Corporate Governance Practises and Market Performance Measures*

(Cluster 3 – US Regional & Diversified Banks – Shareholders-Oriented System Supports Stewardship Theory)

Dependent Variables	P/E	P/BV	Div.Y
(Intercept)	2.423	-0.133	-3.605
	*0.000***	*0.312*	*0.000****
BODS	-0.002	0.004	0.011
	0.736	*0.484*	*0.269*
BODMF	-0.008	-0.012	0.002
	*0.009****	*0.000****	*0.591*
ACS	0.018	0.004	0.042
	*0.036***	*0.593*	*0.002****
ACMF	0.005	-0.009	-0.013
	*0.054**	*0.000****	*0.008****
BODCI	-0.005	0.008	-0.022
	0.587	*0.311*	*0.122*
BODGD%	-0.407	0.275	0.922
	*0.000****	*0.013***	*0.000****
GDS	0.522	0.604	-0.201
	*0.000****	*0.000****	*0.151*
SDS	-0.169	0.272	-1.534
	0.385	*0.127*	*0.000****
EDS	-0.597	-0.579	0.724
	*0.006****	*0.024***	*0.054**
LR	-0.043	-0.031	0.002
	*0.025***	*0.100**	*0.948*
CEOD=0	0.035	-0.011	-0.084
	0.144	*0.585*	*0.015***
UBOARD=0	0[a]	0[a]	0[a]
	.	.	.
IND.CHAIR=0	0[a]	0[a]	0[a]
	.	.	.
Goodness of Fit			
Akaike's Information Criterion (AIC)	*7,312.60*	*1,449.60*	*-6,373.40*
Bayesian Information Criterion (BIC)	*7,383.60*	*1,520.90*	*-6,303.90*
Omnibus Test			
Likelihood Ratio Chi-Square	*74.5*	*112.8*	*91.3*
Df	*12*	*12*	*12*
Sig.	*0.000****	*0.000****	*0.000****

- *Author's Own*
- **: significant at 10%, **: significant at 5%, ***: significant at 1%*
- *a: Set to zero because this parameter is redundant.*
- *n: Independent variables have no impact on market performance measure.*

- *P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

Board size was found to be an unimportant mechanism, with no impact on market performance measures, while its meeting frequency had a weak relationship, negatively significantly impacting the P/E and P/BV, at a level of below 1%.

The audit committee size was found to have a positive significant impact on the P/E and dividend yield by 1.8% and 4.2% respectively at levels below 5% and 1% respectively. Its meeting frequency had a minimal impact on the P/E by 0.5% at a level below 10%. The P/BV and dividend yield experienced a weak impact at levels of below 1%.

The number of independent directors had no impact on any market performance measure. This was due to the fact that this cluster followed a shareholder-oriented governance system via the stewardship theory.

Gender diversity had a strong and significantly negative relationship with the P/E by 40.7% at a level below 1%, while having a positive impact on the P/BV dividend yield of 27.5% and 92.2% at levels below 5% and 1% respectively.

In regard to ESG disclosures, governance information was found to have a positive impact on the P/E and P/BV at 52.2% and 60.4% respectively at levels below 1%. The social score only strongly positively impacts the dividend yield by 1.5 multiples at a level of below 1%. As for the environmental score impacts on all three measures significantly, whereby the P/E and P/BV have a strong and negative impact of 59.7% and 57.9% respectively while positively impacting the dividend yield by 72.4%.

The presence of CEO duality in this cluster only affects the dividend yield significantly negatively by 8.4% at a level of below 5%. Chairperson independence and unitary board are set at 0 as they are considered redundant parameters, since the entire banking groups operate under a Tier 1 board structure while having a non-independent chairperson. Banks with higher leverage witness a marginal negative significant relationship with the P/E and P/BV. Bank size for this cluster is shown to be an unimportant factor for market performance.

Table 4:19 *Summary of Results: Cluster 4 Corporate Governance Practises and Market Performance Measures*

(Cluster 4 – Japanese Banking Group – Market-Oriented System - 2-Tiered Board Endorses Stewardship & Stakeholder Theories)

Dependent Variables	**P/E**	**P/BV**	**Div.Y**
(Intercept)	1.526	-1.956	-4.307
	*0.000****	*0.000****	*0.000****
BODS	0.022	-0.005	-0.013
	*0.004****	*0.523*	*0.058**
BODMF	-0.019	-0.015	0.008
	*0.003****	*0.030***	*0.064**
ACS	-0.008	-0.125	0.002
	0.57	*0.000****	*0.901*
ACMF	0.002	-0.003	-0.001
	0.72	*0.532*	*0.922*
BODCI	-0.128	-0.035	0.016
	*0.000****	*0.26*	*0.394*
BODGD%	-0.068	0.124	-0.318
	0.841	*0.861*	*0.363*
GDS	2.047	2.556	0.731
	*0.001****	*0.004****	*0.054**
SDS	0.109	-2.018	0.589
	0.819	*0.008****	*0.161*
EDS	0.718	2.72	-0.19
	*0.037***	*0.000****	*0.425*
LR	-0.043	0.065	0.083
	0.116	*0.048***	*0.000****
CEOD=0	0.082	0.275	0.001
	*0.062**	*0.001****	*0.974*
UBOARD=0	0[a]	0[a]	0[a]
	.	.	.
IND.CHAIR=0	-0.062	-0.007	-0.15
	0.684	*0.961*	*0.014***
Goodness of Fit			
Akaike's Information Criterion (AIC)	*3,668.30*	*142.80*	*-4,023.70*
Finite Sample Corrected AIC (AICC)	*3,734.40*	*209.20*	*-3,957.40*
Omnibus Test			
Likelihood Ratio Chi-Square	*95.8*	*135.7*	*87.3*
Df	*13*	*13*	*13*
Sig.	*0.000****	*0.000****	*0.000****

- *Author's Own*
- **: significant at 10%, **: significant at 5%, ***: significant at 1%*
- *a: Set to zero because this parameter is redundant.*
- *n: Independent variable has no impact on market performance measure.*

- *P/E: Price to Earnings; P/BV: Price to Book Value; Div.Y: Dividend Yield; BODS: Board Size; ACS: Audit Committee Size; BODGD: Board Gender Diversity; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality; UBOARD: Unitary Board Model; IND.CHAIR: Independent Chairperson; LR: Leverage Ratio.*

The number of directors serving on the banks' boards had a positive significant relationship with the P/E of 2.2% at a level below 1%. It also negatively impacted on the dividend yield at 1.3% at a level below 10%. The frequency of their meetings had a negative impact on the P/E by 1.9% and the P/BV by 1.5% at levels below 10% and 5% respectively and a minimum positive impact on the dividend yield at 0.8%.

The larger the audit committee size, the lower the P/BV b 12.5% at a level of below 1%. while AC activity measured by the number of meetings was found to be an unimportant mechanism with no impact on market performance.

A board composed of a large number of independent directors negatively impacted the P/E by 12.8% at a level of below 1%. The number of female directors had no impact on market performance as none of the models recorded significant values.

The governance disclosure score was the only mechanism that strongly positively significantly affected all three market performance measures at a level of below 1% for the P/E and P/BV and below 5% for the dividend yield. The environmental score had a significant and positive relationship with the P/E and P/BV while the social score only had a strong negative impact on the P/BV by around two multiples.

Banks that practised a dual control of their leadership role had a significant positive impact on the P/E and P/BE by 8.2% and 27.5% at levels of below 10% and 1% respectively. Board chairpersons who were independent directors negatively affected the dividend yield by 15% significantly at a level of below 5%.

This banking group practised a Tier 2 board structure. Larger banks within this structure had a weak significant impact on the P/E ratio while banks with higher leverage had a positive impact on the P/BV and dividend yield.

4.5.1 Comparative Analysis: Similarities and Differences on the Assessment of the Influence of Corporate Governance Practises of G7 Banking Groups on Market Performance

The governance mechanism of board size in clusters 1 and 2 was found to negatively affect banks' market performance. This indicated that the shareholder-oriented banks following the agency theory and the multinational market-oriented banks following the stakeholder theory with a mixture of the agency and stewardship theory were found to be affected negatively by larger boards. The negative impact of board size in clusters 1 and 2 is a view supported by many scholars, who have suggested that when the number of board members increases beyond an optimal number, problems may arise. Jensen (1993), for instance, believes that boards with more than seven to eight members are ineffective. This has been further corroborated by scholars such as Cheng, (2008); Eisenberg et al. (1998); and Yermack (1996), who found a significant negative relationship between board size and profitability in a sample of small and mid-size firms. Bonn et al. (2004); Cheng (2008); and Jensen (1993) revealed that a large board may lead to coordination and communication issue, while Lipton and Lorsch (1992) added that it may lead to higher agency and monitoring costs as well as lower diligence due to dysfunctional behavior. Bonn et al. (2004) also mentioned that large boards are reluctant to take decisions, which was further emphasised by scholars such as Evans and Dion (1991) who suggested that larger boards may have weak cohesion, thus leading to greater conflict, slower decision-making and high overall inefficiencies within the board's role.

An interesting view is propounded by Hermalin and Weisbach (1991), who stated that the larger the board, the more symbolic its role (as opposed to it having an actual managerial impact), thus making way for multiple scholars who also favour a smaller board size, including Lipton and Lorsch (1992) and Yermack (1996). On the other hand, the board size of the shareholder-oriented banks following the stewardship theory (Cluster 3) was found to be an unimportant governance mechanism for their market performance. However, the Japanese market-oriented (Cluster 4) following the stewardship theory was the only banking group in G7 countries found to have a positive relationship between its board size and market performance as measured by the P/E, although a negative relationship between the board size and dividend yield was also discerned, leading the denominator in the dividend yield to increase relative to the nominator (cash dividends distribution percentage). The positive effect of board size in Cluster 4 supported the view that larger boards are effective in driving the performance of banks. This finding is replicated elsewhere in the literature, where a number of researchers (Coles et al., 2008; Dalton et al., 1999; Dwivedi & Jain, 2005; Ehikioya, 2009; Kathuria & Dash, 1999; Klein, 2002; Pearce & Zahra, 1992) have all found positive correlations between board size and

firm profitability. While all the mentioned researchers support larger boards, the underlying evidence varies as to how larger boards positively impact performance. Dalton et al. (1999) and Pearce and Zahra (1992), for example, have argued that a larger pool of board members means greater knowledge and experiences across diverse fields, thus leading to more strategic decision taking and better performance. Klein (2002) believes that a larger board compels members to become more specialised and focused, leading to greater efficiencies, while Coles et al. (2008) argue that more members mean a larger external network and greater monitoring capacity.

This essay has found that more frequent board meetings of all banking groups within the G7 countries invariably affect market performance measures negatively and statistically significantly. Although the Anglo-Saxon banks using the agency theory and the Japanese market-oriented banks using the stewardship theory saw a positive impact on the dividend yield, the results of the P/E and P/BV model may support the results of the decline in stock prices of banks in clusters 1 and 4, which caused the denominator in the dividend yield to decline relative to the numerator (cash dividends distribution percentage).The results coincide with the view of scholars such as Lipton and Lorsch (1992) who state that routine meeting agendas and formalities such as performance reports and presentations tend to occupy most of the meeting time, thus reducing the amount of time available to take decisions and monitor management. On a similar note, researchers such as Alsartawi (2019) and Vafeas (1999) state that the expenses that accompany meetings (such as travel, refreshments) and meeting fees all lead to greater agency costs, which in turn affect a firm's performance. More recently, scholars such as Agyei-Mensah (2021); Rodriguez-Fernandez et al. (2014) find that board meetings are negatively correlated to investment decisions and firm performance.

On the other hand, the results of board meetings and market performance in G7 countries contradict the agency theory, which suggested that board monitoring is one of the methods for controlling the conflicts of interest between CEOs and shareholders (Fama & Jensen, 1983), which reduces moral hazard and information asymmetry, hence lowered the odds of any opportunistic behaviours which may arise on the part of CEOs (Jensen & Meckling, 1976; Mendez & Garcia, 2007). More frequent board meetings therefore allow external directors to exercise their duties with an independent view of companies' strategic plans and managerial performance (Appiah & Amon, 2017; Vafeas, 1999). In contrast to earlier scholars who claimed that active board monitoring ensured the management of organisations made the best strategic decisions and implemented them, having a beneficial impact on firm performance, the study reveals that more frequent board meetings predict inferior performance (Agyei-Mensah,

2021; Conger et al., 1998; Grove et al., 2011; Jensen, 1993; Jensen & Meckling, 1976; Mangena & Tauringana, 2008; Musleh Al-Sartawi, 2019; Vafeas, 1999).

A larger audit committee size in Cluster 1, consisting of US shareholder-oriented banks following the agency theory, was found to be an unimportant governance mechanism related to market performance as none of the performance models were affected statistically significantly. The results of Cluster 1 are supported with previous literature and the empirical works of Abbott et al. (2004), Soliman and Ragab (2013), and Xie et al. (2003), all of which determined that no significant relationship is present between the audit committee size and a company's earnings.

A larger audit committee size in both market-oriented clusters (2 and 4) following the stewardship theory (the multinational market-oriented cluster that follows the stakeholder theory with a mixture of stewardship and agency theories along with the Japanese two-tiered market-oriented cluster following the stewardship theory) was found to negatively affect market performance of banks. These results from Clusters 2 and 4 are supported by previous literature. Ebrahim (2007) and Xie et al. (2003) identified a negative relationship between audit meeting frequency and a firm's performance. The findings of audit committee size in Cluster 2 and Cluster 4 are supported by Krishnan (2005), who found a negative association between the governance issues and the size of the audit committee. Based on the stakeholder theory, a large audit committee generates more delegation of power among members. This behaviour, however, may lead to negligence and delay of duty, which can cause more opportunistic behaviour within the audit committee. Anderson et al. (2004) revealed that the size of the audit committee and the number of their meetings were negatively correlated with the performance gaps, while Cornett et al. (2009) found that the audit committee size systematically influenced the management of revenues, and Pincus et al. (1989) found that larger audit committees were expected to allocate resources to oversee the financial and accounting reporting process. Researchers supporting a smaller audit committee size, such as Baiden (2020), Indrawan et al. (2018), and Xie et al. (2003), have provided evidence that smaller-sized committees tend to have greater participation due to higher oversight and to enhance income smoothing practises.

Eichenseher and Shields (1985) found that large audit committees are less participatory, and Hackman (1990) has stated that the larger a committee, the slower its decision-making process. In contrast, more members serving on the audit committee of the US shareholder-oriented banks following the stewardship theory were found to affect market performance positively and

statistically significantly. The results of a larger audit committee size in Cluster 3 endorsed the agency and resource dependency theories and were supported by previous literature and empirical works that recommend large audit committees as they are considered more effective due to increased resources (Rahmat et al., 2009) and the high range of diversity in their knowledge and experiences (Li et al., 2012). Several other studies have also evidenced the impact of audit committee size on performance (Armstrong & Gyimah, 2019; Ashari & Krismiaji, 2020; Chiu et al., 2001; Chou & Buchdadi, 2017; Dinu & Nedelcu, 2015; Gebba & Aboelmaged, 2016; Al-Matari et al., 2014; Sattar et al., 2020; Yang & Krishnan, 2005; Zhang et al., 2007). Researchers such as Anderson et al. (2004) and Krishnan and Visvanathan (2009) showed that a large audit committee provides strong oversight, improves governance quality, and increase the degree of disclosure and transparency. Anderson and Reeb (2003) similarly revealed that the larger the audit committee, the greater the availability of information on the governance quality for the users of financial statements, thereby positively and directly influenced profits.

The audit committee meeting within all G7 banking clusters was found to be one of the most important governance mechanisms relative to market performance. Generally, the findings of this study related to the activity of audit committees support the view that auditing is composed of the managerial and financial tools utilised to monitor upper management with the aim of protecting existing investments by owners and stakeholders and attracting foreign investments. Ghazali (2010), Kallamu and Saat (2015), and Rustam et al. (2013) also corroborated this definition and highlighted the importance of the audit committee with its overseeing capacity as a monitoring role which is the essence of corporate governance and helps with controlling management practises (Afify, 2009; Campbell & Mínguez-Vera, 2008). Among the primary responsibilities of audit committees is their involvement with the appointment of the external auditors (Aldamen et al., 2012; DeZoort et al., 2002). Besides their monitoring, it is also believed that audit committees boost the quality of reported earnings due to improved financial reporting and lowered audit risk (Abernathy et al., 2015; Contessotto & Moroney, 2014). The characteristics of the audit committee highly impact its effectiveness, with elements such as size, expertise, and independence acting as the forefront of its impact. A suitable combination of these characteristics enhances its effectiveness, thus leading to improved performance (Carcello & Neal, 2000; G. F. Peters et al., 2003; Rustam et al., 2013).

Several studies have been conducted (and continue to be undertaken) to study the impact of these characteristics on organisational performance (E. M. Al-Matari et al., 2012; Aldamen et al., 2012; Dellaportas et al., 2012; Herdjiono & Sari, 2017;

Kallamu & Saat, 2015). In regard to the influence of audit committee meetings on banking groups' market performance within the G7 countries, more frequent meetings of the audit committee affect positively and statistically significantly market performance as measured by the P/E for banks in clusters affected positively and statistically significantly in the first 3 clusters, namely; Cluster 1) US shareholder-oriented banks that follow the agency theory, Cluster 2) the multinational market-oriented banks that follow a mixture of theories are found to be affected positively from active audit committees, and Cluster 3) the US shareholder-oriented banks that follow the stewardship theory. The results of the P/E for the first three clusters are supported by the findings of scholars such as Anghel and Man (2014), Beasley et al. (2000), Persons (2009), and Raghunandan and Rama (2007), all of whom have provided evidence concerning the importance of frequent audit meetings for a company's performance, profitability, financial quality and growth. The findings stem from the theory that when a committee meets more frequently, they become better informed, more efficient, and more reliable to take suitable decisions. Anghel and Man (2014), Beasley et al. (2000), Bryan et al. (2004), Persons (2009), Raghunandan and Rama (2007), and Soliman and Ragab (2013) have also corroborated the results by findings that suggest more frequent audit committee meetings lead to better quality in financial reporting, and higher disclosures. On the other hand, more frequent meetings of the audit committee in Cluster 3, comprising US shareholder-oriented banks following the stewardship theory, are found to have negative impact on market performance measured by P/BV and dividend yield which contradicts the agency and resource dependence theories and are supported by the findings of Ebrahim (2007) and Xie et al. (2003), which identified a negative relationship between frequency of audit committee meetings and firm performance.

Audit committee meetings in Cluster 4, consisting of Japanese two-tiered market-oriented banks, were found to be an unimportant governance mechanism relative to market performance. The results were supported by previous studies such as those generated by Baxter and Cotter (2009) and Lin et al. (2006), who explained that lower meeting frequency means less time to resolve important issues, thus preventing the audit committee from performing its expected role efficiently. However, this might be due to the fact that Japanese corporate governance mechanisms are 'relation-oriented' or bank-centred systems whose features consist of two points. First, Japanese corporations were believed to adopt lifetime employment systems and directors were often elected from among the senior management of the company, which is regarded as "internal" promotion. Auditors were also elected from among senior managers who could not be promoted to become directors of their firms. Second, Japanese bank-centred systems represent commercial banks' ties and financial keiretsu memberships, as stated by Aoki (1990).

The results of the director's independence for banking groups in the G7 countries, and more specifically Clusters 1, 2 and 4, advocate the UK's Higgs Report (Higgs, 2003) and the US's Sarbanes-Oxley Act of 2002, both of which emphasise the significance of director independence for listed firms. While the terms 'outside director' and 'independent director' are mostly used interchangeably, this essay provided a clear distinction between the terms, defining the former as a non-executive director on the board and the latter as an outside director with no material relationship with the firm. This essay found that a greater number of independent directors serving on the US shareholder-oriented banks that follow the agency theory (Cluster 1) and the multinational market-oriented banks following a mixture of agency and stewardship theories had a positive impact on market performance as measured by P/E and P/BV respectively. These findings endorse the agency theory that promotes the role of independent directors and undermine the stewardship theory that favours inside directors over outsiders (independents) and is supported by previous literature and research which states that independent directors are able to better monitor the performance of management as they value maintaining their strong reputation in the directorship market (Fama & Jensen, 1983).

From a financial aspect, a board with independent directors may lower the cost of a firm's debt, decrease its systematic risk and cost of equity, and increase its credit rating (Anderson et al., 2004; Ashbaugh-Skaife et al., 2006). The presence of independent directors is also imperative for banks as they tend to improve the quality of earnings and offer proper compensation incentives to management (Cornett et al., 2009; Mishra & Nielsen, 2000). However, the presence of independent directors in both market-oriented clusters following a mixture of stewardship theory (Cluster 2, the multinational; and Cluster 4, the Japanese) were found to have a negative relationship to market performance as measured by the P/E. These results undermine the agency, stakeholder, and resource dependence theories and support the stewardship theory, which suggests that outside directors (independents) are less effective in monitoring activities compared to inside directors (executive management). The latter are deemed to hold more valuable information due to their involvement in a firm's activities, which enables them to assess top managers fairly and accurately. These findings are also supported by the previous literature and empirical works of De Andres and Vallelado (2008) in particular, who analysed an international sample of banks over a 10-year period from 1995 to 2005 with a one-tier board structure. The sample generated an inverted U-shaped relationship between external directors and bank performance, and revealed that, although the inclusion of external directors improves performance, the results begin to shift and performance starts to worsen if the proportion of independent directors is high. Moreover, Erkens et al. (2012) showed that bank

boards with a larger number of independent directors experienced the worst stock returns during the crisis of 2007–2008 when investigating 296 large financial firms from 30 countries during that period. The independent directors of firms in this sample were found to have encouraged managers to raise equity capital during the crisis to ensure capital adequacy and reduce the risk of bankruptcy. Accordingly, the firms were unable to utilise short-term loans against these declined assets and were forced to raise capital, which impacted returns.

In Cluster 3, the number of independent directors serving on boards as a governance mechanism was found to be unimportant for banks' market performance. This might be due to the governance behaviour of banks in this cluster, which follow the stewardship theory, supporting insiders at the expense of outsiders. These results are supported by previous empirical studies that found independent directors have no significant relationship with banks and other nonfinancial firms (Choi et al., 2007; Minton et al., 2010). Therefore, the nature of the relationship between market performance and banks in G7 countries supports the argument that outside directors' skills and the knowledge they offer to the banks are of no importance to their market performance.

With regards to female directors serving on banks' boards in the banking groups of G7 countries, it was found that a more gender-diverse board impacts market performance positively and statistically significantly as measured by the P/BV among Clusters 2 and 3 and by the dividend yield among Clusters 1, 2, and 3. These findings, however, endorse the stakeholder and resource dependence theories and are supported by previous literature (Dalton et al., 1999; Hillman & Dalziel, 2003; Lorsch, 1989; Zahra & Pearce, 1989).

On the other hand, a more gender-diverse board in the US shareholder-oriented banks following the stewardship theory was found to have a strong negative effect on market performance as measured by the P/E, although the P/BV and dividend yield were affected positively. The finding in the P/E model of Cluster 3 undermined the stakeholder and resource dependence theories and is supported by studies that show a negative relationship between gender diversity and the performance of banks, as mainly measured by the ROA, ROE, and Tobin's Q. Among these studies, Rashid and Sajjad (2015) have found an inverse relationship between board gender diversity and banks' performance. Furthermore, Adams and Ferreira (2009) and Ahern and Dittmar (2012)

found that firms perform worsen when there was a large gender diversity, and these results were also confirmed by Boubaker et al. (2014) for French firms and Ali et al. (2014) for Australian firms.

However, due to the insignificant results of gender diversity in Cluster 3, the number of women serving on the board was considered important to market performance. It is argued that an optimal number of women serving on the board must be determined to ensure appropriate returns for the bank, as greater risk mitigation will eventually negatively impact market performance since the level of returns was associated with the level of risk taken. Thus, in order for banks to enjoy adequate returns, a balance of risk and return must be achieved. The number of women serving on the Japanese market-oriented banks' boards in Cluster 4 was found to be an unimportant governance mechanism relative to their market performance, as none of the performance models were affected statistically significantly. This indicated that the Japanese market does not react to the appointment of women on banks' boards. Further, the results were inconsistent with the stakeholder theory. The environmental, social, and governance disclosures were found to be an important governance mechanism relative to market performance among all G7 clusters. The findings of this study are also in line with previous empirical works which generated mixed results regarding the correlation between corporate governance and market performance.

The results of market performance in US shareholder-oriented banks following the agency theory were found to be positively impacted by the information flow related to governance and social aspects while negatively impacted by the environmental disclosures, while Cluster 2, the multinational market-oriented banks, which follow a mixture of theories, were all negatively impacted by ESG disclosures. In Cluster 3 (the US shareholder-oriented banks following the stewardship theory), social and environmental disclosures were found to have a negative relationship with market performance measures, although the dividend yield was impacted positively, which might support the positive results of both the P/E and P/BV as the dividend yield model consists of a denominator of market price. The results of Cluster 2 and Cluster 4 showed that, as the level of disclosure and transparency in managerial governance affairs increased, the market performance of banks likewise increases with a statistically significant effect. However, ESG disclosures in the Japanese market-oriented banks following the stewardship theory indicated that greater information flow related to governance and environmental aspects positively and statistically significantly affected market performance. Social disclosures, however, negatively impacted market performance. It is noteworthy that the Japanese

cluster was the only banking group within the G7 countries that was found to show a positive and significant relationship between market performance and environmental disclosures when compared to the other clusters.

Multiple studies have examined the correlation between risk and disclosure in the banking industry. It has been found that the disclosure of information about banks' current and future operations creates disciplined behaviour when it comes to risk-taking. Bliss and Flannery (2002) and Flannery (2001) have argued that market discipline depends on two aspects. First, it depends on investors and creditors' ability to properly assess a bank's condition and, second, their ability to influence the decisions taken by management. The degree of information disclosed impacts both of these aspects. In theory, greater disclosure offers more information to the market, which compels investors and creditors to assess a firm's condition carefully and accurately. Greater disclosure causes a significant market reaction to changing conditions, provoking an immediate response by management. According to Myers and Rajan (1998), banks are able to maintain a certain level of ambiguity mostly due to their ability to adjust their asset and risk positions as they see fit. It has been found that banks with high ambiguity tend to have greater allocations of assets with high liquidity (Hirtle, 2007; Iannotta, 2006; Morgan, 2002). Market discipline and greater disclosure therefore directly affect the behaviour of firms' management and constrains their risk-taking decisions, as any costs deemed to arise from increased risk would be completely assumed by the bank. As market prices become more risk-sensitive, regulators will intervene, thus influencing supervisory action (Flannery, 2001).

Corporate governance disclosure and transparency have grown increasingly important since the 2007–2008 financial crisis, as multiple studies identify the lack of financial disclosure and weak supervision by directors as the main causes of the financial crash. This has led to a greater demand for regulation and stricter requirements for disclosure while complicating accounting standards to protect market performance. Companies are required to disclose accurate information to their shareholders and the public concerning their financial performance, assets, liabilities, corporate governance, and ownership (Kosack & Fung, 2014). The relationship between corporate governance disclosure and a firm's performance makes clear that their correlation produces effective operations for internal and external mechanisms for governance (Chen & Lu, 2009).

Our findings concerning the CEO duality governance mechanism in Clusters 2 and 4 indicated that the presence of dual leadership roles (CEO/chairperson) increases market performance, although there was a negative impact on dividend yield in

Cluster 2 which might support the positive impact on the P/BV, as the stock price is considered a denominator in the dividend yield model. The results of both market-oriented clusters were consistent with the stewardship theory, which is based on the existence of a credible and trustworthy relationship between principals and agents, since agents should act for the benefit of the public interest and the shareholders in particular. CEO duality did not negatively impact corporate governance. The findings revealed that CEO duality lowers bank equity performance, but the finding provided a further two aspects that enable banks to excel. CEO duality may also have a beneficial effect on the likelihood of a bank default and/or risk-taking by lowering the possibility of a bank's instability and failure.

The findings around the positive impact of the presence of dual control as practised in Clusters 2 and 4 were inconsistent with the agency and stakeholder theories and contradicted BCBS (2006), Cadbury (1992), and OECD (2004), suggesting that the separation of roles between the chairperson and the CEO is a necessity. The agency theory emerged in order to solve issues regarding the relationship between the agent (manager) and the principal (shareholders/BOD) because it considers the agent as egocentric (Jensen & Meckling, 1976). The stewardship theory also asserts that the CEO is more knowledgeable and better informed about investment opportunities and firm strategies than a non-executive director (Weir et al., 2002). Supporters of this view add that duality allows the CEO to focus on the operation and the objectives of the company, which improves and accelerates the decision-making process and improves performance as a consequence (Haniffa & Hudaib, 2006). It has also been suggested that CEO duality reduces compensation and thus cost, and will increase accountability because the decision-maker is known (Bozec, 2005; Vafeas & Theodorou, 1998). Thus, it can be concluded that the duality of leadership role as a corporate governance mechanism should be reconsidered by policymakers, central banks, and market practitioners, depending on the social, ethical, and cultural aspects of each context.

In Cluster 1, the duality mechanism was considered a redundant parameter as the banking group in this cluster was regarded as shareholder-oriented and following the agency theory with 100% separation of roles. However, Cluster 3, the shareholder-oriented banking group following the stewardship theory, resulted in a negative relationship between the presence of dual control and market performance as measured by the dividend yield, which challenges the idea that CEO duality strengthens the effectiveness of corporate governance. The negative impact in Cluster 3 is supported by some studies that suggest that combining

the role of CEO and chair affects performance negatively (Jensen, 1993; Lipton & Lorsch, 1992), as it is argued that duality increases agency cost since the board has responsibility for compensating and remunerating the CEO.

The results of the unitary board type in Clusters 1, 3, and 4 were considered redundant in the analysis due to their inclusion of more than 99% one-tier boards in Clusters 1 and 3 and the two-tiered boards in Cluster 4. In Cluster 2, which consists of a mixture type of unitary boards, the results indicated a statistical insignificant impact among all market performance measures. Last, the independent director, who is also is a chairperson on the board in the US shareholder-oriented banks following the agency theory in Cluster 1, was found to have a strong positive and statistically significant impact on market performance as measured by the P/BV while negatively and statistically significantly affecting the dividend yield of the Japanese market-oriented banks following the stewardship theory.

The results of Cluster 1 support the agency and stakeholder theories and are supported by previous researchers who state independent directors are widely believed to be better monitors of managers as they strongly value maintaining their personal reputation in the directorship market (Fama & Jensen, 1983). An independent board might lower the cost of debt financing (Anderson et al., 2004), increase a firm's credit rating or lower its idiosyncratic risk, systematic risk and cost of equity (Ashbaugh-Skaife et al., 2006). Board independence is also important for banks, as it tends to help improve earning quality and provide compatible compensation incentives for managers (Cornett et al., 2009; Mishra & Nielsen, 2000), while the negative impact of the independent chairperson on the performance of banks in Cluster 4 is clear due to their governance practises, as Japanese banks follow the stewardship theory. This suggests that an outside (independent) chairperson is less effective in monitoring activities compared to inside directors (executive management) as outsiders hold less valuable information than those insiders who involved in a bank's day-to-day business.

Based on the results and discussion of this essay, this section provides recommendations to banks, policy makers, investors, market practitioners and central banks in G7 countries, with the aim of boosting their market performance (shareholder perspective), thus reflecting positively on the investment climate and the overall G7 market.

1. US shareholder-oriented banks following the agency theory (Cluster 1):
    - To reduce board size.

- To reduce board meeting frequency.
- To have more frequent audit committee meetings.
- To increase the number of independent directors serving on the board.
- To increase the gender diversity ratio of the board.
- To increase transparency scores related to governance and social aspects.
- To have better and effective information flow related to the environmental aspect while examining the rationale for the negative impact attributed to environmental information disclosed to the market.
- To consider having more independent chairpersons of the board.

2. Multinational market-oriented banks following the stakeholder theory and a mixture of stewardship and agency theories (Cluster 2):
    - To reduce board size.
    - To reduce board meeting frequency.
    - To reduce audit committee size.
    - To increase the number of audit committee meetings.
    - To increase the representation of women on banks' boards.
    - To have better information flow related to the environmental, social, and governance disclosures in parallel with investigating in depth the rationale for their market reactions towards the ESG disclosures, as they are considered one of the most important modern governance mechanisms that are related to transparency.
    - To reconsider the duality of CEO-Chairperson roles.
3. US shareholder-oriented banks following the stewardship theory (Cluster 3):
    - To decrease the number of board meeting frequency.
    - To increase the number of audit committee members.
    - To decrease and optimise the number of audit committee meetings.
    - To reconsider the roles and expertise of the independent directors.
    - To optimise the number of women serving on banks' boards.

- To increase transparency scores related to their managerial governance aspect.
- To have better information flow related to the environmental and social disclosures in parallel with investigating in depth the rationale for their market reactions towards the ES disclosures, as they are considered one of the most important modern governance mechanisms that are related to transparency.
- To limit certain banking practises related to the duality of roles of their CEO-Chairperson.

4. Japanese market-oriented banks following the stakeholder and stewardship theories (Cluster 4):
    - To lower the frequency of board meetings.
    - To decrease the number of audit committee members.
    - To reconsider the roles and expertise of their audit committee members, as none of the performance measures impacted statistically significantly as a result of their activity.
    - To decrease the number of independent directors serving on the board.
    - To reconsider the roles and expertise of female directors serving on the board.
    - To have higher governance disclosure scores.
    - To have better information disclosures related to the social aspect.
    - To increase the environmental disclosure score.
    - To continue to practise the dual leadership roles of CEO-Chairperson.
    - To reconsider having a non-independent chairperson on the board.

4.6. Conclusion

This essay aimed to develop a greater understanding of key issues related to the banking industry in G7 countries by investigating the impact of corporate governance on market performance with respect to 397 diversified and regional banks listed on the seven major advanced markets during the period 2011 to 2019. The Generalised Linear Mixed Models (GLMM) was used as the appropriate panel regression modelling technique due to its predictive power, which combines alternative panel regression modelling of random and fixed effects in a single modelling run. The use of the GLMM model was also due to the endogeneous nature of the dataset used in this study, as it was detected that corporate governance practises and market performance are affected by both cross-sections and time, which requires a powerful model with the ability to analyse complex covariance matrices in order to report valid, reliable, and stable results. This was supported by empirical literature on the international banking industry and other non-financial firms. The essay analysed the impact of various corporate governance mechanisms on market performance metrics, using data extracted from the Bloomberg online database and banks' annual reports, along with other statistical data extracted from the IMF and World Bank databases to investigate the governance practises and market data of various banking corporations.

The essay also furnished a new perspective on banks' market performance within the major advanced economies. The results of the G7 countries showed that corporate governance mechanisms generally had a statistically significant impact on the market performance of banks in G7 countries, with positive and negative contradictory relationships. Five out of eight corporate governance mechanisms (board size, audit committee size, board gender diversity, audit committee meeting frequency, and governance disclosure score) were found to significantly impact banks' market performance in G7 countries by at least one of the performance measures. However, the proportion of female directors on the board was found to be an unimportant governance mechanism, having no significant impact on market performance measures of banks in G7 countries.

Board size was found to be an important corporate governance mechanism negatively impacting the P/BV and positively impacting the price risk of banks in G7 countries while insignificantly affecting the P/E and dividend yield. This generally implied that a larger board size in G7 countries marginally worsens a bank's market performance and slightly increased market volatility and risk. It was found that active boards in G7 countries are an important governance mechanism for banks' market performance. The results further indicated that the number of board meetings minimally negatively and statistically significantly affected the

P/E and P/BV while the dividend yield and price risk were affected statistically insignificantly. This in turn suggests that more frequent board meetings of banks in G7 countries worsen market performance measures, which may imply that boards of directors in G7 countries meet too often during the fiscal year, causing coordination and communication issues, conflicts, and distractions for the management, thereby lowering productivity. Higher board meeting frequency was also directly associated with higher costs in the short term, while the importance of board members' experience, as stated in the literature previously discussed, is noted.

Larger audit committee size regressed positively in only one area of market performance measured by the dividend yield while being considered irrelevant on the remaining metrics. The results showed that audit committee size was an important corporate governance mechanism significantly associated with banks' dividend yield in G7 countries. The findings support the agency and resource dependency theories, as larger audit committees in G7 countries are found to be more effective from a shareholder perspective in performing reliable monitoring due to the diversity in experience, knowledge, and opinions offered by larger committees, which in turn improves banks' overall performance, thus leading to an increase in dividends. The results may also indicate that large committees will have the ability to monitor the accounting process and financial reporting, which results in greater transparency and ultimately improves performance, although a very large audit committee may lead to inefficient governance and poor performance due to communication problems and conflicts with management.

The number of audit committee meetings of banks in G7 countries was found to be one of the most important corporate governance mechanisms related to market performance. The results showed that more frequent audit committee meetings impact the P/BV and dividend yield negatively and statistically significantly while minimally increasing market volatility. This may possibly indicate that in G7 countries a higher frequency of audit committee meetings may shake investor confidence due to the nature of the committee's duties, which include internal control/risk management activities and disclosures that may signal pessimistic decisions relative to banks' operations, projects, and outlook.

A high percentage of female members on a BOD tended to be an unimportant mechanism in relation to market performance, having no statistically significant impact on the G7 countries' banks' market performance. These findings contradict the stakeholder theory and resource dependency theory, as the results suggest that women are risk-averse by nature, thereby

shaking market confidence, as greater risk mitigation may limit growth. Moreover, the findings may indicate that women on boards reduce the unity of board members and cause greater dissimilarity, adversely affecting the quality of decision-making, although they may provide cognitive diversity and financial stability, thereby improving the effectiveness of monitoring and the overall performance.

The number of independent directors serving on banks' boards in G7 countries was found to be an important governance mechanism relative to market performance measured by the P/BV and price risk. The results showed that outside directors are positively associated with banks' P/BV while slightly lowering their price risk. This may be due to the fact that the role of independent directors on G7 banking boards is biased towards shareholders while maintaining the risk level of a bank, with the aim of securing the interests of minority and majority shareholders through the practise of excessive monitoring. Although outsiders generally prefer increasing equity capital to secure debtholders' interests, the results of G7 countries specifically show that the market value of equity increases relative to shareholders' equity.

Banks in G7 countries that achieve high governance disclosure scores showed improved market performance. More publicly disclosed information positively significantly affects the P/E and P/BV while lowering the dividend yield. However, the negative impact on the dividend yield may be due to the increase in stock price, considered as a denominator in the dividend yield equation, according to the findings of both the P/E and P/BV models.

The findings of this essay revealed that governance disclosure is the most important mechanism relative to banks' market performance in G7 countries. This implies that banks that practise greater disclosure of governance information increase both investors and overall market confidence, ultimately boosting their market value. These results are consistent with other empirical studies indicating that banks and non-financial firms with greater disclosure of information allow investors and creditors to properly assess a firm's condition, leading markets to react immediately and significantly.

The duality of the chairperson and CEO leadership role was found to be an important governance mechanism with regards to the G7 banks' market performance. The results showed that the presence of CEO duality negatively significantly impacts the P/E. These findings also affirm the agency theory whereby the duality of roles is claimed to lead to agency problems, which in turn leads to poor corporate performance. It is argued that by combining the roles of CEO and chair, consistent with the stewardship

theory, a board's monitoring function becomes less effective and compromised while generating difficulties in the flow of information (transparency). Furthermore, my findings support corporate governance codes and regulators' recommendations that the leadership roles should be separated. Therefore, from a shareholder perspective, it is essential for banks in G7 countries to ensure a separation of roles between the CEO and chairperson in order to implement equity governance practises, increase transparency, introduce more effective monitoring, establish sound decision-making, and enhance overall bank performance. Additionally, the data demonstrated that the CEO-chairperson roles should be separated to ensure effective risk-taking and improve the market performance of banks to ensure that returns are not jeopardised while still meeting the objectives of shareholders, although there was some evidence that, when the CEO-chairperson role is operating, there is a greater chance that a bank will perform better from a market aspect (if the individual does indeed act transparently and ethically).

This essay finds support for previous arguments which conclude that boards and committees composed of members with a greater diversity of skills, business contacts, and experience will ultimately produce a greater positive level of influence in guiding and monitoring banks' activities and thus improve their overall performance. Controversially, boards that include substantial numbers of women who are over-represented on audit and board committees and incorporate more frequent audit committee meetings might have a detrimental impact on banks when communication-, coordination-, and conflict-related problems occur. Consequently, conflicts, inefficiency, and delays may result in slower decision-making and lower performance. The most suitable corporate governance values will depend on each bank's particular situation. Nevertheless, the results prove that outsider representation on boards and audit committees should be reviewed carefully, since excessive representation may lead to inefficient governance and lower performance due to its role in securing stakeholders' interests, including those of depositors and minority shareholders. In addition, outsiders might lack the knowledge of complex banking operations and may not function properly due to their social relations with major shareholders or lack concentration as they are part-time may not be fully focused on a bank's activities.

This essay's findings make more apparent that the design of bank governance practises is critical in determining banks' market performance. The findings show that if sound corporate governance practises are applied to banking, a positive effect will ripple through to society due to the significant impact of the banking sector on the world economy. When considering whether to put in place a new type of corporate governance, BODs and senior management must keep in mind the connection between their

internal governance processes and market performance. My results demonstrate that banks with effective corporate governance gain market success.

This essay recommends that banks exercise proper corporate governance to encourage potential investors and depositors. On the basis of our findings, the governance disclosure score proved to be the strongest mechanism, impacting market performance measures both positively and significantly, which indicates that greater information flow provides investors (both shareholders and depositors) with security and confidence. Thus, banks should exercise high transparency and promote it in their operations. Consequently, proper disclosure serves as a method of commitment, obliging banks to provide adequate information to the market regarding their current condition and future plans and therefore limiting their ability to adjust their risk profile in a way that may cause disadvantages to creditors or investors, which in turn enhances banks' performance, specifically from their shareholders' perspective.

Additionally, this essay recommends that banks and regulators in G7 countries take necessary action to improve their market performance by slightly decreasing the number of audit committee meetings and board meetings. Furthermore, banks ought to practise greater transparency by ensuring a high quality of governance disclosures. These corporate governance mechanisms should then be optimised to guarantee a balanced tradeoff between their advantages and disadvantages to ensure that equity governance practises are in place, in parallel with maintaining a suitable number of independent directors serving on the boards and separating the roles of CEO and chairperson.

Moreover, the utilisation of an optimal board size, meeting frequency and board composition of female and independent directors, while ensuring the presence of members with diverse knowledge, skills, and experiences, leads to an enhancement of banks' market performance in regard to enhancing efficiency and making appropriate decisions. Audit committees serve the interests of shareholders, and more accountable board conduct may be achieved when the ideal size and meeting frequency of board audit committees are established.

Finally, effective, and equitable corporate governance practises in the major advanced economies is vital for the growth and expansion of the world economy towards a more sustainable global ecology, as good governance practises of banks in G7 countries will help reduce failures in the banking system, attract significant sources of funds and foreign direct investments, and

generate more diversified and accelerated investment portfolios. Central banks and regulators in G7 countries should therefore review their corporate governance regulations, policies, and frameworks to oblige banks to assess their corporate governance practises from different stakeholders' perspectives and to ensure optimisation of equity practises and sustainable development of all banks, societies, and the world economy in general.

In summary and based on all the results generated for the overall governance practises in G7 countries, as well as the segmentation of G7 and G20 governance mechanisms and their effect on market performance, it is clear that corporate governance practises can be deemed important and significant for market performance. That said, their degree of importance and impact varies according to time, geography, and culture. Therefore, to ensure their effectiveness, the adopted governance practises are required to be dynamic and extracted from a flexible framework, with the aim of contributing towards economic growth and development both at micro and macro levels. This allows for a healthy investment climate, which is considered one of the most important factors in achieving sustainability, thus producing a cyclical environment which directly and indirectly benefits the interests of the institutions practising these frameworks, even if these practises show a negative impact on organisational performance in the short term.

Accordingly, and to facilitate the adoption of dynamic and flexible governance frameworks among regulators and underlying institutions, all relevant stakeholders must adopt best-fit practises based on an organisational strategy and architecture that revolves around growth and financial sustainability from a holistic ESG point of view while effectively monitoring corporate performance in the direction of desired goals. The organisational strategy must focus to enable flexibility within the banks to create a dynamic governance structure, namely research and development, with a focus on intellectual property, in order to build and continuously develop machine learning and artificial intelligence modelling to optimise governance practises in the direction of sustainability goals. This can be achieved by banks being adaptable to change and utilising the latest and most advanced information technology systems to improve transparency levels through information flow. Higher transparency levels and use of technology go hand in hand and lower the need for human intervention. Banks are therefore required to implement well-regulated and highly governed data as data governance is the backbone and main nerve to activate and enable machine learning and AI under the rubric of the modern Dynamic and Systemised Capabilities Governance Model.

Based on the above, there is a gap to be tackled by future researchers on how to utilize digital technologies in banking CG in order to have a dynamic framework that impacts positively on the sustainability of both the macro and micro level; therefore, futures studies should be done in terms of digitalisation and future of banking corporate governance.

This study relates to market and financial performance in essays 1 and 2 respectively. Accordingly, essay 3 will focus on the future of corporate governance, revolving around Decentralised Ledger Technology (DLT), which allows the real-time transfer, protection and storage of data, as is the case with cryptocurrencies and the enablement of the digitisation of banks and its relation to corporate governance mechanisms.

Chapter Five

5. Essay Three: Emerging Technologies, Digitalisation, and the Future of Banking Corporate Governance

5.1. Introduction

In a general sense, corporate governance can be defined as the effective decentralisation and delegation of authorities and responsibilities through boards of directors (BOD) or senior management so that proactive control of bank affairs can be carried out diligently (Hopt, 2021). In light of this, the primary and prioritised objective behind corporate governance in banks can be regarded as the safeguarding of stakeholders' interest in compliance and consideration of public interest on a long-term basis. In a particular context, the mechanism through which control can be exercised in these circumstances could either be the BOD, internal controls, compensation or balancing power. Corporate governance in supply chain finance in this regard is about the governance of the intermediaries that facilitates the transaction between both parties. Although supply chain finance is dynamic, it can be stated as tech-based financing and business processes that work to improve the efficiency of the parties while reducing cost incursion (Saudi et al., 2019). In the contemporary era, banking processes have induced greater flexibility, however, the level of risk associated with it has significantly increased over time. Supply chain management online and offline in this respect has become a necessity rather than an alternative (Hryhorak et al., 2021) Consequently, the strength of these practises has increased exponentially since the rise of fintech companies that have potential with the use of sophisticated technologies such as blockchain and cloud computing Concerning these changes in the banking sector, the research study will seek to highlight and evaluate the future corporate governance in banking.

In the current age of digitalisation, many financial institutions situated globally are experiencing a sudden need for transformation concerning operations to derive more economic benefits whilst inducing more security and stability. Digital technology is a rising trend that minimises the gap between organisations and investors, as the digital system enhances the accessibility of information. The digital era is not only favourable for any particular industry, it is also productive for different industries, including banking, retail, telecom and many other economic sectors. Consequently, many trends are rapidly emerging within the corporate governance of banking institutions that are more flexible and customer-oriented, such as optimised reality,

wherein technologies including artificial intelligence cater to customers' needs as it also monitors their movements. Similarly, following the trend of ethical impact, service personalisation is provided to customers, prioritising their well-being over monetary benefits (Effah et al., 2022).

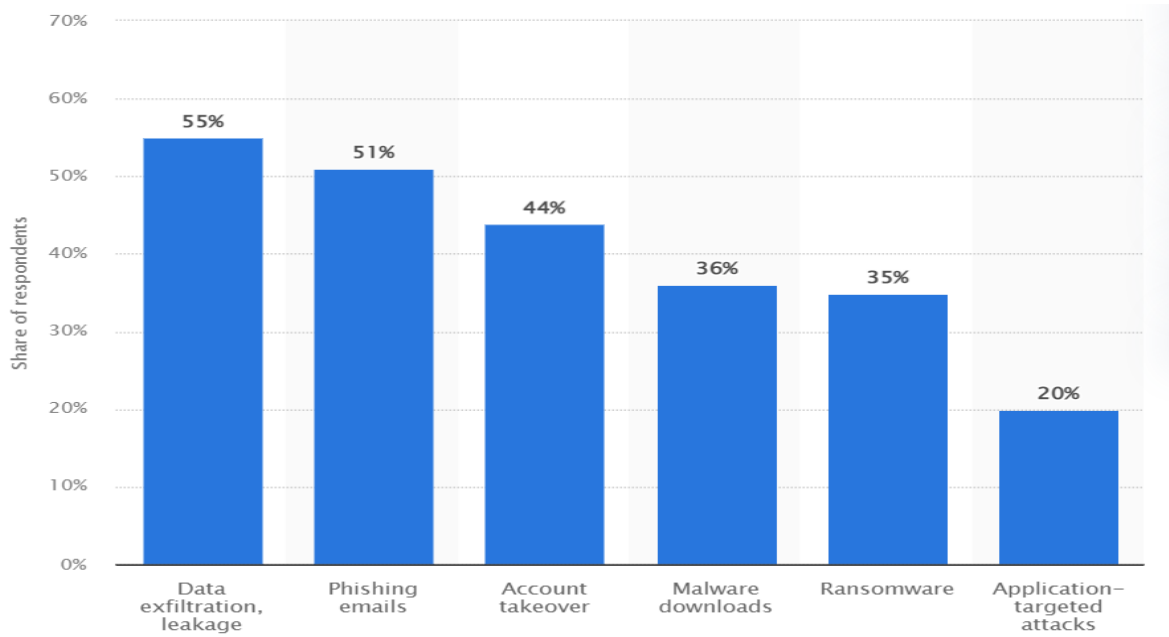
Corporate governance in the banking environment has always been a tough job to handle in the rapidly changing governance landscape. More strategic policies and relationships are continuously shaped in light of stakeholders' requirements. In this regard, corporate governance from the perspective of the banking industry should consider people, process, performance and purpose, elements sometimes referred to as the 4 Ps of corporate governance (Klein, 2016). Each element encompasses a key area that should be considered before setting and implementing any strategy within the organisational infrastructure. For instance, monetising data governance evaluates the worth of information for an organisation's internal functions as well as provides an external cash stream.

As banks mostly emphasise service improvement rather than service addition, they rely on innovative solutions and ways to facilitate customers with prompt service experience. In this regard, according to a survey from 2018 concerning technological solutions, around 70% of senior bank executives thought collaboration with big-tech and fintech companies was a huge opportunity for them to introduce new services to generate more revenues. Consequently, around $112 billion in investment was made into fintech companies worldwide, which was reported to be very high in the industry (Statista, 2021). In a similar context, the emergence of cryptocurrencies has paved new avenues for the banks, providing much-needed credibility and stability in an unbridled environment. Despite the instability that is associated with cryptocurrencies, many private banks have separate divisions within their premises which are responsible for handling cryptocurrency transactions. Many private and public banks in the UK charge customers transaction fees that are applicable in every transaction customers make through bank channels; this practise sometimes becomes the major reason behind customers' lack of involvement with the banks (Athanassiou, 2021). However, cryptocurrencies enable peer-to-peer exchanges to operate without a regulatory intermediary.

Embracing sophisticated technologies has emerged as essential for banks to support the utilisation of cryptocurrency. For instance, blockchain technology is not just capable of delivering peer-to-peer transaction security but simultaneously also capable of safeguarding tangible and intangible resources from the activities of cyber-crimes (Ghosh et al., 2020). The COVID-19

epidemic accelerated the proliferation of cyber-crime organisations worldwide, particularly in the areas of data exfiltration and phishing attacks, as shown in Figure 5:1 (Statista, 2021). Thus, blockchain technology, which works on a consensus and a distributed ledger mechanism, provides banks with much-needed transparency to operate from a stable stance.

Figure 5:1 *Increased Cyber-Crime Following COVID-19*



- *Source: (Statista, 2021)*

Conversely, there are several disadvantages to utilising cryptocurrencies and blockchain for the corporate governance of banks. In this regard, one of the major challenges attached to their adoption is a poor financial base. Banks that operate in a highly capitalistic market have more flexibility regarding their adoption. Banks such as JPMorgan Chase and Bank of America, who are considered as vanguards of innovation, have distributed their expenditure budget in 2018 to be 50/50 and 30/70 respectively between 'change the bank' and 'run the bank'. The only banks that can match such spending are the big Chinese banks and HSBC (Noonan, 2018). In 2018, the percentage of assets, IT spending in US regional banks is higher by percentage than in mega banks, as shown in Figure 5:2.

Figure 5:2 *Bank Tech Spending as a % of Assets ($ in Billions)*

Similarly, disintermediation is another disadvantage, as blockchain facilitates peer-to-peer transactions; this removes all the intermediaries that usually facilitate this arrangement in a secured way (Amsyar et al., 2020). This practise could ultimately result in the reduction of jobs which might disrupt the operations of the bank, although with fewer working personnel, corporate governance can also be easily maintained. Furthermore, this will reduce the extra expenditure that banks usually employ in ensuring privacy and protection of the data and resources of the customers while removing the operational cost of the banks by reducing the human input in the services (Blémus et al., 2020).

The main aim of this research is to investigate and assess the future of corporate governance in banks in term of digitalisation and emerging technologies. To support this aim, the research will focus on the following objectives in a structured and cohesive manner in order to present a coherent research project:

- To determine the role of DLT/ blockchain technology in banking business and operations.
- To analyse DLT/blockchain technology governance frameworks in banking and decentralised autonomous corporate governance.

- To conduct a comparative investigation of countries that allowed digital trading currencies, especially cryptos, and countries which have banned or restricted trading, and why they banned it, if possible (benefits and risks).
- To empirically examine the impact of emerging digital technologies and digitalisation on the G7 banking system's corporate governance mechanisms, stability, and performance.

Companies in the financial services industry are becoming increasingly interested in distributed ledger technology (DLT), which is viewed as a potential savings generator for infrastructure and back-office processes. Moreover, DLTs may become a catalyst for the development of new digital enterprises, resulting in new revenue streams. However, DLTs are not yet suitable for widespread adoption due to unresolved technological, operational, business, and regulatory challenges.

Blockchain technologies are hailed as the next major disruption in the financial services industry. Potential applications may indeed offer enormous benefits to the industry and spawn an entirely new generation of services. However, there are numerous legal uncertainties that must be resolved.

Since this essay aims to shed light on the general characteristics of banking's future corporate governance as well as the anticipated effects of emerging digital technologies and innovation on banking governance practises, stability, and performance, the following research questions have been developed:

a) The following RQs that will be addressed in the thematic analysis of previous literatures:
   - R.Q.1: What factors are responsible for influencing the rising role and significance of blockchain technology in corporate governance
   - R.Q2: What is the role of digital transformation and blockchain technology in banking system operations
   - R.Q.3: What is the impact of the rising role and significance of blockchain technology in the corporate governance of banking institutions?

b) The following RQs that will be addressed in the positivism deductive paradigm:
   - R.Q.4: To what extent do emerging digital technologies, and digitalisation have an influence on corporate governance practises and transparency of banks in G7 countries?

- R.Q.5: What is the impact of advanced information and communication technologies and digitalisation on the G7 banking system's financial sustainability?
- R.Q.6: How do emerging digital technologies and digitalisation affect G7 banks' sustainability in the presence and absence of duality of CEO/chairperson roles?

Corporate governance in banks appears to have been highly vulnerable and influenced due to the recent technological advancements and improved strategies that have been constantly deployed by fintech companies. These technological advancements and transformations are working as a catalyst and chain reaction in bringing improved practises by banks in the contemporary world (Hanafizadeh & Amin, 2022). Similarly, during the COVID-19 pandemic, many financial institutions, including banks, have had to manage the scale of interest rates and public debt rates at extremely low percentages due to both government pressures as well as for self-survival. Along with this, cyber-crime related activities also received a major boost that ultimately challenged the security levels of the banks' operations systems, for instance, the security of data and funds. Data breaches, transaction issues, and unnecessarily prolonged waiting times have all become prevalent and have been compared to other services (Mersha & Workou, 2020). In light of these existing frameworks of corporate governance, this essay will throw light on different domains of corporate banking and examine the interrelated role of blockchain technology within a multi-organisational context.

Transparency and information disclosure are seen as critical components of corporate governance. This includes financial reporting, boards and systems to improve disclosure, ownership and governance disclosure and information asymmetry (Agyei-Mensah, 2016). Banks, like various limited liability corporations, are formed to increase shareholder wealth or increase the company's value, not only revenue. Authorities must use their judgment, expertise, and impartiality to run the company while putting the values of shareholders first. In actuality, corporate management frequently ignores the interests of shareholders for self-enrichment, resulting in a detrimental influence on the banks' performance. Shareholders possess a keen interest in the funds of the company, which are managed effectively to maximise profits. The complications in the banking processes and risks have been affecting the interests of the shareholders. Thus, knowledge about the significance and implication of corporate governance in banking would be worthy research for attaining the goal of stakeholder relationship management and goodwill as a whole. Corporate governance is an indispensable requirement in the banking sector to ensure trust, integrity, credibility, accountability

and transparency. The direct and significant relationship of corporate governance with various components that drive and strengthen banking institutions' position and performance would be worth researching to gain insight into components that relate to the stakeholder's interests (Hopt, 2021). The components connected to corporate governance effectively guided banking organisations and facilitated operational control.

Besides this, corporate governance integrates internal and external governance for effective banking operations. Thus, exploration of the subject of corporate governance in the contemporary period in this proposed study would provide an opportunity to develop adequate practical and implied knowledge. The considerable importance of corporate governance in the banking sector has been driven home after the financial crisis because ineffective corporate governance was identified as one of its significant causes. Because the banks' insolvency resulted from their poor management and decision-making, governance must be effective Understanding the need of strong corporate governance is crucial for ensuring financial stability and sustainable financial performance in the era of digitalisation and digital finance. Interlinks between corporate governance and solvency or financial stability can be determined with this proposed research in the context of the financial crisis, a critical event, that would also contribute toward real-time and practical knowledge enhancement.

Banks are enticed to take calculated risks since they usually depend on the funding of the depositors. For instance, when high-risk investments have the potential to make the intermediary more money, depositors will share a significant portion of the costs if the transaction fails. Because debt holders' loans are typically short-term, banks are forced to reapply for more funds. Renegotiation of debt will prove to be challenging for banks as their obligation is distributed among numerous small depositors, making the process more complicated (De Haan & Vlahu, 2016). In this regard, the potential of blockchain technology in recent decades has received a lot of attention; as a result, many research studies have been conducted to analyse its applications in different sections of an economy. The application of blockchain technology in the banking sector has been gaining importance in recent times, but it is still not highly adopted and prevalent across global banking institutions. Blockchain technology application is beneficial for banking organisations to maintain transparency, security integrity and decentralisation (Chowdhury et al., 2021). Digital ledger feasibility with blockchain technology provides an advantage in tracking and verifying transactions that lessens the risk of scams and fake transactions. Besides this, blockchain technology also renders various benefits, such as huge transactions and lower operational expenses. Survey results conducted by IBM in 2016, published in a study by Kawasmi et al. (2020), reflected

that 66% of the total sample of banks (i.e., 200 banks from 16 countries) showed interest in adopting the new technology, and the application of blockchain technology in the banking industry is increasing. In the UK, Goldman Sachs, HSBC, Deutsche Bank and Bank of England have been using blockchain technology in banking transactions such as Bitcoin, bond transactions, trade finance, remittances and real-time gross settlement.

Similarly, banking institutions in the US, Germany, India, Spain, Canada, Japan, UAE, China and Singapore have also applied blockchain technology. Thus, the current adoption of blockchain technology is more than just projection (Kawasmi et al., 2020). The viewpoints of the professionals working with commercial banks in this study have also revealed higher interests of the banking institutions in exploring and applying blockchain technology for managing banking transactions like payments. The banking industry's positive disposition towards adopting blockchain technology prompts interest in understanding the reasons behind the rapid acceleration of such technology (Ullah et al., 2022). Conversely, certain banking organisations do not perceive the adoption of blockchain technology as posing a danger to the current system. (Kawasmi et al., 2020). The positive and negative outlooks of banking institution professionals in the context of blockchain technology, smart contracts, artificial intelligence, and big data analytics have been the motivation for conducting research into this area since the application of these technologies assures transparency and security, which are critical components of corporate governance. This proposed study will provide an opportunity to critically explore risks or impediments in the blockchain technology adoption in the banking industry.

Blockchain's role in the banks is also discussed, but only done with the purpose of assessing its pros and cons. Previous studies have not undertaken any special research on this subject, resulting in a limited grasp of the future of corporate governance in banking in relation to innovative digital practises. Hence, by acknowledging this disparity, this research endeavor will prove valuable to policymakers engaged in this domain, enabling them to formulate well-defined and impactful policies by drawing upon the insights derived from this specific study.

5.2. Methodological Framework

5.2.1. Introduction

This essay aims to analyse the future of corporate governance in the global banking sector. In this context, the research methodology chapter provides general information about the research philosophy, approaches and design adopted to address the research area most effectively. Furthermore, the present chapter highlights the research philosophy, approach, and design used by the researcher supported by explanation of the choices made. At last, the following two chapters will address the detailed methods of data sampling, collection, and analysis whereby; section 5.4 present the thematic literature review methodology while section 5.5 presents the positivism deductive research methodology.

5.2.2. Research Philosophy

According to Brinkmann (2018), research philosophy refers to collecting the data for the research purpose. Therefore, it is crucial for the overall progress and result of the research. There are three major research philosophy categories: interpretivism research philosophy, pragmatism research philosophy, and positivism research philosophy (Brinkmann, 2018). In order to analyse the future of corporate governance in the banking world, the essay uses two methods whereby the first methodology is concerned with thematic analysis of previous literatures and theory while the second methodology follows the positivism-deductive research paradigms in order to gather information with the help of more than one data collection method through a mixed method approach (Shusterman, 2016).

As the objectives of the present research also focus on the increasing use of emerging digital technologies and digital transformation such as blockchain, smart contract enabled by Artificial-Intelligence, Big Data analytics, Cloud Computing among other advanced technologies in the banking sector, it is essential to use mixed-method research approach that addresses the aims and objectives effectively.

Pragmatic research assists in interpreting the world and conducting research from various aspects to explore reality via the combination of two or more different approaches that may provide a broader understanding of the research phenomena. Pragmatism is usually related to mixed-methods (Johnson & Onwuegbuzie, 2004; Morgan, 2014). A major underpinning of pragmatist philosophy is that knowledge and reality are based on beliefs and habits that are socially constructed (Yefimov, 2004).

Pragmatists believe that the process of acquiring knowledge is a continuum rather than two opposing and mutually exclusive poles of either objectivity and subjectivity (Goles & Hirschheim, 2000). Thus, pragmatism is situated somewhere in the center of the paradigm continuum in terms of mode of inquiry. Pragmatism embraces the two extremes and offers a flexible and more reflexive approach to research design (Feilzer, 2010). In adopting this stance, the pragmatist researcher is able to select the research design and the methodology that are most appropriate to address the research question. Pragmatism is typically associated with abductive reasoning that moves back and forth between deduction and induction. In this way, the researcher is actively involved in creating data as well as theories (Goldkhul, 2012; Morgan, 2014).

The thematic analysis method enables the collection and reading of quality literatures and theories and allows the researcher to focus on examining patterns or common themes of meaning within the literature thereby gaining a wide range of detailed information on the research area. As it can be stated that corporate governance is a broad topic and has many applications and uses, the general research area is very broad, which requires the need for a thematic analysis method that enables the collection of in-depth information from previous literatures. Additionally, as the essay aims to gather quality literatures from academic articles, books, and other research papers, the use of thematic review of literatures will lead to integrate narrations and multiple patterns, to reach at the logical conclusion.

This however, will be followed by the positivism research philosophy which in turn is used for gathering quantitative data and is used to examine the causal relationship shared between the study variables (Karamagi, 2021). As the present research aims to evaluate the causal relationship between variables, the use of positivism research philosophy is accepted.

In the present research context, as the use of thematic literatures and quantitative data which are both considered powerful and suitable enough to address the research's aim and objectives, the use of pragmatism research philosophy is justifiable.

5.2.3. Research Approach

The research approach helps decide all the broad steps of gathering and analysing the data. The research approach can be divided into two categories: the deductive research approach and the inductive research approach (Creswell & Creswell, 2017). In order to analyse the future of corporate governance in the form of emerging digital technologies such as blockchain, AI, and cloud computing in the banking industry, the study uses both inductive and deductive research approaches. The inductive research

approach moves from bottom to top generalising the findings of the research area for the entire banking industry and covering a wide range of parameters while understanding in depth the research problem (Glaser, 2014), while the deductive approach moves from top to bottom and helps specify the research area.

Moreover, the positivist approach supports quantitative market-based data collection. The increased availability of reliable online data has contributed to a surge in the collection of quantitative financial and non-financial data in accounting and finance research. Using statistical methods, the validity of the data is designed to assist the researcher to reach a conclusion in a scientific, irrefutable and methodological manner (Nachmias & Nachmias, 1996). As such, this research uses quantitative data collected from reliable secondary sources. The collected panel data was then examined to ensure their use is suitable for linear regression analysis and to find the appropriate model to be deployed to determine the impact of emerging technologies and digitalisation on corporate governance, stability, and performance in G7 and G20 countries. Sample data was collected in conformity with the research population focus.

Accordingly, this research use of the deductive research approach, which enables the generation of specific findings for the study, it is adopted to assist in testing the research hypothesis of a study. In contrast, the inductive research approach is generally used to explore the concept of a phenomenon and identify its applications and utility according to Glaser (2014). As the present research aim to explore the concept of a phenomena while also test hypotheses to examine the association between the variables, the use of the mixed-method research approach is approved.

5.3. Review of Literature and Thematic Analysis on The Role of Blockchain Technology and Cryptocurrency in Banking Operations and Corporate Governance.

This section contains three subsections that are related to the thematic review of previous literatures and research conducted on the role of blockchain technology in banking operations and corporate governance. Whereby section 5.3.1 discusses literatures of previous scholars. Section 5.3.2 presents the data collection methods, searching and screening strategies. Section 5.3.3. presents the thematic analysis of literatures. Lastly, section 5.3.4 summarizes the expected outcomes according the researcher’s thematic review of literature.

5.3.1. Review of Literature

5.3.1.1. Introduction

It is anticipated that in the coming years blockchain technology will drive the digital transformation of how businesses, governments, and societies interact on a global scale. This section examines the current and future applications of blockchain technology in the financial services and finance industries. It also examines important concerns regarding the impact of blockchain technology on banking corporate governance. The essay highlights the technology and addresses the challenges, significance, and approaches for blockchain application in banking institutions towards a more consistent and coherent corporate governance concerning blockchain innovation.

The disruption to financial markets caused by the COVID-19 pandemic prompted policy responses and rescue packages that emphasised corporate financing and access to capital from domestic and international investors. Good corporate governance is essential to establishing a capital formation environment based on trust, transparency, and accountability; it is also a prerequisite for long-term investment and financial stability. This is especially significant in light of the growing significance of cross-border equity investment (De La Cruz et al., 2019).

The literature review is primarily focused on the future of business, operations, and corporate governance in banking. Under focus is the literature review which covers themes related to evaluating the effect of DLT/blockchain on corporate governance of banks, examining the impact of digital transformation/DLT on banks' performance, discussing the advantages and disadvantages of the role of DLT/blockchain technology in banking business and operations, discussing the functionality and features of blockchain in the banking sector, and discussing blockchain technology governance frameworks in banking and decentralised autonomous corporate governance. The review also discusses the technological strengths of cryptocurrency, regulatory frameworks for cryptocurrency in the US and China, and a country-wide analysis for key central banking laws, rules and regulations for exchanges.

5.3.1.2. Evaluating the Effect of DLT/Blockchain on the Corporate Governance of Banks

According to the World Economic Forum, blockchain and distributed ledger technology is described as a cryptographic system developed to 1) enhance transparency and security of records and 2) manage and authenticate transactional data distributed on ledgers specifically within the financial technology industry and across other industries

(World Economic Forum, 12th Ed., 2017). The report adds that some emerging technologies are regulated effectively heavily, while others are not (or barely) governed due to misalignment with existing law and regulations under the regulatory authorities' remit.

The use of DLT/blockchain has a significant effect on all four dimensions of corporate governance, which are people, performance, process and purpose. In this light, the findings of Wang et al. (2018) revealed that people or the managers who are responsible for deploying and real-use cases of the technology in areas such as cross-border payments, currency settlements in trade finances are significantly benefited as, under the majority of instances, these practises require manual work which has now been automated. Automation of these functions serves as an effective use-case of technology which in turn satisfies the interest of both owners and shareholders within a banking company. In the meantime, the findings of Dutta et al. (2020) examined its effect on corporate governance with the application of stewardship theory, wherein it has been found that the ineffectiveness and inefficiency in the system of corporate governance because of the complex investment chain and a large number of market intermediaries have totally been eliminated with the use of blockchain. The purpose of corporate governance, which entails assuring transparency, accountability, responsiveness and fairness, has been fulfilled by utilisation of certain properties of blockchain like shared distributed ledgers, irreversibility of records, peer-to-peer communication and smart contacts. The use of blockchain reflects attributes of stewardship theory that emphasises the contribution of top management towards organisational goals as per the findings of Jayasuriya and Sims (2020)

In the meantime, Goertzel et al. (2017) examined the application of blockchain with agency theory and reflected that blockchain could eliminate the necessity for organisations to arrange themselves in order to get work done through command and control. Also, it has been asserted that by using blockchain technology, people who work together will be able to collaborate as free agents rather than collaborating with a hierarchy of bosses.

According to Bech et al. (2020), the use of DLL/blockchain for managing functions of stock ownership such as transfer, recording, disclosure and transparency, the use of underlying DLT and blockchain tokens offer numerous benefits. These benefits mainly include a reduction in the complexity of security settlement which in turn provides a simpler and

direct system for holdings. The facilitation of an increase in automation reduces unnecessary paperwork in this process as well. Aside from that, Liu et al. (2019) found that the integration of DLT/blockchain under banking functions streamlines the process of financial reporting and auditing, which results in enhanced performance. The effective application of this technology provides auditors with real-time data access to read-only nodes, which allows them to obtain information in a recurring and consistent format. This, in turn, eliminates manual data extraction and audit preparation process to a significant extent which are time-consuming and labour-intensive for a banking entity.

Investigating the effect of DLT/blockchain on corporate governance further demonstrated that with the use of this technology, banking entities could modernise the process. This facet has been explored by Lafarre and Van der Elst (2018) determining that, with the use of blockchain, shareholder voting costs can be substantially reduced, and new opportunities for enhancing the functions of AGM's forum can be offered. Alongside, blockchain increases the decision-making efficacy during meetings and makes corporate governance of banking entities a lean corporate organ.

Moreover, the findings of Alkan (2021) explored a systematic model of real-time accounting as a concept related to a blockchain-based accounting system. For banking entities, it is characterised as a software solution which potentially serves the purpose of strongly encrypted data related to transactions in peer-to-peer nodes and the records that are validated in blocks. The use of blockchain in real-time accounting also offers a significant advantage in four main areas, which are disintermediation, trust and transparency, ongoing auditing and assuring trust and transparency, which were less likely to be feasible in traditional accounting systems. Similarly, Chondrogiannis et al. (2022) explained the use of smart contracts in blockchain, which function by performing automatic transfers of currency and other important assets in accordance with predetermined conditions. This, in turn, facilitates the automation of tax collection with reduced transaction costs and value-added tax evasions. Besides that, Lafarre and Van der Elst (2018) further revealed that transactions could be settled in close to real-time with the use of DLT/blockchain technologies by banking firms. This reduces the likelihood that one of the parties to the transaction will fail to fulfil their financial obligation and makes it effective for corporate governance to manage transactional functions.

The potential for digital transformation in corporate governance has been hampered by inefficiencies and a lack of transparency in certain shareholder-relations practises and with regard to corporations' beneficial proprietors. Shareholder voting, for instance, is frequently conducted through a complex voting chain involving a multitude of intermediaries, where identifying and communicating with the beneficial owners or others with legal authority to vote can be challenging, and it can be difficult for those owners to be confident that their votes were cast as intended.

In addition, to provide valuable information on the beneficial owners of corporate entities and investment vehicles while preserving the owners' privacy, blockchain solutions have been proposed for recording and monitoring share transactions. Such applications could aid in addressing the opacity of ownership that makes AML/CFT and OECD global tax regulations challenging to implement (De Jong et al., 2017). In addition, the use of smart contracts based on blockchain technology has been proposed as a way to improve the efficacy of auditing procedures.

Theoretically, smart contracts eradicate the need for trust between parties to a transaction because the transaction's norms are predictable and transparent. However, parties must be satisfied with the smart contract's integrity, which can be difficult to achieve without sophisticated programming skills. There are numerous high-profile instances of flaws or security vulnerabilities being exploited in smart contracts. Smart contracts are defined as parts of code inscribed on a blockchain that implement a predetermined action when certain conditions are met. Smart contracts are a significant component of the "automation" and "disintermediation" characteristics of blockchain technology, as processes can be programmed in a smart contract and then left to run, with users having the option to interact with the smart contract to access the service it is providing. These smart contracts are an indispensable tool for regulating blockchain activity, as they can be used to establish the norms and parameters for user interactions. Moreover, they are the fundamental components of decentralised applications and platforms, such as decentralised financial Services and Decentralised Autonomous Organisations.

In contrast, decentralised corporate governance structures are now a prevalent aspect of the crypto-asset industry, particularly in the decentralised finance (DeFi) market. The majority of the DeFi market is governed by smart contracts, and its networks and applications are said to be generally open, decentralised, permissionless, and autonomous in smart

contracts involving lending, derivatives, and exchanges. The significant growth of DeFi and the potential for interconnection with the traditional financial sector necessitated the attention of regulators (OECD, 2021).

In theory, a decentralised organisation's governance could be more democratic and transparent, but in practise, such organisations may face the same challenges as traditional corporate governance. According to OECD research, the holdings of governance tokens in some of the most prominent DeFi protocols are centralised in the hands of a small number of actors, including the original developers, resulting in conflicts of interest. Governance tokens could be obtained through a flash loan in which they are borrowed, used to vote, and then returned promptly, granting actors disproportionate and unpredictable influence. Voting participation of governance token holders can be low, with resolutions passing with as few as 1% of eligible votes cast, and decentralisation does not appear to facilitate the ability of many token holders to access and evaluate relevant information for decision-making (OECD, 2022). This implies that, despite the so-called "decentralised trust," the current practises of DAOs and DeFi markets have not resolved some of the fundamental issues that corporate governance is meant to address, such as conflicts of interest and information asymmetry.

5.3.1.2.1. The Development of Structures and Governance Models for DLT/Blockchain Adoption by Financial Services and Banking Institutions

Legal and business researchers have presented three governance models in order to employ a suitable structure for blockchain technology. The first governance model stipulates that firms with shared ownership control, governance, and risk appetite establish a separate joint venture entity. The second model of governance involves the formulation of a taskforce composed of market leaders from multiple sectors through the formation of an association of business partnerships. The third governance model involves establishing a statutory/governmental organisation funded by a government authority within a network in which the regulatory authority controls the administration and operations of the organisation (Deloitte, 2017).

The joint venture governance model is concerned with the formation of distinct entities by two or more firms, where consensus on crucial decisions can be reached more easily, resulting in a quicker time to market. Since joint ventures are deemed legal entities, accountability protocols and guidelines are established from the inception, and the likelihood of internal conflict is lower than in a consortium (Lawless, 2010). This paradigm of governance

focuses on activities that maximise financial profitability. In this model, the entity's pioneers are expected to jointly fund the organisation, and decisions are made by a steering committee comprising representatives of the founding members.

The governance model of consortium formation to manage and develop private DLTs is a prevalent phenomenon today especially in the financial industry (Gilbert & Tobin, 2016). Members of the consortium share installation and maintenance expenses, consolidate resources, conduct research, and establish the operational and process standards necessary to implement the DLT solution within their existing infrastructure. On behalf of each member, a steering committee representative negotiates and makes decisions. A consortium composed of UBS financial group, Bank of New York Mellon, and Deutsche Bank, for instance, created a "Utility Settlement Coin" to facilitate digital cash settlement (Kelly, 2016). In addition, the consortium is not considered a legal entity in which each participant firm owns and operates its own node, and decisions in this model should be harmonised and agreed upon by all representatives on behalf of banks as members and participants in the consortium, who make decisions regarding the provision of resources to achieve their common objective.

In the statutory organisation model, participating members (such as banking institutions) adhere to the statutory model directives and contribute to the attainment of common goals. This model of governance provides transparency and data governance. In this paradigm, the organisation is regarded as a separate legal entity that is managed and operated by the government and may include bank representatives.

5.3.1.3. The Role of DLT/Blockchain Technology in Banking operations and performance

According to Choi et al. (2020), the role of cost and trust has co-existed as the factors in determining the adoption of blockchain technology in the banks. The addition of the value of the transactions has prompted a new journey in blockchain within the banking sector. Most banks (especially big ones) have started investing in blockchain to improve their functioning via digital transactions. In these banks, blockchain technology has moved numerous operations of the banks under different segments of records in a unique identification manner. As such, it supports a regular pattern of empowering different types of transactions related to different accounts of the customers. It has allowed the banks to add value to transactions; where faster execution and less labour-intensive operation has added value to performance which in

turn made the supply chain more efficient. The most effective feature of the blockchain is the decentralisation of the monetary data that helps all the stakeholders involved in the transaction created for specific interests to identify, analyse, and report the information of their interest to one another across a particular system of digital nodes. Contrarily, Mik (2017) assessed that the role of blockchain in the banking sector has become brutal in some contexts of the transactions that contain flexibilities in expressing the addresses of the nodes. In this context, various paradoxes have affected banks that have allocated huge investments in block chain technology and have executed most of their transactions through the nodes of the blockchain. However, in this context, it is argued that only a few cases may cater to the huge risks in the transformation of the data across the structure of the blockchain. Furthermore, Vivekanadam (2020) assessed that blockchain is widely covered by the blocks at different nodes that act as the validators of the users or the stakeholders who add to the transactions of the chain of a particular system followed by the banks.

In the viewpoint of Rauchs et al. (2018) to protect the data under the blockchain system and the supply chain, numerous activities are performed by the elements of both these interfaces in the banking system. As such, the systems of these interfaces have different structures that work interdependently on each other. The structure of the supply chain system used to be complex and trafficking and involved infinite stakeholders that interacted with one another for the monetary exchanges. However, in the blockchain system, the structure is well-defined, and the role of each element is predetermined with important disclosures like making the data permanently stored and verified at one time. The supply chain system of the banks is constituted by the undebatable pressure of the stakeholders, such as big corporate businesses that execute hundreds of transactions and monetary deals online within the software of the banks. In this context, Zhang (2019) examined improving the flow and privacy of the transactions among various stakeholders that are involved in a banking transaction. Therefore, blockchain acts as a manager of the supply chain system and manages peaceful traffic of the stakeholders' intervention in the banking system. In a similar context, Chang et al. (2019) assessed that blockchain has improved the processes of the digital transactions of the banks more than that has been in earlier technologies. For this purpose, it involves a real-time synchronisation of the activities of all parties that are involved in it. Similarly, it reduces the errors at the data entry stage by enabling the channels of distribution automatically record the events of the transactions with each stakeholder's role in it. Moreover, the data information is stored once across all systems and does not follow any

modification unless the case arises. Hence, there is an immutable trust among the stakeholders for assuming the threat-free exchange of the services in the blockchain system.

In a particular context, Choi et al. (2020) viewed that the smart contract feature of blockchain technology facilitates the different types of stakeholders in completing their transactions at a given point in time. This process has produced a clear and authenticated response for the stakeholders in pursuing real-time settlements of the liabilities within a banking context. International banking was mostly a nightmare for almost all banks working with the issue of cross-border transfers that enable a regular flow of foreign capital through inter-bank transactions. In this case, there was an increased chance of reduced insurance in the contracts entered into by the international banks. Apart from this, the contracts also needed to be utterly proper logistically to reach the destination bank. During that time, huge expenses were associated with the transactions, including the fees, the value of the contract, and the opportunity costs that had to be earned from any of the alternatives available at that time. In this context, the current banking structure has altogether changed in the smart-contracting phase of blockchain technology. The propriety of smart contracting has involved banks from every corner of the world to deal with numerous banking initiatives and improve capital formation. In this context, Belke and Beretta (2020) stated that the role of digital transformation has efficiently contributed to the welfare of the transactions that are executed in the form of trading in foreign currencies. The concept of the Euro currency is an effective example of this. The Euro currency is a special type of foreign reserve that retains the right of all international banks to have their annual and short-term investments. In this way, blockchain technology has positively impacted the performance of formal banking relations in the international banking industry. However, the performance of these entities has been affected in some ways by digital hackers for political or scientific purposes. The violations made in the services of these areas are led by the hacking agencies of different countries.

According to Zeranski & Sancak (2020), digital transformation is a shift in the behaviours of persons as well as enterprises caused by the use of digital technology to provide significant advances in company, personal observations, as well as innovative business models. In particular, digital transformation is the process which tries to enhance an organisation by modifying its attributes significantly using a mix of information, computation, communications, and networking technologies. For a long period of time, scholars have been interested in the role of digital transformation in

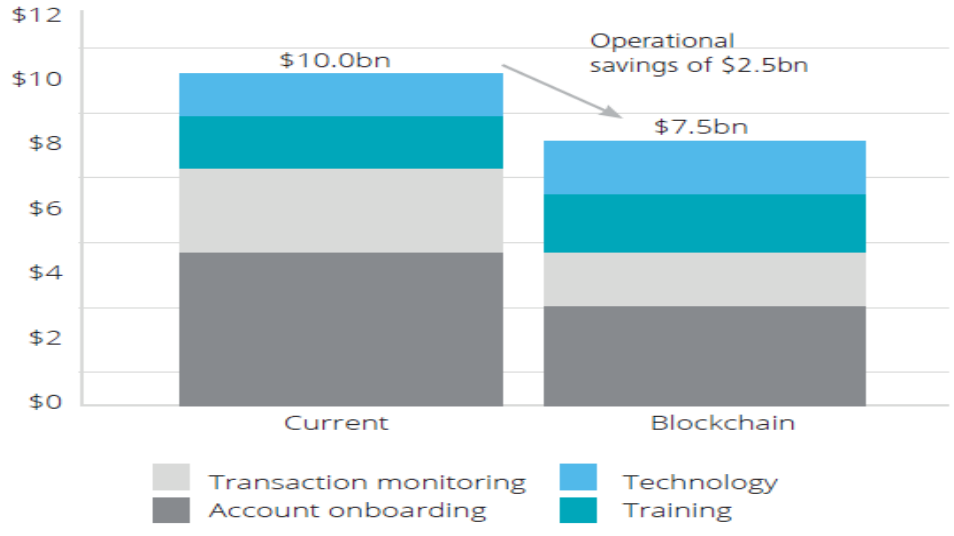
producing value for commercial banks. Whereas many financial institutions had conducted extensive research on digital transformation, researchers as well as management have encountered several challenges in analysing the relationship between digital transformation and business success. Fang et al. (2017) described online banking as the quantity of effectiveness that bankers accomplish in distributing inputs to optimum output, representing the level of utilisation of energy (people, material, and financial) to meet set goals. As stated in the preamble, digital transformation has had an influence on business operations, causing institutions to change their business practises. Digital transformation is playing a role in reshaping the conventional contact among clients and institutions. Consumers, in particular, have the right to a plethora of communication channels via which they may actively and readily communicate with banks and other consumers through the use of online customer care services. More crucially, digital transformation enables banks to service multiple consumers at same moment. Furthermore, the employee's job procedures are computerised, reducing both human capital and transaction processing times. Therefore, digital transformation can assist the company improve output (by increasing the number of clients) while also lowering input expenses. As a result, one would anticipate digital transformation to have a favourable influence on bank efficiency.

In the view of Qiu et al. (2021), throughout this stage of the digitalisation process, when institutions consider automating procedures to eliminate manual as well as repetitious duties, efficiency will be enhanced by lightening up the entire system. Though financial firms have indeed been conscious of the notion of automation for some time, it bears new relevance in the current era of digitalisation: the emphasis is now not just on back-office activities, but also on deploying automated front-office procedures to attract and retain consumers. They are starting to apply analytical approaches and advanced algorithms, robotics, and artificial intelligence to enhance scores, produce automatic and personalised product offers, or give personalised advice solutions. The research conducted by Thanh-hoang et al. (2016), with the help of secondary data, identified that upgrades to technological infrastructure necessitate new expenditures in relation to the total IT expenditure, which is also a significant item on banks' balance sheets. This should be emphasised that a significant portion of IT expenditure is a recurrent expense necessary for the maintenance of big data centres as well as communication infrastructures.

The financial industry must conduct a cost-benefit analysis to determine if blockchain implementation is feasible. The increased trust made possible by blockchain can reduce friction, which includes all types of direct and indirect costs and efforts resulting from a lack of trust, and bring certainty through transaction logic encoded in code (Beck et al., 2018). The permissionless and non-territorial characteristics of blockchain, according to MacDonald et al. (2016), can significantly reduce institutional exit costs. Briefly, Accenture (2017) determined that blockchain technology can result in significant cost savings for banking in the range of 8 billion USD, whereas a 2016 Goldman Sachs report suggests that blockchain technology could save financial institutions between 11 and 12 billion USD annually by reducing the number of errors that result in fees and higher operating costs. According to Meola (2017), blockchain-based solutions could produce annual cost savings of up to 20 billion USD.

Based on the findings of the 2016 Goldman Sachs paper titled "Blockchain: Putting Theory into Practise," the banking industry could reduce its workforce by 10% and the time spent monitoring transactions by 30% if blockchain technology was used. Based on research conducted by Gartner (2017), it is predicted that businesses might save up to 2.5 billion USD annually in operating costs.

Figure 5:3 *Banking Sector Cost Structure – Current vs Blockchain Technology Adoption*



Source: Celent, Goldman Sachs Global Investment Research 2016

In a world in which multinational corporations may pay up to 25 USD for an international transaction (Hillsberg, 2018), eliminating the need for intermediaries (Marr, 2017) and their affiliated fees allows for additional

cost reductions when conducting bank transactions. The ability for institutions to share information transparently through a blockchain system would also significantly reduce the administrative costs of compliance departments (Marr, 2017).

IBM's blockchain app store is a good example of how blockchain can reduce back-end costs for banks by providing access to seven vetted blockchain vendors, allowing banks to streamline their trading processes and back-end operations by creating a single set of records. There is also evidence that ICICI Bank and Emirates NBD are investigating the use of blockchain technology to reduce transaction costs (Higgins, 2016). The Central Bank of India estimates that by 2022, the use of blockchain technology for interbank transactions will result in cost savings between $15 billion and $20 billion (Richter et al., 2018). Banks can also pursue the incorporation of fintechs as service providers to avoid costly interaction efforts (Drasch et al., 2018).

5.3.1.3.1. Assembly general meetings and voting

In the view of Hansmann and Pargendler (2014) the use of digital transformation is one of the prominent things that contributed to changing the general meetings and the voting procedures of the banks and financial institutions. The processes of voting and the meetings of the banks are occurring online through the digital medium and increasing the efficiency of the process by enhancing the level of communication between the stakeholders.

As noted by Armour et al. (2017), meeting the stakeholders is one of the critical elements of the function of financial institutions as they help in providing details of the ownership, and the management is able to make general decisions that help in improving the facilities and conducting functioning of banks. The management of banks makes decisions after discussing the issues in meetings, and some decisions are taken by the board of directors that are the fundamental elements of the working of banks. On the other hand, Castagna et al. (2020) have stated that the adoption of the e-voting tools after the implementation of the digital transformation also helps in improving the level of communication as the members of the board and the stakeholder are able to communicate directly with the help of digital communication media, one of the prominent methods of improving the level of coordination between the board members. The meetings of the board started to use advanced tools that help in improving their performance by enhancing the level of communication between the members.

5.3.1.3.2. Accounting, Auditing, and Transparency

The findings of the research conducted by Cziesla (2014) have suggested that the change of the process from physical to digital in the financial industry contributed to increasing transparency in processes as people are able to access the digital formats of financial reports and the accounting information. Companies are able to support customer-centric solutions, which is one of the major advantages of using digital solutions by the banks. It also improves the relationship between the companies and the customers, which is suitable for the sustainability of the financial institutions. On the other hand, Oliveira et al. (2011) have also stated that the increase in the transparency in accounting and reporting helps in improving the level of risk management of the companies, and they are able to perform well in the competitive business market. The ability to include risk in the functioning of a company is highly dependent on the efficiency of the management, and the implementation of digital transformation improved the level of coordination between the management and the board members.

The research conducted by Filotto et al. (2021) used the focus group method and used a survey questionnaire that was distributed to the customers of Italian banks in which the responses were analysed using Shapley Value regression analysis. The findings of the research suggested that the implementation of digital services contributed to enhancing the user-friendliness of the accounting practises, and the management is able to perform the services properly. The digital transformation made the management of accounts easy and enhanced the performance of financial institutions. Moreover, Manita et al. (2020) have stated that digital solutions help in improving the quality of the information provided through accounting. The improvement in communication with the stakeholder also helps in the improvement of the functioning of the banks that is suitable in the competitive business environment.

Transparency is becoming an increasingly essential factor as transaction capacities increase. While the traditional banking system is extremely secretive, blockchain technology can make the entire banking process more transparent and secure by locking records and granting users access to the complete historical data, with the option of granting only authorised parties' access to shared transaction ledgers (Hillsberg, 2018). In fact, according to Tapscott and Tapscott (2016), blockchain technology can reduce or even eliminate the need for trust in transactions while simultaneously making auditing transparent and real-time. It is also promising for automating financial

reporting (Collomb & Sok, 2016), and the blockchain's transparency enables banks and regulators to communicate in real time and enables prompt action when compliance violations occur (Patel, 2019).

Liu et al. (2019) discussed the effects of blockchains on auditing practises, as well as the difficulties and opportunities posed by permissioned and permissionless blockchains for auditors. In addition, Dai and Vasarhelyi (2017) envisioned that blockchains "could enable a real-time, verifiable, and transparent accounting ecosystem" and have "the potential to transform current auditing practises, resulting in a more precise and timely automatic assurance system".

Some academics hypothesized that smart contracts could be implemented and incorporated into future financial statement audits. Rozario and Vasarhelyi (2018) for instance, proposed that smart audit procedures (a new type of audit data analytics), enabled by smart contracts and carried out in blockchain environments, could be autonomously implemented to address various audit risks and have the potential to realise near-real-time audit reporting. In addition, Rozario and Thomas (2019) proposed the concept of interconnected blockchain ecosystems consisting of external audit and business private/permissioned blockchain ecosystems in which smart audit procedures could be carried out. Auditors would partake as a node on the business blockchain with read-only access to ensure they have access to audit-relevant information recorded on the blockchain and transfer it to the external audit blockchain. After that, the predetermined smart audit procedures (including smart internal control tests, smart test of details, and smart analytics) could be carried out autonomously, with the intention of detecting material misstatements. On the external audit blockchain, auditors can also share pertinent information with stakeholders such as the Public Company Accounting Oversight Board (PCAOB), SEC, and audit committee.

According to ACCA (2019), businesses in virtually every industry are directly experiencing the disruptive changes that are also impacting their auditors. The following categories of advanced technologies have an impact on the audit profession, both in terms of the instruments available to auditors and the systems that must be audited: artificial intelligence, machine learning, business intelligence, and big data (Chen et al., 2012; Forbes, 2018; McAfee & Brynjolfsson, 2012; Toni, 2018) are the smart digital hubs, which serve as "smart platforms" that enable

auditors to work remotely and in real-time with data and analytics, automation, and visualisation (Forbes, 2018); smart digital hubs also include distributed ledger technology and drone technology, Internet of things and sensor technologies (ACCA, 2019; Chui et al., 2010; Pisching et al., 2015)..

5.3.1.3.3. Systems, Process and Controls

According to Bharadwaj et al. (2013), the use of digital tools and techniques contributed to improving functional-level strategy by improving the existing processes of banks. The change in the process of business also helps in improving the level of services provided to the customers as they are able to get services in the shortest possible time. The products and services are digitalised, and the way of accessing information is also changed in the alignment of the digital transformation of the services. However, Ederer and Manso (2013) have stated that the implementation of digital services also helped the banks in increasing the level of robustness as the companies are able to increase their productivity and profitability in the competitive business environment, which is one of the major advantages of digital services. The companies are able to change the existing processes and provide digital services in which the customers are able to get financial services on their electronic devices.

As per the view of Yeow et al. (2018), digital services are changing the current processes and the functioning of the banks as the information technology (IT) capabilities are improving the effectiveness of marketing initiatives and operations. Banks are able to use digital services in order to make functional level strategies and improve their performance. In addition to this, the digital transformation in the banks also poses a challenge of aligning the existing processes with the new processes, which is the core element in the development of strategies. In a similar manner, Tilson et al. (2010) have stated that the implementation of digital strategies requires the installation of diverse capabilities of digital transformation in which the firms require to work without issues in managing the tasks.

5.3.1.4. Opportunities and Challenges of DLT/ Blockchain Technology in Banking Business and Operations.

In the perspective of Ganne (2018), the role of digital or blockchain technology has been affected by several fronts, like acceptance of the new features in the blockchain that involves various users cooperating with the bank accounts in a diversified way to handle different banking operations areas. In a similar context, Tripoli and Schmidhuber (2018)

explained that many small and medium-sized banks in developed and developing countries are still facing issues with using blockchain technology, particularly because of the cost involved in it and the amount of associated risk. In this respect, acceptance of this technology model for dealing with inter-banking transactions and facilitating the power of unlimited transactions has been dithered in many. In this context, most of the time, the banks involved in digital transactions have been attacked with digital; policies of the hackers have reduced the pressure on these banks in blockchain technology. It is the tricky actions of the users, have also influenced banks in adopting blockchain technology. Therefore, three terms have been identified for the barriers to blockchain technology adoption in the banking sector. These terms include trialability, compatibility, and the complexity of adopting the new technology.

Currently, the utilisation of digital technology is rapidly growing, leading to a significant rise in revenue for banks. This is primarily due to their adoption of the smart contracting approach facilitated by blockchain technology. In this regard, Anderson (2020) argued that the main reason behind resistance to the technology is the lack of knowledge and training of the banks' staffs, who get perplexed by the language of blockchain technology.

In a particular context, according to Choi et al. (2020), the modernisation of capitalism in the banking industry has revolutionised the role of blockchain technology in large corporate banks. The existence of the Technology, Organisation and Environment Framework (TOE) has been intimately related to the core performance of the banks in the current-day mechanisms of business transactions. A structured relationship between the technological, organisational, and environmental spheres of the banks involved a huge sharing of the responsibilities in both delegation and decentralised form. These frameworks have led to the distinction of the banks from each other in terms of the infrastructure they use. Large corporate banks have adopted blockchain technology by addressing agents for monitoring, directing, processing, coordinating, and controlling the operations of the banking business. However, these banks have also undergone several attacks in the technological context of their structure and many times avoided the smart contracting as the blockchain data of the banks went viral several times. In this context, several scholars have argued over the performance of blockchain technology in the banking system. It is viewed that blockchain technology is mainly used for interconnected user exchanges under the banking system. Hasanova et al. (2019) assessed that the blockchain mechanism involves an open availability of the users' data before its stakeholders that cause numerous attacks on the actions of the transactions that happen through

the blockchain technology. In this case, banks have observed more vulnerability in the performance of the smart contracts in which most transactions have been on the brink of a reduced success rate because of the openness of the data available on the bank software using blockchain technology. However, these issues aside, an inclusive part of blockchain technology has promoted the economic well-being of the banks since its inception. Banks are aware that the procedure of making transactions is quite vulnerable to technical faults that occur in the algorithms of the clouds of data. This issue has, however, vitally affected the performance of the stakeholders in the banking system. Therefore, it is argued that the practises of the bank, as well as stakeholders, might be inconsistent with their contracts which brings to the forefront essential employment of technical agents to check the strength of the connection among a distributed set of stakeholders' interventions.

According to Cunha et al. (2021), Within the framework of the Theory of Economic Expansion (TOE), there has been a significant and forceful pushback against the leniency shown towards the entire banking system. The transferability of opportunities across different sectors of the banking industry depends on the level of interoperability (compatibility) among banks. The presence of financial factors that influence the adoption of blockchain technology has been analysed. Furthermore, it is highlighted that even if blockchain technology is cost-effective and helps accomplish the transactions in very little time, the structure of hiring the technology first remains a big issue. In this context, Peters and Panayi (2016) argued that the structure of the bank is a crucial determinant of the utilisation of blockchain technology and, as such, they broadly classify the range of services and the smart contracts they will utilize. Therefore, many banking organisations adopt blockchain technology effectively and make appropriate relations with the stakeholders through this technology. It is further examined that if the banks cannot become fully developed in adopting the latest innovations in this technology, they can still proceed by developing the existing one in small steps. Hence, blockchain technology has not deprived any banking organisation from the digital infrastructure.

In the viewpoint of Yermack (2017) concerning inter-organisational constraints, which might be much more difficult, organisations may perceive information as a competitive advantage. Individual firms' standards for adoption of technology should be acknowledged by other firms' decisions in supply-chain networks within a system combined with their organisational characteristics. Because of this variation, banks differ in terms of network size. Concerning inter-organisational constraints, which might be much more difficult, organisations may perceive information as a competitive

advantage. Individual banks' standards for adoption of technology should be acknowledged by other banks' decisions in supply-chain networks within the system. This creates a system combined with their organisational characteristics.

This results in the formation of a system that incorporates their unique organisational traits. Scott et al. (2017) highlighted that bank vary in terms of their network size, pre-existing assumptions, and the extent to which they share information. These factors influence the amount of knowledge they consider when making adoption decisions at different stages.

As a result, banks may be unwilling to disclose information and may instead enforce strict security as they preserve internal information as extremely sensitive and which must be kept secret from others. Banks should have the inclination to break through this obstacle.

Furthermore, Arnbak (2016) stated that because each bank has its own culture, this could lead to contention in supply chain partnerships. To deploy the system, the four horses of blockchain technology in supply chain operations, competent authorities, certification bodies, and stakeholders should be in sync. When one of these fails, the entire system may suffer as a result; social comparison theory can be used directly in this situation. As a result, some participants may find performance concerns to be a barrier to the implementation. Problems concerning third stakeholders that are not directly engaged in the system but have an influence on supply-chain operations, including governments, bank institutions, and industries, are of major concern and should be addressed in the final category. The lack of government and industrial policies slows adoption and prevents stakeholders from interacting with the blockchain. In a similar context, Blanchard (2021) explained that blockchain technology is being used in domains other than supply chains. Banks of all sizes continue to debate its uses, frequently taking a wait-and-see strategy instead of being the first one to implement it. Catalysts such as economic and political governmental support and help are required to promote the engagement of external parties. Recognising banks with blockchain solutions and offering legal assistance, financial assistance, workshops, training programmes, and other such services will ultimately reduce business opposition to blockchain adoption.

The use of blockchain systems to register shareholding might also solve several lengthy issues associated with corporations' failing to maintain timely and accurate information about who owns their shares. Future developments may

allow blockchain technologies to store self-prepared smart contracts, including employee stock options or contracts purchased by outside capitalists. Such smart contracts can be used to pre-contract the settlement of financial difficulties. Most importantly, blockchains have the potential to generate extraordinary transparency by allowing investors to recognise the ownership positions of equity and debt investors (including the bank managers) and reduce the opportunity for rent-seeking or corrupt behaviour by regulators, exchanges, and publicly traded companies. If a bank chose to keep all or most of its bank documents on a blockchain network, as some critics have suggested, possibilities for earning management as well as other financial reporting schemes could be drastically reduced, and financial intermediaries will indeed become quite transparent (Choi et al., 2020). Filotto et al. (2021) have stated that the issues of security concerns and the lack of awareness are the main issues that contribute to creating issues in the digital processing of bank functions. Customers are facing issues of cybersecurity and the risk of loss of personal data that can harm them and cause serious issues for their integrity. In this concern, the additional factors that contribute to increasing integrity and the safety of the banking processes should be followed by the officials in order to increase the effectiveness of the banking services in the competitive business environment. The enhancement of security will also increase the acceptance of the services by the customers, which is helpful in ensuring the sustainability of the banking institutions.

Yermack (2017) also identified that blockchains might offer lower trading costs and more accessible ownership information to stakeholders while also allowing apparent real-time monitoring of share transfers across different owners. To activists, the technology might allow for faster, cheaper share acquisitions but with significantly less confidentiality than the present structure. Activists may also be able to liquidate their stakes more easily and transparently, making the exit route of corporate governance more appealing at the expense of the voice or engagement channel. Corporate governance may become quite transparent, with insider transactions detected in real time by the market and manipulations such as stock reimbursement backdating becoming quite difficult, if not impossible, because respondents in certain blockchain systems are unable to rewrite history by modifying their entries pre-emptively. In a similar context, Singh and Faisal (2019) suggested that corporate voting may grow more accurate, and techniques aimed to isolate voting privileges from other features of ownership concentration would become harder to implement surreptitiously. Any one of these modifications can have a significant impact on the power balance among directors, management, and shareholders.

However, the impact will be heavily influenced by the type of blockchain used, regardless of whether public and fully accessible to anyone, as is the case with Bitcoin and similar other digital currencies, or restricted and permission-based, as is the framework currently tested by a handful of large financial institutions and partnerships.

5.3.1.4.1. Opportunities of Blockchain/DLT for Banking Operations and Business

According to Vovchenko et al. (2017), the application of blockchain technology is advantageous for financial business contracts that are focused on the elimination of the cost that is generated by the expenses due to the interaction levels of the agents. Blockchain technology is beneficial for governing effective control of the risks that are identified at the operational level. Blockchain technology has also been identified as effectively contributing towards ensuring financial security under modernised business operations. The application of blockchain technology under distributed ledger technology is also advantageous for safeguarding the business transactions that are executed by large multinational corporations as well as commercial banking companies.

Crosby et al. (2016) asserted that the application of blockchain technology is advantageous for the establishment of smart contractual agreements. Smart contracts tend to be computer programmes capable of executing the contractual terms in an automatic manner. In addition, blockchain technology holds an advantage in terms of smart property. Smart property is identified as a type of contract that is useful for controlling the ownership levels revolving around the property. This property can be identified as physical property like an automobile, or smartphone, or as a non-physical source of property such as shares within an organisation.

Woodside et al. (2017) asserted that the blockchain technologies comprising the value exchange-related transactions as well as distributed ledgers are advantageous in terms of re-positioning a considerable portion of the business practises in order to make them efficient to re-invest as well as compete in the areas of new growth. The instant and secure verification attribute of Blockchain technology is advantageous for the maintenance of the voting schemes along with the health record maintenance.

Taufiq et al. (2018) reviewed that the use of blockchain technology in banking payment systems is advantageous because it enhances the ease of use as well as privacy levels identified in bank-related transactions.

Moreover, the incorporation of the blockchain involves low transaction fees and requires a considerably smaller portion of time, which makes the undertaken transaction process fast and efficient. Furthermore, it has been found that blockchain technology provides advantages to bank-related operational operations in terms of managing micro-transactions. Blockchain technology is efficient for managing the key issues revolving around the irreversibility of transactions and alternate storage of value. Buitenhek (2016) asserted that the use of blockchain provides an advantage to banking companies in terms of generating effective trust levels across the transaction network. It is observed that the transactional, as well as operational expenses and monetary transaction-related risks, along with traceability, are reduced with the help of blockchain technology.

On another point, as per anti-money laundering regulations, institutions are frequently required to verify their consumers' identities (Sarnitz & Maier, 2017). Given the growing threat of terrorism, Know Your Customer (KYC) is essential for preventing the illegal use of banking funds and services for money laundering and terrorism (Marr, 2017). Financial institutions spend between 60 to 500 million USD annually to comply with KYC regulations. Consequently, current KYC procedures are not only expensive but also inefficient and contribute to a negative consumer experience (Walker, 2018). Moreover, the 4th Anti-Money Laundering Directive (4AMLD) mandates that consumer data be continuously monitored and updated (Wolos, 2018), whereas the General Data Protection Regulation (GDPR) mandates stringent internal controls pertaining to consumer security (Walker, 2018).

Therefore, if implemented correctly, blockchain technology can be exceedingly beneficial for KYC. This is because blockchain technology can eliminate the need to fill out numerous KYC documents when establishing a bank account (Sarnitz & Maier, 2017).

According to Lang (2017), blockchain enables banks to securely exchange consumer data throughout their organisation, thereby expediting administrative processes by eradicating duplicate requests and data. Other institutions can access the independent client verification of a single bank using blockchain technology (Marr, 2017). Standardised exchange of customer account opening information via blockchain produces a singular,

immutable KYC record that demonstrates regulatory compliance (Walker, 2018). Blockchain technology could be used to improve consumers' access to banking services by enabling them to establish a verifiable, decentralised, and independent digital identity (García-Morales, 2018). According to Luu et al. (2017), the decentralisation of cryptocurrencies makes them susceptible to money laundering and terrorism financing, which makes Know Your Customer efforts more crucial than ever.

The use of blockchain technology can reduce settlement timeframes for banks due to the certainty it provides by allowing individuals and businesses to transact directly and view the same immutable ledger of transactions that is updated by consensus (Lang, 2017). Moreover, according to Tapscott and Tapscott (2016), blockchain technology can reduce settlement times to minutes or seconds.

Moreover, traditional banking practises and local banking standards prescribe diverse financing requirements, resulting in significant delays in the closing of a single transaction (Lowry et al., 2017). By employing a shared version of the truth regarding transactions in real time, blockchain enables trade partners to interact with a higher level of trust, thereby enhancing access to funding and saving time during the trade process (Appelbaum & Smith, 2018).

Today, companies like Ripple can accomplish international money transfers in a matter of seconds (Sarwar, 2018). The fact that nearly half of GPI payments are credited to final beneficiaries within 30 minutes and nearly all payments are processed within 24 hours (Wass, 2017) demonstrates that SWIFT is rapidly competing without blockchain technology.

5.3.1.4.2. Challenges of Blockchain/DLT for the Banking Businesses and Operations

In comparison to the data-security-related advantage of blockchain, Pedersen et al. (2019) found that scalability is the critical disadvantage associated with blockchain technology. Scalability problems are often identified to be prevalent in blockchain technologies as there is a vast amount of data required to be stored on the blockchain platforms and the rate of processing identified with blockchain technology tends to become slow as well as costly due to the incorporation of transaction fees as well as prolonged time duration needed for verification

purposes. Moreover, usage of blockchain platforms is also disadvantageous in cases where international stakeholders are involved. There is a requirement for validating the identity of the stakeholders at the global level, and it is compulsory to assess the authorisation of the stakeholders. On the other hand, Cocco et al. (2017) asserted that the disadvantage of blockchain technology can be understood by means of the Bitcoin system. Application of Bitcoin blockchain innovation is less effective as it involves a low number of business transactions along with a high computation potential. Furthermore, the use of blockchain technology in Bitcoin uses distributed ledger technology that leads to the generation of disadvantages in terms of complex computations which are performed to determine the validity of the mined data entities. Moreover, there is also a need for special hardware resources to execute the blockchain computations, and monetary expenditure is also required to assure the continued working operationality of the hardware.

In comparison to the above, Kussy et al. (2018) stated that blockchain technology is associated with disadvantages in terms of technological aspects such as the throughput of data. The use of blockchain technology in Bitcoin technology is not effective enough to exceed the speed of transactions for more than 7 transactions in a single second. Moreover, another disadvantage of blockchain technology can be observed in the area of energy efficiency. During the application of blockchain technology in the cloud computing area, blockchain will need a substantial rate of energy for performing the banking transactions as well as determining the reliability of the performed transactions. In order to resolve the limitation of the number of transactions, the challenges surrounding blockchain verification throughput and size need to be managed. In the opinion of Shaikh and Bhausaheb (2021), irreversibility is a critical disadvantage of blockchain technology, since banking transactions performed in the blockchain cannot be reversed. It is analysed that the majority of the verification steps present in the blockchain are also disadvantageous because they increase complexity in terms of altering the details. Additionally, the drawback of blockchain technology includes transaction delays caused by the need for confirmation from the existing network and delays resulting from the verification of banking operations. Another disadvantage of blockchain technology is the scarcity of dependable banking parties.

Regarding KYC blockchain-based registries, developing a blockchain-enabled system is a costly endeavour, and if the banking industry is to benefit from the system, it must be standardised across institutions (Walker, 2018). For example, a standardised policy on the identification and verification of consumers is required for KYC information to be usefully shared across the banking industry (Walker, 2018). It is unlikely that all institutions will employ KYC blockchain-based registries due to their reluctance to rely solely on third-party data validation, according to Clarence-Smith (2018). Each Bitcoin transaction costs roughly 0.20 USD and can store no more than eighty bytes of data (Bauerle, 2018). Unless addressed, the absence of harmonised industry standards (Schou-Zibell & Phair, 2018) will be a significant barrier to the adoption and growth of blockchain in banking.

The cost of energy required to operate blockchain algorithms is another difficulty that is regarded as a concern in relation to the blockchain. Galeon (2017) noted that the amount of energy required to mine Bitcoin is equivalent to the annual energy consumption of 159 countries. In fact, it is estimated that 10% of China's energy consumption would be required to process cryptocurrencies if they were to account for 5% of the global money supply (Caplen, 2018). In addition, due to utility costs, the cost of a bitcoin transaction can range from 75 USD to 160 USD (Bloomberg, 2018).

Another challenge faced is that the use of Bitcoin as a currency is not welcomed by bankers (Hillsberg, 2018). The stability of the fundamental currency is a significant concern for the adoption of blockchain payments in banking, particularly given the excessive volatility of the cryptocurrency market (Luu et al., 2017). Currency stability is essential to assuring that neither the buyer nor the vendor suffers a loss due to price fluctuations in trade (Lund, 2018).

In lieu of conventional cryptocurrencies, Lund (2018) proposes a "stable coin," which is essentially a digital token that will have low price volatility due to being pegged to some underlying fiat currency, thus serving as a store of value, medium of exchange, and unit of account for blockchain-based payments. Stronghold USD, which is supported by USD deposits and is undergoing development at IBM as a credible token for blockchain payments (Lund, 2018), is an example of a stable coin (Corradino, 2018). The utility settlement coin, which is backed by six

of the world's largest institutions, intends to allow financial institutions to pay each other or acquire securities without waiting for traditional money transfers to complete (Arnold et al., 2019; Harsono, 2020).

The security element presents both an opportunity and a challenge for the adoption of blockchain technology in the financial industry. It is generally understood that banking necessitates a high measure of security. Historically, banks were only liable for the security of their safes and deposits at branch locations. The transition to online banking resulted in the emergence of a new security threat from hackers around the globe, thereby creating a market for cybersecurity professionals and increasing bank expenses. In the banking industry, cyberattacks have resulted in 100 USD million in losses over the past few years; therefore, banks are hesitant to allow their financial data to reside outside of their secure perimeter (Hillsberg, 2018).

Data privacy remains a concern in blockchain technology due to the fact that transactions can be viewed across network nodes, resulting in the production of metadata that can be used for pattern recognition (Schou-Zibell & Phair, 2018). However, 'self-sovereign identity' is an emerging solution to privacy concerns (Schou-Zibell & Phair, 2018). "Self-sovereign identity" enables consumers to have greater control over their confidential information and who they share it with. In numerous respects, blockchains are significantly more secure than centralised systems (Schou-Zibell & Phair, 2018). As a security measure miners can verify daily blockchain records, but due to the irreversible nature of blockchain transactions, manual data entry errors can be extremely problematic (Hillsberg, 2018).

Another security challenge presented by blockchain is anonymity. As blockchain technology enables anonymity, such untraceable transactions would pose a threat to the banking industry and the regulator, as they would make taxation more difficult and facilitate money-laundering by criminals (Cook, 2018). There are cryptographic techniques, such as zero-knowledge proofs, that enable block verification and transaction correctness without providing visibility into the transaction details in order to protect privacy as much as feasible (Eyal, 2017).

In an early review by Guo & Liang (2016) the authors discussed the significance of establishing a regulatory laboratory to limit the scope of blockchain implementation and operation while still allowing for innovation.

Central Bank rules and bank secrecy regulations have a negative impact on blockchain adoption in banking, and lobbyists opposing this disruption are likely to obstruct further government intervention (Hillsberg, 2018). Additionally, the General Data Protection Regulation (GDPR) and other privacy regulations hinder the financial sector's use of blockchain technology. Other authors urge Central Banks to begin employing blockchain technology (Thew, 2018). According to Iansiti and Lakhani (2017), however, all participants to monetary transactions will be required to implement it, posing a challenge to the government and institutions that have managed and supervised these transactions for decades.

5.3.1.5. Functionality and Features of Blockchain in Banking Sector

Distributed ledger technologies (DLT) could potentially disrupt the way information is shared and establish a higher level of automation, security, and privacy control across a wide variety of processes. DLT is an innovative and rapidly evolving system for documenting and disseminating data across multiple data repositories (or ledgers). This technology permits multiple network participants to record, authorise, communicate, and synchronise transactions and data throughout a distributed network. A "blockchain" is a data structure utilised by certain distributed ledgers that stores and transmits data in "blocks" connected in a digital chain (Natarajan et al., 2017). Blockchains employ cryptographic and algorithmic techniques to record and synchronise data across a network in an immutable fashion.

Global multi-stakeholder co-regulation has been proposed, but its immediate implementation is highly improbable. The FCA has proposed a global regulatory laboratory to facilitate policy and regulatory collaboration among regulators from multiple jurisdictions and multi-market aspirant firms. As a first step, the initiative proposes the establishment of an international ‘college’ of regulators, each with its own mandate or laboratory model, thereby awarding firms access to multiple regulators. It is a pragmatic approach to market entry that provides firms with guiding principles as opposed to a comprehensive inventory of standards for all participating jurisdictions. Other experts have proposed a long-term vision for a global multilateral laboratory that could be administered by a multilateral international organisation like the World Bank Group or the IMF. The European Commission could advocate for and coordinate these initiatives with its member states. The newly signed European Blockchain Partnership is a positive first step towards exchanging knowledge in

technical and regulatory disciplines and preparing for the introduction of blockchain applications on the European Union's Digital Single Market.

According to Diener and Spacek (2021), it is increasingly crucial for organisations, especially the banking sector, to stay current with the most recent technology and developments in order to remain competitive in today's quickly digitalising world. In the last several years, several financial institutions have incorporated technological advances into their workflow such as mobile payments, cloud services, and machine learning, in an effort to adapt and stay competitive in their respective markets. Because of these efforts, banks have been able to enhance the sevices to their customers, boost the efficiency of their operations, and penetrate new marketplaces.

In addition to this, Kitsios et al. (2021) mentioned that whenever it concerns the introduction of new technologies, the banking industry has shown to be among the most resistant to innovation and introduction of new technologies. Historically, the resistance was logical due to the sensitive nature of online banking and the requirement for face-to-face contacts when performing tasks such as establishing an account or applying for credit. Nevertheless, over the last decade there has also been a change in consumer expectations and behaviour, with an increasing number of individuals conducting regular financial transactions electronically or via the use of mobile applications. Consequently, institutions have been forced to change or suffer being left behind.

Moreover, Güler and Büyüközkan (2019) asserted that transition to digital commerce has already taken place, and it does not seem to be slowing down any time soon. In order for financial institutions to stay up to date with the most recent developments in technological trends, they are continually required to upgrade the systems and procedures they use. In addition, businesses are now under pressure to create smooth customer service throughout all platforms, whether it be in-person, online, or via smartphone apps. This additional strain is making it difficult for the banks to meet their customers' expectations. Despite the difficulties, banks are starting to adopt technological change and are starting to enjoy the advantages, such as greater client customer satisfaction.

In the view of Nachit and Belhcen (2020), traditional financial institutions have depended for a very long time on an intricate constitutional system in order to handle financial transactions and account balances. One of the primary

advantages of the digitalisation of the banking industry would be that this framework no longer needs to be used; It is a method that is both ineffective and expensive, and it exposes financial institutions to the risk of making mistakes. Online banking software provides an option that is more effective since it automates a significant number of the procedures that are engaged in transactions. Because of this mechanisation, the amount of time and manpower needed to complete transactions may be considerably reduced, hence reducing the likelihood of making expensive errors. Additionally, Mavlutova and Volkova (2019) believe that digital financial institutions provide insight into financial accounts in real time, which makes it simpler for financial institutions to detect and prevent fraudulent conduct. Because of this, digitalisation may assist financial institutions in improving their bottom position by lowering their operational expenses and increasing their level of safety.

According to Nadeem et al. (2018), Customer risk evaluations and identification conduct testing are crucial components of digital banking. They make it possible for banks to provide consumers with rapid and easy assistance, and they also make it possible for individuals, not just account-holders in the bank, to have exposure to financial products. In addition to this, Cuesta et al. (2015) asserted that one of the most significant benefits of using online payments is that customers have the ability to access a broad variety of services and complete any purchase from any location and around the clock thanks to this feature. Another benefit is that online banks are able to provide more competitive interest rates and charges in comparison to conventional banks. This is because they do not possess the same production expenses, which include branches and personnel. People who live in rural regions or who are always on the go will also find that using online payments is much more practical for them.

As per the views of Naimi-Sadigh et al. (2022) the software used in digital banking allows complex personalisation tactics driven by artificial intelligence (AI) and machine learning (ML). Customers may benefit from timely access to appropriate educational information, online elements, and financial possibilities when they bank with a financial institution. Customers are better informed and more engaged with businesses that provide tools such as automated budgeting, statistics for expenditure, and reminders to save money. For instance, a client who consistently goes over the limit on their savings account might well be given access to instructional materials on how to better manage their finances; a consumer who satisfies a specific set of requirements may be offered a new credit or debit card that comes with perks.

The use of online banking technology enables financial institutions to provide consumers with more individualised experiences, which in turn may help clients manage their economic health while also fostering loyalty and trust.

The introduction of blockchain has been one of the prominent emerging technologies that have attracted academic researchers and practitioners in various business domains over the past decade, including supply chain (Saberi et al., 2019), finance, marketing (Tapscott & Tapscott, 2017), accounting (Liu et al., 2019), and auditing (Dai et al., 2017b). The underlying mechanisms of cryptographic hash functions, asymmetric-key cryptography, and various consensus mechanisms support its decentralised, persistent, transparent, traceable (auditable), and immutable properties (Dai et al., 2017a; Yaga et al., 2018). Bitcoin, which Satoshi Nakamoto created in 2008, is arguably the most well-known blockchain application, indirectly encouraging the development of other digital asset ecosystems, decentralised applications (DApps), non-fungible tokens (NFTs), central bank digital currencies (CBDCs), and other blockchain.

There are three distinct phases in the evolution of blockchains: Blockchain 1.0, Blockchain 2.0, and Blockchain 3.0 (Swan, 2015; Xu et al., 2019). Blockchain 1.0 consists of applications pertaining to digital currencies (such as Bitcoin) that are designed to establish decentralised payment systems. Blockchain 2.0 includes a broader spectrum of applications, such as DApps, decentralised autonomous organisations (DAOs), etc., created by smart contracts in the financial industry. Blockchain 3.0 incorporates natural science, healthcare, and token-based applications in addition to financial applications (Swan, 2015). Blockchain technology continues to expand and evolve.

According to Rahmayati (2021), the blockchain system has garnered a significant amount of attention, moving it past the acclaim of specialised Bitcoin devotees into the general debate among banking industry professionals and financiers. There are many fascinating aspects of blockchains, but ‘immutability’ stands out as among the most important aspects of this decentralised ledger system. Immutability refers to a state in which something cannot be altered or modified in any way. This is among the most important elements of the network, and it helps to guarantee that the system will continue to exist in its current state, which is that of a permanent and unchangeable network. The blockchain system operates in a manner that is rather unlike to the conventional financial system. It is not reliant on centralised authority but rather relies on a group of nodes to guarantee that the blockchain features are maintained. Moreover, Osmani et al. (2020)

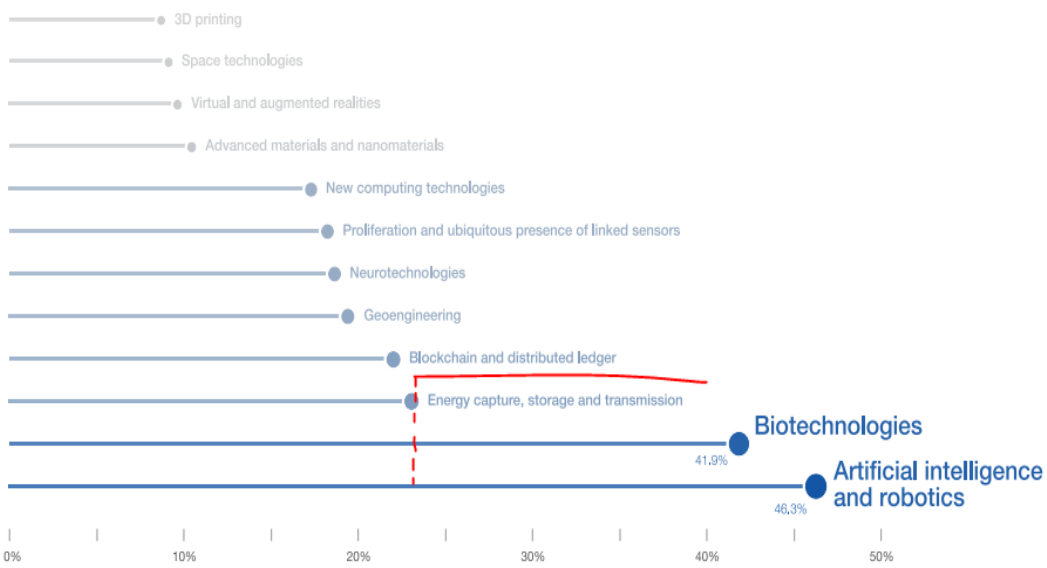
stated that the digital ledger is stored in duplicate form at each node in the network; each node in the network must validate a transaction before it can be added. If the vast majority of people agree that it should be included in the ledger, then it will be. This helps to foster openness and renders it resistant to corruption. Because of this, no one is able to add additional transaction entries to the blockchain until they get the approval of the plurality of the nodes. Whenever the transaction blocks have been recorded to the blockchain, it is impossible for anybody to go back and edit the information. This is another point that lends credence to the list of important blockchain characteristics. Because of this, it will be impossible for any person on the system to modify, remove, or otherwise change it.

In a similar context, Swan (2017) evaluated that the system is decentralised, which means that it does not have any controlling body or a single individual responsible for maintaining the structure. The network is maintained by a distributed collection of nodes, giving it a decentralised structure. This is one of the most important aspects of blockchain technology that is implemented flawlessly. Companies are able to easily access the network over the Internet and save their assets there since it does not need the involvement of any regulating body. Furthermore, Ulieru (2016) noted that companies are able to save anything, beginning with cryptocurrency, crucial papers, and contracts, as well as other important crypto-assets. In addition to this, with the assistance of blockchain technology, companies will still have full control over them by utilising their private key. Moreover, companies can see that ordinary people are regaining their authority and privileges over the things they own thanks to the decentralised system.

5.3.1.6. DLT/Blockchain Technology Governance Framework in Banking and the Decentralised Autonomous Corporate Governance

Blockchain and distributed ledgers were ranked as the fourth technology that requires better governance, with about 22% of respondents choosing blockchain among the other two technologies that call for an improved governance framework, according to survey results from 2016 that were included in a report by the World Economic Forum, noting that robots and artificial intelligence are the top two technologies in need of improved governance.

Figure 5:4 *Emerging Technologies Alleged to Require Enhanced and Effective Governance*



- *Source: Global Risks Report (2017) and Global Risks Perception Survey (2016), the World Economic Forum.*

Cocco et al. (2017) stated that by incorporating blockchain technology as the primary method for record-keeping in the banking system, there will be a greater inclination to enhance the system's governance. Legacy technology systems impede the flow of digital transactions by utilising cloud data, which has significant implications for data ownership and possession. The late rejection or approval of the transactions will serve as a determining factor in this regard. Hence, it has to be kept in a particular governance framework that involves making less decentralisation in the blockchain system. Liu et al. (2021) emphasised the need for increased attention to the occurrence of conspiracies in the digital actions of individuals who hinder the effectiveness of blockchain technology.

Engaging in an open mess with data has resulted in the emergence of new threats in today's bank operations, such as software alterations in the banking system that affect third-party applications. Unscrupulous participants may instill fear in the transactions by making alterations to them. In this regard, it is important to have an essential governance framework ready to prevent such violations in blockchain technology. In this case, it is important to have a gatekeeper authority in the blockchain network to maintain the flow of transactions according to the protocols. However, in this context, Zhang (2022) argued that the role of the gatekeeper authorities has been compromised by threats from some blockchain participants who demanded an influential amount for completing a transaction or even passing a smart contract in any digital currency.

Therefore, for this purpose, the role of the government authorities has increased in the blockchain system of various banks. It is revealed in this context that multiple privately owned banks have begun implementing precautionary measures to ensure the efficiency of their blockchain management system.

One of these methods is mining, which makes use of several gatekeepers in the blockchain, who are known as ‘competitive bookkeepers’; the miners identify and approve the transactions held in the blockchain network and enable different users to authenticate the transactions before the transfer of money. Zhu (2018) stated that another precautionary method is the inventory pledge financing undertaken by the stakeholders of the banks to obtain loans from the banks. Inventory pledge financing is a fundamental aspect of the banks' relationship with stakeholders seeking loans and aiming to streamline operations by utilising the banks' blockchain system. This case has gained significant attention in recent establishments.

However, traditional banks still consider it unsuitable due to the requirement of adhering to the implementation of the online ledger, which necessitates meticulous and accurate maintenance within the banks' premises. In this case, newly established modern banks have made progress on this front as they have predetermined projections and follow protocols for the maintenance of the online ledgers.

Due to differences in ledger installation and bank locations, banks encounter challenges in effectively managing warehouse operations and bank deposits using a reliable blockchain technology system. This method has been quite helpful in the supply-chain financing of the stakeholders or the suppliers that indulge in smart contracts with the banks for the loans from the banks made by the suppliers. However, in this method, the risks of duplication and fraud have been common in banks in developing countries. Crosser (2021) examined the Chinese banking industry in 2012 and was shocked by the theft of stock between the banks’ warehouses, wherein around 1,250 cases of the stock pledges had been stolen by the online bank agents and several other corporate agencies in the district of Shanghai. Therefore, implementing inventory pledging financing under the blockchain system is considered risky due to the complexity of integrating multiple work systems and incorporating additional smart contracts. The significance of supply chain financing has been enhanced

through the introduction of more competitive services by new intermediaries. The banks' collaborative framework, with the help of fintech, has provided them with the capacity to integrate the operations of the different stakeholders.

Peters and Panayi (2016) asserted that an important governance framework of the banks includes the consolidation of all its activities that come under its jurisdiction and that of its stakeholders. The banks should prioritise implementing Internet of Things (IoT) technologies to enhance the efficiency of inventory ledger financing within the supply chain financing system. Given the circumstances, banks must develop various models to effectively manage the risks associated with payments and receipts. The credit risk prediction model is one of the models that must be adopted by the banks to avoid risk of any kind of intervention in smart contracts. The utilisation of disruptive contemporary technologies has played a crucial role in the preservation of the blockchain networking procedures in this instance. Therefore, the utilisation of digital inventory ledger financing becomes more advantageous for conventional banks. However, Priem (2020) attested that bank need to identify different models for the special governance of digital inventory ledger financing so that supply chain financing of the banks can be processed with utmost clarity.

Liu et al. (2021) stated that in the development of online supply chain financing (OSCF), many models of the operational frameworks have been established, including B2B (business to business) and C2C (customer to customer) platforms, along with the codes for buyers and suppliers of the platforms, as an online service provider.

The SME sector has been the prime beneficiary of supply-chain financing. It has been noted that online supply-chain financing (OSCF) has been empowered with various new features and standards for the smooth operations of financing in the blockchain network. Consequently, the transaction amounts have increased while the associated costs have decreased, thus giving an advantage to the challenge of managing inventory ledger financing in the banking industry. Lekhanya (2018) observed that since banking operations are spread across various branch locations, the opportunities for credit growth have become more significant in supply-chain financing. The exponential growth of credit in online supply-chain financing (OSCF) has overwhelmed the managerial operations and exposed a deadlock in the functioning of the stable credit system under the banks' blockchain technology. There is a potential risk that the electronic credit system, initiated by unidentified stakeholders, may result in subpar transactions. This can lead to inconsistencies in the standards

of the current smart contracts and hinder their future execution. Thus, the need arises to set strict procedures for the management of online financing mechanisms that must be followed by all banking institutions.

Generally, market rules and regulations seek to address undesirable consequences of an activity by holding individuals or entities liable and accountable for results associated with that activity. Due to the technology's decentralisation, disintermediation, and anonymity, the absence of a responsible legal entity may make implementing and enforcing rules on blockchain networks challenging. Governance of the network may be determined by pre-programmed protocols that cannot be altered, network activities may operate autonomously, and actor identities may be difficult to discern. The degree to which these obstacles exist depends on network accessibility. Private enterprise blockchains will be administered and utilised by parties whose identities are known and who are likely to exercise some level of network control. In contrast, public, permissionless, and universally accessible blockchains will and do present a number of these problems. No matter where a network or application falls on the spectrum between open and closed, all activities and actors must be able to demonstrate compliance with all applicable laws and regulations.

5.3.1.7. Technological Strengths of the Cryptocurrency

In the view of Cai (2018), cryptocurrencies are the cheaper forms of online transactions that have not required the services of intermediaries for initiating or completing a transaction. The elimination of intermediaries has allowed SMEs to take part in the trading of online money with banks and normal stakeholders. Therefore, there are fewer hindrances to managing the processes with full personal control. Authorisation and transaction fees for the online exchange of money have been eliminated from this system. It has also helped migrant businessmen to send remittances to their homes through cross-border transactions. Moreover, it has been found that only 1% of the normal fee for sending money online is charged to the migrants who send remittances through cross-border transactions.

Belke and Beretta (2020) noted that the utilisation of cryptocurrency enables both residents and non-residents to acquire money independently, without relying on the official currency issued by the country's central banks. However, this move has been restricted in various countries because of illegal or fraudulent use of the money. In a specific context, Yermack (2015) advanced the theory that the utilisation of cryptocurrency for transactions allows users to avoid paying any interest when exchanging legal tender for US Dollars. For instance, whenever there is a crisis, such as the Argentina

Peso crisis, Bitcoin is used to make regular exchanges of money online. As a result, it has continued to sustain a vital business curriculum and a consistent flow of remittances into and out of the nation. Similarly, Pinzón and Rocha (2016) stated that an additional significant aspect of cryptocurrency is its ability to facilitate the duplication-free rehearsal of individual monetary transactions.

According to Xie (2019), cryptocurrency is heavily underpinned by distributed ledger technology, which is built on entirely decentralised networks. Cryptocurrency decentralises money and has digitally disturbed the world's economic structures. It has also provided a powerful cryptographic mode that allows digital currency to remain untraceable. The emergence of digital cryptocurrencies such as Bitcoin and Altcoins was facilitated by the concept of cryptocurrency. By offering cryptographic verification of integrity, individuals can directly engage in monetary transactions without the need for a third-party intermediary. The economic standing has increased to a market valuation of more than 2 trillion USD, which is supported by advanced capabilities. Digital currencies are disrupting traditional organisations as well as marketplaces all over the globe, bringing with them the prospect of economic liberty for all through democratisation.

Joo et al. (2020) proves that blockchain is making big improvements to industries, especially the finance industry, which is at the heart of why cryptocurrency is so appealing. Cryptocurrencies provide a decentralised structure which levels the playing field by removing intermediaries; as well, it allows users to deal independently and as peer-to-peer. DAI stablecoins, a cryptocurrency whose value is pegged to a fiat currency, for instance, mitigates client risk by ensuring that its liquidity is not dependent on trustworthy partners. All DAI is guaranteed by security costs and has greater accessible contracts on the Ethereum platform, allowing market participants to monitor the system's status in real time where service charges are low. Transactions costs are low because Bitcoin transactions are peer-to-peer and do not require centralised middlemen. For instance, an international financial transaction through a centralised bank, including Bank of America, would contain conversion costs, whereas currency conversion fees are not charged by decentralised systems.

As DeVries (2016) noted, payments are made instantly. As a point of protocol, centralised authorities and third parties increase transfer times in addition to costs. By allowing near-instant peer-to-peer payments, cryptocurrencies alleviate this irritation. When purchasing and selling products outside geographical boundaries, people and corporations

frequently deal with outsiders, which opens the possibility of fraud. While there will always be people who want to defraud a system, Bitcoin technology can reduce risk of fraud since activities on a blockchain are visible and cannot be modified. According to Xie (2019), The process can be described as a series of digital certificates, where a client transfers virtual currency by verifying a hashing preliminary operation and then attaching the resulting shared key to the next coin. The owner may detect whether a transaction has not really been verified for each node by using the hashes for every currency specified. These transactions are processed without involvement of a third entity and are publicly disclosed as part of digital monetary imprint. Although a private key is necessary to generate a unique identifier, it is not utilised for validation. The produced access policy is used for verification. A digital signature is a cryptography sign used by the secret key holder to verify the decryption key.

From the perspective of Calvão (2019), Smart contracts are utilised by multiple cryptocurrencies, such as Bitcoin, Horizon, Polkadot, and Ethereum, to navigate and enforce pertinent legal frameworks and regulations on technological events. Cryptocurrencies rely on the transparent actions of honest miners to either expose or conceal data. The integration of smart contracts in cryptocurrency enables seamless functionality, indicating a promising future for this digital currency as technological advancements continue to reshape the fields of finance, healthcare, and other aspects of daily life. The smart contract outlines the process of verifying and rewarding participants. The contract's instructions are stored in a specific address on the blockchain. To initiate the transaction, the contract requires specific parameter information.

5.3.1.8. An Investigation Between Countries for Allowing and Banning Digital Trading Currencies, Especially Cryptocurrency

According to Okpalaojiego (2021), digital trading currencies, because they are highly decentralised while being regulated in virtual ledgers, directly influence the volume of economic transactions that are usually regulated in an economy. Moreover, in these types of transactions (whether physical or abstract), the fundamental value that determines and governs their occurrence in an economy is primarily influenced by perceived inherent characteristics, while also having an indirect connection to the trading and investment of company shares. In other words, just like stocks of a company, cryptocurrencies are also guided by intentions of investment and profitability. However, as per Dimpfl and Elshiaty (2020), cryptocurrencies are more volatile or risky in nature compared to stocks and are mostly guided by illegal and unethical

practises, and their circulation ultimately directly influences governments to exert control and administration of commercial transactions in an economy. Kim and Chung (2018), on the contrary, characterised this practise as highly profitable. They argue that the crypto-economic system can enhance and supplant conventional paper-based commercialisation models in an economy.

In this regard, the UK, which regulates such practise, has now also started integrating this crypto-economic model within the banking system of the economy. For instance, the Bank of England in this regard has initiated and directed its focus towards effective regulation of cryptocurrency, taking into account its soaring demand backed up by blockchain technology. Similarly, Bhimani et al. (2022) states that the correlation between the state of the economy and national development factors is directly influenced by the acceptance and utilisation of cryptocurrency. For instance, the UK, which follows the privatisation model, is also a developed economy. Hence, its administrative capability as well as its resource value far exceeds the level that developing economies have in terms of proper regulation and monitoring. The prohibition and restriction of this activity in developing/emerging economies like Morocco can be attributed to the absence of consumer protection policies and inadequate administrative infrastructure.

Conversely, Adil and Fadi (2022) stated that the potential of cryptocurrency in emerging economies is huge and can lead to substantial growth and development. Financial inclusion, increasing social trust and improved accessibility of financial services can be regarded as some of its major benefits. In light of this, Marella et al. (2020) stated that mutual or social trust is a key element in a financial transaction that motivates commerce within an economy. Cryptography backed by innovative technologies such as blockchain in this regard provide cryptocurrency with this element. Similarly, stability in currency is also a significant national development factor that influences the relative growth of developing economies.

In Indonesia, for example, where currency swings are common, government intervention is unavoidable, even though commercial transactions may be readily carried out using cryptocurrencies. Because of this, it is understandable that Indonesia does not legalise cryptocurrencies in the economy.

When Morocco banned cryptocurrencies in 2017, it didn’t get much pushback except from people who had investments in cryptocurrencies. However, the official communication conveyed by the Morocco stock exchange was

extremely ambiguous, stating that the regulatory status surrounding this practise is not yet developed and could place users at great risk if implemented without an adequate level of oversight. In addition, it urges individuals to comply with existing laws and utilise authorised financial intermediaries for all types of transactions and remittances.

Due to the nature of cryptocurrencies, Bagus and de la Horra (2021) contend that ethical considerations also contribute to their prohibition in various economies. In other words, this practise can imbue an economy with unethical activities such as tax evasion, money laundering, and even the unlawful trade of narcotics and weapons. Despite this, cryptocurrency exchanges are facilitated by blockchain, which is reputed to be both secure and quick (Pomelnikov, 2021). This element is predominantly supported in the United Kingdom by stringent government regulations and guidelines on business ethics and standards. Nevertheless, recent Coinbase statistics indicate that approximately 34% of people in the UK possess cryptocurrency assets, while 61% intend to expand their investment portfolios (Pravdiuk, 2021).

The impact of digital currency investments has disrupted conventional commercial operations. The primary cause is the absence of infrastructure in poor nations, which necessitates a sizable investment and entails weak planning and regulating frameworks on the blockchain system. Blockchain, on the other hand, is appreciated in the routine business transactions that helped capitalists in developed nations like the US. This has made it possible for entrepreneurs and workers alike to create shares in various marketplaces. Thus, the use of blockchain has completely simplified commercial processes in industrialised nations. Khanfar et al. (2021) on the other hand, concluded that the online payment system has become immoral as a result of blockchain. The users are free to distribute assets privately to their peers without restriction. In this regard, a number of academics have noted how blockchain technology has greatly increased decentralisation and given consumers more options when transferring assets. According to studies, blockchain has given consumers the necessary tools to operate digital currency contracts, enabling them to engage in productive transactions. Toorajipour et al. (2022) countered that the blockchain system lacks the intelligence to fully restrict the transparency of trade practises.

Due to their rapid proliferation, virtual currencies pose a threat to established sovereign currencies, official currencies, and central bank fiscal policies, despite being swift, secure, and transparent. Cryptocurrencies such as Ethereum and Libra are created by organisations unaffiliated with any governmental or corporate power structure. Consequently,

these digital currencies are distinct from fiat currencies administered by central banks and subject to policy agendas. Some contend that this autonomy functions as a check on the monopoly of central banks, discouraging them from mismanaging the monetary supply (Raskin & Yermack, 2018).

This may result in financial institutions becoming less leveraged, credit creation being reinvented, and monetary policy being downgraded. The European Central Bank warns that speculative inflation, issuer failure, and fraud are potential issues with digital currencies, according to research published in 2018 (Dabrowski & Janikowski, 2018). In order to reduce these complexities, it is suggested that governments align their laws. The data demonstrates that central banks respond to the development of new digital currencies in a variety of ways, including explicit prohibition, tolerance, and participation. The majority of developed countries have taken a middle ground by allowing their use and acting in good faith.

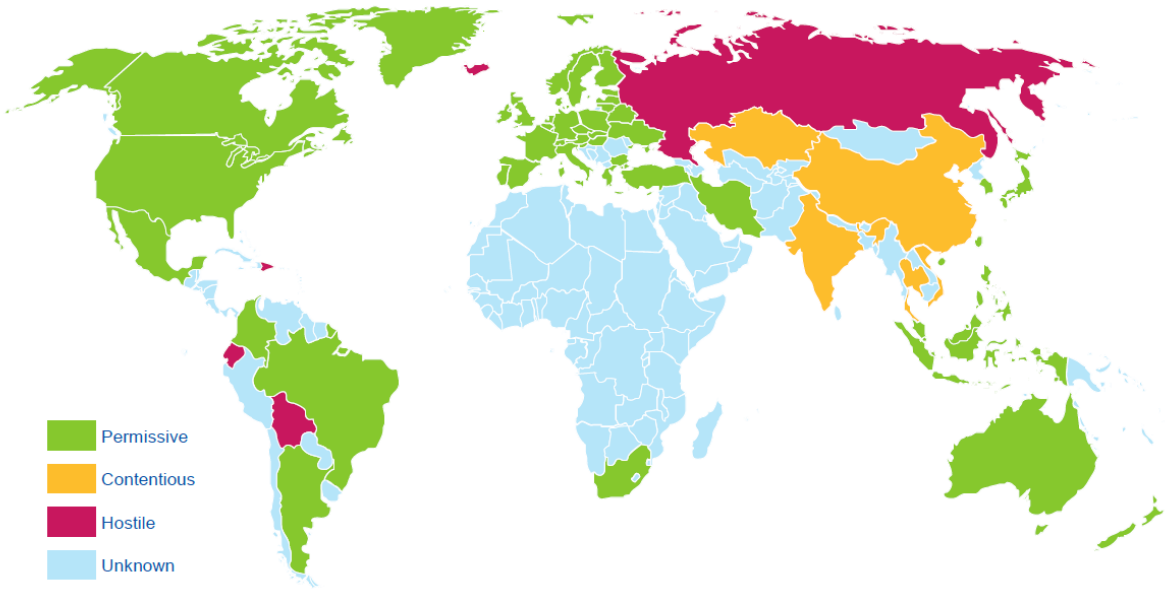
Moreover, the UK is now outlining plans for safer adoption of cryptocurrency in the economy whilst also utilising it for addressing different economic areas. For instance, improving stature as an international leader in financial services, promotion and adoption of innovative technologies in the financial sector as well as curbing the prevalence of illicit money (Coulter, 2022), specific perspective behind legalisation of cryptography although, can also be effective against fighting general persuasive challenges of developing economies such as poverty by making financial accessibility much easier and flexible. However, in the UK, cryptocurrency use as a currency exchange system is still complex and is not generally accepted by some financial and non-financial institutions.

As per the Bank of England, cryptocurrencies cannot be regarded as “money” due to their lacking the traditional typological qualities of money and therefore do not present a systemic danger to the viability of the banking industry. Nevertheless, the Bank of England and the Financial Conduct Authority (FCA) have issued a number of precautionary measures and guidelines regarding the use of cryptocurrencies in the UK because the judicial ramifications, legislation, and position of currencies and crypto assets could shift depending on their identity, category, and utilisation. These cautions focus on the lack of financial and regulatory safety nets, the use of cryptocurrencies as safe havens for money, and the risks associated with speculation and volatility (Coulter, 2022).

Depending on which component of DLTs we are discussing – cryptocurrencies, blockchains, shared ledgers, smart contracts, etc. – the current regulatory landscape pertaining to DLTs is both infantile and complex. The regulatory treatment of each of these components varies, but a lack of specific regulation is shared among them.

Regarding the legality of Bitcoin usage, few nations have taken a stance against it. The majority of countries are permissive regarding Bitcoin usage, as depicted by the map below.

Figure 5:5 *Attitude of Countries Toward Bitcoin*



- *Source: The World Bank (https://www.worldbank.org/en/topic/fintech/brief/key-data-from-regulatory-sandboxes-across-the-globe)*

How countries view cryptocurrencies in terms of taxation is a distinct issue: some countries view cryptocurrencies as digital money, while others view them as digital products or commodities. Significant progress was made when the European Court of Justice (ECJ) ruled in October 2015 that Bitcoin exchange transactions should be exempt from value-added tax (VAT). The ECJ ruled that Bitcoin transactions are exempt from value-added tax under the provision pertaining to transactions involving currency, bank notes, and legal tender coinage. This ruling implies that Bitcoin is treated as currency, which is a change from previous Member State regulations (such as Germany, where Bitcoin was considered a commodity).

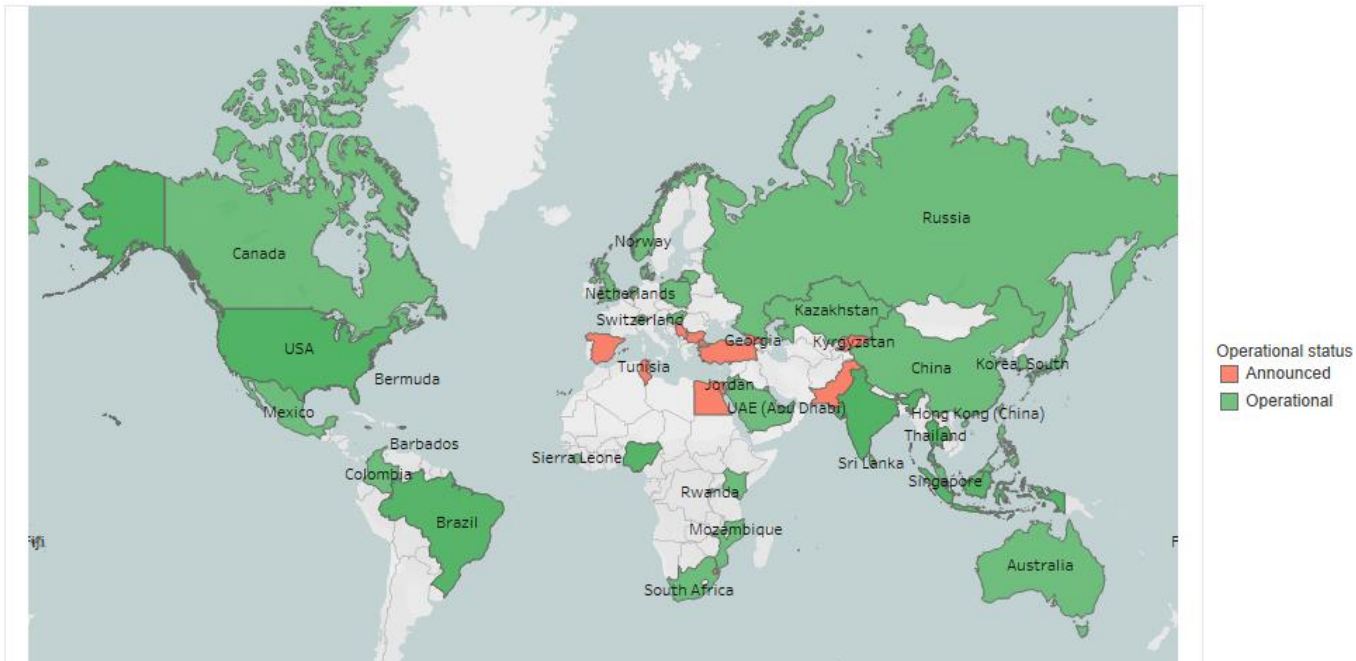
As a counterexample, regulators in the United States have diverse criteria for Bitcoin: some consider it money (FinCEN, SEC), while others consider it a commodity (CFTC) or even a property (IRS, Internal Revenue Service). This gives a judge discretion when a Bitcoin-related lawsuit is brought to court.

Initiatives to investigate and regulate blockchain technology, the formation of a specialised task force, and the development of national policies have been recommended and undertaken by various regulatory and supervisory authorities around the world in relation to virtual currencies and distributed ledgers with positive positions, including but not limited to the European Parliament, the US Congress, the US state governments, the EU Securities and Markets Authority, the Options Clearing Corporation, and the Options Clearing Corporation.

In contrast, some regulatory and national authorities have a neutral and negative positions regarding DLT and virtual currencies, focusing on the risks more than the benefits, such as the European Commission, the US Senate, the US House of Representatives, the European Banking Authority, the Financial Crimes Enforcement Network of the US Treasury Department, the Consumer Financial Protection Bureau, the US Securities and Exchange Commission, the Financial Action Task Force, and Bank for International Settlements, all of which deduced and recommended having more extensive exploration of the risks associated with blockchain and virtual currencies, such as avoiding illicit activities and limiting the role of central banks by the application of blockchains (noting that the negative positions of the aforementioned authorities do not represent an actual opposition to the use of DLT and virtual currencies).

On the other hand, according to the World Bank, the number of regulatory sandboxes globally reached 73 sandboxes within 57 jurisdictions. The figures below show regulatory sandboxes' allocations and density on the global scale:

Figure 5:6 *Distribution of Regulatory Sandboxes by Country*

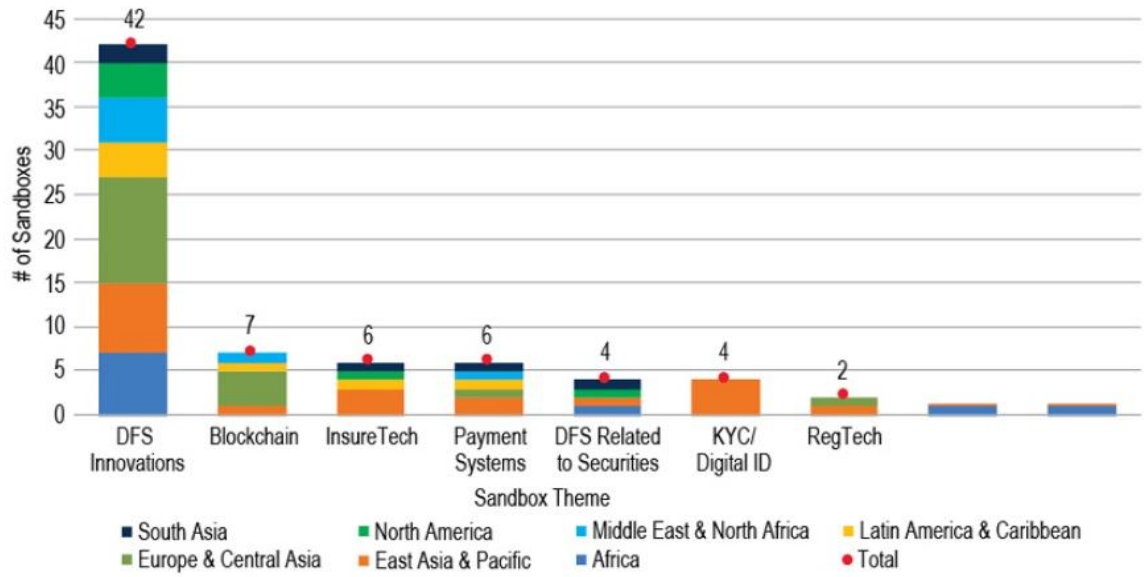


- *Source: The World Bank https://www.worldbank.org/en/topic/fintech/brief/key-data-from-regulatory-sandboxes-across-the-globe*

According to the World Bank, the total distribution of sandboxes as shown in Figure 5:6 above reached 71 sandboxes worldwide, 7 (or 10%) of which are related to the blockchain technology topic for purposes of increasing remote verification.

Furthermore, Europe and Central Asia are the regions that use the 7 blockchain sandboxes the most, followed by the Middle East and North Africa, East Asia and the Pacific, and Latin America and the Caribbean.

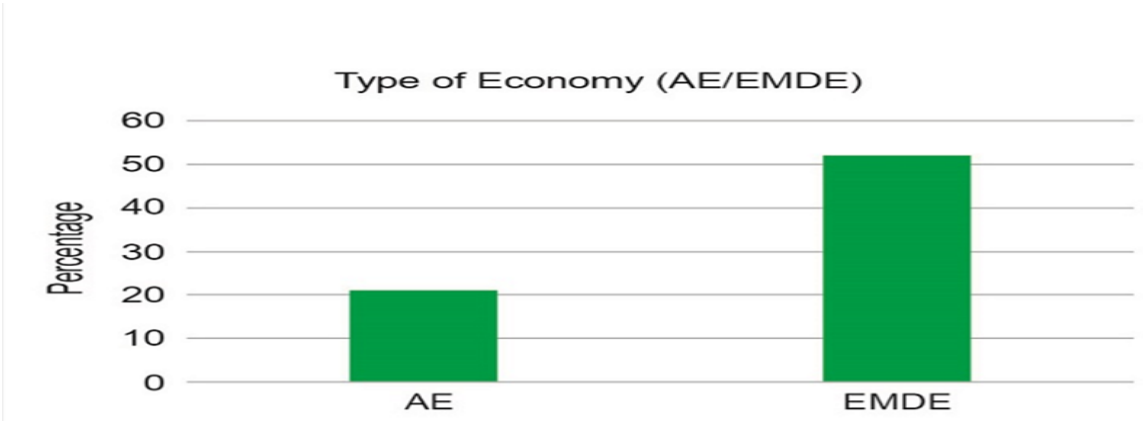
Figure 5:7 *Distribution of Thematic Sandboxes by Region*



- *Source: The World BankSource: The World Bank https://www.worldbank.org/en/topic/fintech/brief/key-data-from-regulatory-sandboxes-across-the-globe*

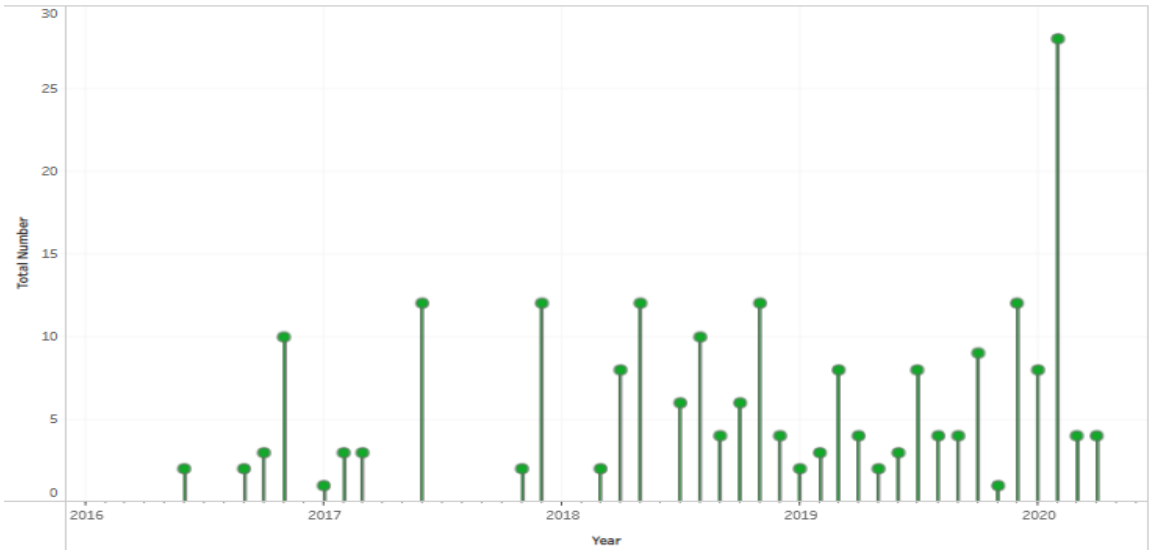
According to Figure 5:8 below, emerging and developing economies utilise more than 50% of the world's regulatory sandboxes, compared to industrialised countries, which use around 21%.

Figure 5:8 *Regulatory Sandboxes Distribution by Market Type*



- *AE: Advanced Economies*
- *EMDE: Emerging Markets & Developing Economies*
- *Source: The World Bank https://www.worldbank.org/en/topic/fintech/brief/key-data-from-regulatory-sandboxes-across-the-globe.*

Figure 5:9 *Density of Global Financial Technology Related to Sandboxes.*



- *Source: The World Bank https://www.worldbank.org/en/topic/fintech/brief/key-data-from-regulatory-sandboxes-across-the-globe*

First to implement a regulatory sandbox in 2001 was the Philippines, as reported in the World Bank Fintech's "Key Data from Regulatory Sandboxes across the Globe," briefed on November 1, 2020. Since then, other countries have followed suit, including Australia, Hong Kong, Malaysia, Singapore, the United Arab Emirates, and the United Kingdom, primarily through their central banks and securities regulators and other financial supervision authorities. Figure 5:7 further illustrates that the number of worldwide fintech-related sandboxes expanded, especially from the middle of 2018 to 2020. Rapid expansion in the usage of sandboxes to test fintech innovations and regulation can be seen all over the world, with more than half of all relevant sandboxes being constructed between 2018 and 2019, and nearly a fifth being developed in the first half of 2020 alone.

5.3.1.9. Regulatory Frameworks for Cryptocurrency in the US and China

In the perspective of Xie (2019), the cryptocurrency market has been strengthened over the past years in countries that had an average growth of 750 billion USD over 7 years. The transformation of markets to digitisations allowed investors to make ingenious investments in the stock market by managing a portfolio of investments. Studies have argued that the role of cryptocurrency is to decentralise the flow of digital money in the economy. Therefore, it has engendered new forces in the regulatory laws governing the digital economic spectrum of the world. Due to this, countries such as

China and the US have argued over the use of cryptocurrency as the medium of currency as legal tender. In this regard, China has completely ignored the widespread and specific adoption of cryptocurrency in the banking sector and has prohibited the circulation of cryptocurrency within the country. Conversely, the US has integrated the fundamental aspects of cryptocurrency into every aspect of the banking system. However, Gomber et al. (2018) argued that several conflicting zones operate in the network of cryptocurrency that inhibit the processes and the mechanisms in the online trading and financial system in the world's banking sector. In this context, most of the areas in the banking system are highly vulnerable to the threats caused by hacking agents either of some companies or competing banks. In this respect, Marke (2018) stated that China has followed the conventions of eliminating the barriers to the use of cryptocurrencies in the banking sector. As a result, these specific areas of the banking system are susceptible to online fraudsters and are in violation of the laws set by central banks to protect the integrity of banks and ensure efficient transactions. However, in this field, the dominant capitalist system in the US has deviated from the regulations set by the state government regarding the standards for specific banking transactions. This has disrupted the smooth operation of various participants in the digital currency exchange.

According to Xie (2019), There are multiple rationales for employing cryptocurrency in the realms of digital currency exchange, including mining and the chronological recording of online transactions in the banking system. However, several disadvantages of cryptocurrencies have made investors reluctant to trust the services of the online agents associated with blockchain technology management. Due to its decentralisation, the Bitcoin blockchain allows volunteers and technologists (referred to as the blockchain network) to upgrade it through unofficial procedures that rely on imprecise measurements and concepts of consensus that are not constrained by any legal or organisational structure. Likewise, Bitcoin functions as virtual money, acting as an exchange medium functioning fully intangibly that is not legal tender but can replace legal tender. It is defined as an Internet-based virtual currency wherein the title of a specific unit of value is validated through cryptography. Puddu et al. (2017) justified that mining serves as both a transaction system and a mechanism for releasing Bitcoin. The procedure includes solving complicated mathematical problems and rigorous coding, which results in the creation of extra blocks on the blockchain to permit subsequent transactions. The emergence of this alternate yet effective form of money is such an element that gives Bitcoin its worth as a virtual currency. When Bitcoin

was released, miners were rewarded for solving mathematical problems with a fixed amount of Bitcoin. This limit has been fixed at 21 million bitcoins.

The Constitution of the US has regulated the term of money creation under Article I, Section 8, Clause 5, which authorised the use of money under the federal government and allowed the future establishment of regulatory departments that ensure the inception of virtual money to facilitate a more powerful economic system in the country. In this regard, Hughes (2017) stated that FinCEN (the Financial Crimes Enforcement Network) is a treasury department in the US that has accepted Bitcoin as a special medium of money in the business sector of the US and is therefore called a money service business in the US. In this space, Bitcoin has been used as the legal tender of money in business; however, it is neglected in the context of most of the normal monetary exchanges in the country. In a particular context, cryptocurrency has been given the value of legal tender in the US as it is used to execute transactions for the purchase of goods and services. In this way, the giver and the accepter of the virtual money have been considered the money transmitters under the regulations of the FinCEN. In a similar context, Xie (2019) stated that in a case in the US, the federal district court has emphasised that the nature of Bitcoin and Ethereum is such that they can be used for the exchange in purchase and sale services; however, it will not work under the direct supervision of government regulations. It is because of the highly decentralised nature of cryptocurrency that it can be modified by the stakeholders independently at any time. However, cryptocurrency has generally not yielded significant results in various areas of the banking sector, such as stock markets, small and medium-sized banks, and large corporations. The primary cause for this is the lack of authenticity in the operations conducted within the blockchain technology, which can be altered by users at any time without the involvement of any governing body. In this context, Liu et al. (2021) stated that the larger banks have terminated the use of cryptocurrencies as the security for any smart contracts is held among the beneficiaries of the transactions.

Furthermore, commissions such as the commodity futures trading commission and the Commodities Exchange Act have also supported the legal use of cryptocurrency in different banking businesses with the prior consent of the parties involved.

Magnuson (2018) stated that China has implemented strict regulations on cryptocurrency exchanges, effectively controlling the streamlined business and banking sector. The People's Bank of China (PBoC) issues the legal tender of the country and has openly repudiated any amendments in the use of any substitute currency in the banking sector. However, like the US, it has also allowed investors to regulate the use of cryptocurrency in the general or personal interests of business. Moreover, banks in China are not allowed to make any payment or smart contract via using cryptocurrencies with foreign banks. In this context, if a bank gets involved in such activities, such banks will be criminally liable. However, Jiaying (2019) contended that China dominates 90% of the cryptocurrency market's trade volume. However, this convention was subsequently limited due to the efforts of fraudsters, money launderers, and fundraisers. In 2017, the Chinese government ordered a complete ban on the use of cryptocurrency as the medium of legal tender in all domains of business in banking and the associated corporate sector. From this announcement, all crypto markets were shut for any business in the country.

According to Nadeem et al. (2021), the regulatory landscape in China continues to pose challenges for the crypto-markets. The examination of blockchain technology for sustaining trading in the crypto market has been specifically focused on the performance of domestic banks in China. However, the type of cryptocurrency that China's banks have to use will be the state-created cryptocurrency that would be legally used as legal tender in the domestic banking sector of China. Apart from this, the announcement made by the Chinese government to ban cryptocurrency has not been much use because of the suspected use of cryptocurrency in the insider trading markets of China. There are still various platforms that are operated privately by entrepreneurs to execute overseas smart contracts with local persons. This has presented a major threat to the regulation system of payments in the banks of China. In this context, Economy and Levi (2014) argued that, like the US, China has to discover new regulations on the move so that the mainstream businessmen can have a strong dealing with domestic as well as foreign businessmen.

5.3.1.10. A Country-Wise Analysis for Key Central Banking Laws, Rules and Regulations for Exchanges

In the view of Kiff et al. (2020), the current scenario of corporate governance as determined by the central banks of several countries has been debated many times the sense of using cryptocurrency in the blockchain system. This debate has been mainly aimed at increasing the conditional frameworks for using cryptocurrency as legal tender in most parts of

the banking business. In this case, the Bahamas, Ecuador, and Ukraine have conducted surveys on the legal use of cryptocurrency through central banks' issuance plans. The central banks of these countries want to mitigate the impacts of the private issuance of money and its dominance in making payments. As these regulations of the central banks may reduce the social cost of the people associated with the transactions, the use of cryptocurrency through the blockchain system is upheld by the central banks of these countries. However, Piazza (2017) determined that certain banks have not yet taken into account the utilisation of certain technologies due to concerns about cybercrime, which disrupts the financial services ecosystem within a specific financial framework. In a specific context, the utilisation of digital currency can facilitate the connection of impoverished and geographically isolated individuals with others through digital means, overcoming the constraints imposed by poverty and remote living conditions. Furthermore, Griffoli et al. (2018) argue that digital currencies can facilitate the implementation of government subsidy policies in remote regions of certain countries. Furthermore, individuals residing in isolated regions devoid of banking institutions can receive prompt access to funds. In addition, the interest rates applied to physical cash were higher than those applied to the issuance of digital currency.

In the context of digital currency, Raskin and Yermack (2018) stated that the mature use of blockchain technology can empower effective money transmission by stimulating attractive investment policies in digital currency. Central banks can earn huge interest rates on the digital transmission of money and can help governments to make increased public expenditures for the welfare of the people. An important aspect is that central banks will maintain liquid assets in the form of cash while the heavy use of cryptocurrency in the mainstream context of money will stabilise the liquidity. Central banks which are strongly contemplating CBDC (Central Bank Digital Currency) use a variety of strategies to consider user viewpoints during the design phase. They use practises in product development such as user-centred design and experience design analysis, to help achieve optimal user happiness and usability. Again, Neufeld (2020) asserted that for the Bank of Canada, this has involved conducting surveys and focus groups with potential customers. They concluded that the most key aspects are low transaction fees, convenience of use, affordability, and data protection perceptions. User participation (particularly merchants) throughout the agile development process generates highly functional and approachable technologies that encourage adoption, improve robustness, and may lead to product uptake.

Raskin and Yermack (2018) also recommended that the majority of existing CBDC experiments be centred on centralised authority designs. However, decentralised or hybrid architectures, as well as offline peer-to-peer existing payment platforms without a ledger, are all viable. In the field of digital assets, “decentralisation” mainly refers to the decentralised authority for verifying and committing transactions to the blockchain. In a traditional setting, transactions are recorded in a centralised ledger (a client-server approach with no middleware). The payer would connect to the centralised ledger keeper and initiate a transaction. The funds are transferred to the recipient’s account. The blockchain would be modified once the payer has paid and been validated as the account owner with sufficient funds to complete the transaction. Rauchs et al. (2018) determined that DLT networks can be public (open to everybody) or limited to a chosen number of players (private). Therefore, the integrity of the ledger as a blockchain can be governed by a subset of users (permissioned) or by every network user (permissionless).

According to the Central Bank of the UAE (2021), global efforts for abuse prevention within the banking system to eliminate financial terrorist actions as well as money laundering, have been highly essential. Article 11, based on the standards for UAE-based exchange business, is utilised by the UAE-based central banks that involve important sections related to security and risk management, customer protection, compliance with anti-money laundering, governance and management and licensing. These sections are valuable for managing financial transactions and monetary exchanges in an ethical, legal and safe manner in digital banking. For example, SMS notifications are necessary to be delivered to every outward remittance during the payment instruction's processing to transmit to the correspondents, for example, exchange houses and foreign banks (Central Bank of the UAE, 2021). On the other side, an article by Reuters (2022) revealed that different governments of different countries have different exchange rules in the banking system in regard to digital technologies’ utilisation. For example, the government of Bolivia restricted the use of distinct cryptocurrencies like Bitcoin since 2014 because it believed that monetary instability and tax evasion would be facilitated by it. In contrast, the Brazilian exchange and security commission provided approval to multiple cryptocurrencies. Bitcoins are declared as assets by the government, due to which it has been subjected to taxes on capital gains. Further, even though Mexico’s central banks prohibited cryptocurrencies for investment and exchange, some portion of this country’s population embraced different

cryptocurrencies. Mexico's biggest crypto exchange, i.e., Bitsos, attracted one million or more potential users on this exchange platform (Reuters, 2022). However, to use cryptocurrencies for exchange purposes, one must abide by the laws.

An article by Bossu et al. (2020) It is stated that in the UK, Central Bank Digital Currency (CBDC) must comply with private law, tax law, legal payment system regulations, contract law, property law, as well as financial and privacy laws in the context of international exchange. The central banks in the UK are giving significant consideration to the advantages of central bank digital currency in relation to the potential insurance of blockchain usage and private virtual currencies.

In addition to this, the article by Global Legal Insights (GLI, 2022) revealed that in the UK, the principal laws regarding money exchange and transmission include electronic money regulation and payment system regulators. These rules set out the regulatory framework, i.e., apply to the payment services such as providing electronic money and conducting money remittance with proper and required business conduct, regulatory capital and authorisation. As an advanced technology, distributed ledger technology (DLT) has been growingly utilised by central banks for validating and securing monetary exchanges and transactions. Blockchain, as well as cryptocurrency regulations in 2022 based in the UK, have been well applied by the central banks based in this country for secured money transactions and digital transfer of money (Global Legal Insights (GLI), 2023).

Apart from the developed countries discussed above, Bharathan (2020) emphasised that emerging and developing countries have also been alert regarding the use of regulations and laws for central banks in regard to monetary exchange. For example, blockchain and DLT have been growingly used by the central banks based in the Arab countries for secured money transmission purposes. Data encryption rules have also been considered valuable and important for money exchange security purposes (Bharathan, 2020). However, it is also noted that certain settlement algorithms, as well as monetary policies, are required to be improvised through fully homomorphic data encryption (FHE). This mechanism involves computation of aggregations of the data, i.e., encrypted. For cross-border exchange and flow of money, different regional currencies tend to be utilised with a data-encryption mechanism to eradicate the possibility of data threat under the data protection rules based in Saudi Arabia (Bharathan, 2020).

Deloitte (2022) argued that those distinct rules of data security, customer data privacy, accounting standards, fair financial reporting and audit are anticipated to be followed by central banks utilising digital currencies for monetary exchange and financial transactions. These rules are applicable to the central bank digital currencies being operated in distinct countries, including the Bahamas, Cambodia, China, Nigeria and Eastern Caribbean (Deloitte, 2022). On the other hand, the article by Douglas and Chance (2021) revealed that in the UK, the Financial Service and Market Act (FSMA) 2000 has been utilised by the central banks for arranging and authentically managing financial transactions within the derivatives of cryptocurrency. Regulation-based guidance is applied for the safe use of exchange tokens in money processing. Other effective legal provisions based in the UK for safely deploying and utilising virtual currencies involve intellectual property law, consumer-protection law, cyber-security, and rules for distance selling and outsourcing. In relation to the financial investment regulations, within FSMA-based Section 19, an individual should not conduct a regulated action or activity within the UK unless gaining authorisation for it (Douglas & Chance, 2021).

Apart from the above, the article by Dolan (2020) reflected that in the US, the decentralised nature of digital technology raised queries and concerns for the users when it comes to a digital currency-based monetary exchange. However, the US manages a positive view in regard to the usage of cryptocurrencies, including Bitcoin. The US Security and Exchange Commission takes account of setting rules for safe and secure usage of digital cryptocurrency within the US. Similarly, the European Union also welcomed and praised blockchain technology. The European Union has implemented an Anti-Money Laundering Directive to safeguard against illicit activities in the process of exchanging money, particularly when involving cryptocurrencies (Dolan, 2020). Therefore, central banks in the EU, as well as in other developed countries, also provide assurance for secure money exchange. It has been deduced that both emerging and developed countries are worried about using digital cryptocurrency for efficient money exchange and transactions. However, these countries are also aware of the security and privacy regulations in place to prevent criminal activities that could compromise the financial data and personal information of users of central banks' services (Dolan, 2020).

5.3.1.11. Summary and Gap

The adoption of blockchain technology in banks has been influenced by the interplay of cost and trust as critical factors. The blockchain’s most powerful characteristic is its decentralisation of monetary data. The banks’ supply chain

system is shaped by the constant pressure of stakeholders. On various fronts, the role of digital or blockchain technology has been impacted. Small and medium-sized banks in both developed and developing nations continue to have difficulties adopting it. The hurdles to adoption in the banking sector have been classified into three categories: trialability, compatibility, and complexity. Nevertheless, within the technological framework of their establishment, these institutions have also encountered various attacks. The TOE framework has been aggressive in its pursuit of the collective tolerance of the financial sector. The transferability of possibilities between banking sectors differs according to the banks' interoperability (compatibility). Banks differ in terms of network size, pre-existing assumptions, and the amount of observable knowledge. Other banks should recognise individual banks' technological adoption norms. The cryptocurrency market has created new dynamics in the regulatory regulations that control the world's digital economic spectrum. The use of cryptocurrencies as legal tender has been a source of contention between China and the United States. Several conflicting zones exist in the Bitcoin network, impeding the procedures and mechanisms in the online trade and financial system. There are multiple reasons for adopting cryptocurrencies in the realms of digital currency exchange, including mining and the chronology of online transactions in the financial system. Bitcoin transactions are low-cost because they are peer-to-peer and do not require centralised intermediaries. The literature aims to address the lack of substantial evidence from in-depth research in this context by attempting to bridge the gap.

5.3.2. Methodology

5.3.2.1. Data Collection

According to Largan and Morris (2019), there are two distinct categories of data, which are referred to respectively as primary data and secondary data.

Secondary data refers to already-existing information present in websites, journals and research articles (Largan & Morris, 2019). On the other hand, primary data is the new data collected specially for a study. Secondary data was used to address the research question in the essay. Secondary data provides detailed results about the research area and enables information collection in the shortest possible time (Laycock et al., 2016). This essay gathered secondary data with the help of the library research method under which articles that provide information about corporate governance and its applications and role in the banking sector were used in the essay. However, primary research studies require more time,

and the overall cost associated with data collection from methods like surveys reduces its utility and cost-effectiveness. Thus, primary data collection methods were avoided in the present essay. In the context of the library research method, the articles in the essay were selected with the help of inclusion and exclusion criteria. The use of inclusion and exclusion criteria in the study facilitates the effective collection of the most relevant data making the data collection process more accessible. The inclusion and exclusion criteria for the study are presented in table 5:1 below:

Table 5:1 *Research Articles Inclusion and Exclusion Criteria*

Inclusion Criteria	Exclusion Criteria
Year: Research articles published after 2014 are used for the study.	Research articles published before 2014 are excluded from the study.
Language: Research articles published only in English are used in the present research. As English is spoken worldwide, the use of articles published in English will allow more people to use and understand it in the future.	All those articles that are not published in English and are published in other languages that that are not spoken worldwide, such as French, Chinese and Spanish, are avoided for the study.
Research articles that are most relevant in the context of the research area and provide information about corporate governance, blockchain and digital technologies in banking are used. The use of the most relevant research articles for the study has facilitated the flow of correct and detailed information on the research area.	Irrelevant research articles are avoided in the study to retain the reliability of research findings.

- *Author's Own*

5.3.2.2. Searching Strategy

Based on the defined inclusion and exclusion framework, searching the articles or studies was performed by considering and combining keywords/concepts and themes related to the research question. The searching strategy in the secondary method followed a coherent and organised structure for article identification and search for the review purpose (Largan & Morris, 2019). In the searching strategy, it was vital to explore and enlist search terms at the introductory level with accuracy, to avoid missing relevant and authentic searches of the articles.

In this essay, a search strategy was initiated with search-term identification and then particular keywords and phrases formulation based on the research questions and objectives (Chandola & Booker, 2022). Keyword search involved researching problem-related word searching, such as ‘digital transformation’, ‘blockchain technology’, ‘corporate governance’, ‘bank performance’, and ‘banking trading’, while phrase search in the direction of this essay’s objectives used terms like ‘blockchain technology’, ‘role in the corporate governance’, ‘blockchain technology role in managing operations of banking institutions’, and ‘corporate governance management’. The search for exact research-related words and phrases led the researcher to access entire and relevant articles published and conducted in the same research context.

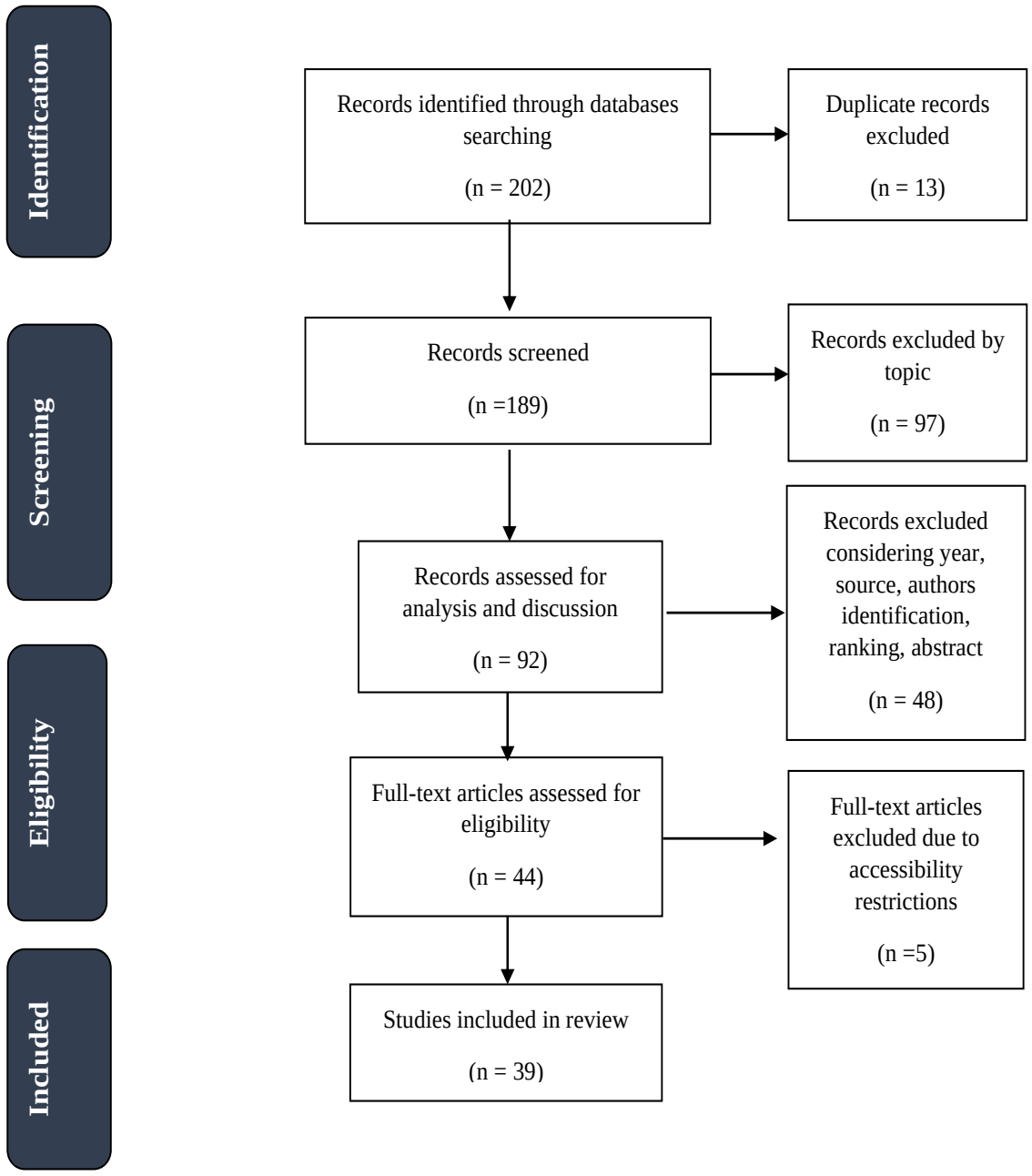
Moreover, in this secondary research, exact phrase search was preferred to manage time by avoiding irrelevant articles. A search of the articles using inverted commas, for example, ‘DLT/Blockchain Technology’ and ‘Blockchain technology in governance framework’ or ‘Blockchain-enabled corporate governance in the banking sector and banking operations efficiency’ was carried out to gain in-depth knowledge. In addition to this, an articles search was performed using the truncation symbol (*Asterisk) that led to articles based on keywords in singular and plural form, such as in this research work, ‘blockchain technology*’ or ‘corporate governance*’. The search undertook Boolean operators or logic to process relevant articles search in the defined direction. Boolean operators, such as ‘OR’, ‘AND’, and ‘Not’, mainly or commonly used operators in the secondary search, were preferred to search articles about digital transformation in the banking sector (Chandola & Booker, 2022).

- OR – Digital transformation or blockchain technology, blockchain technology in large scale banks or small and medium scale in developed and growing economies/nations, cost or trust in relation to blockchain technology adoption in the banking sector, cryptocurrencies or Bitcoin transactions.
- AND – Blockchain technology in large and small/medium scale operating banking institutions, costs and benefits of using blockchain technology in relation to corporate governance in the banking sector, the decentralised and centralised authority of banking institutions about blockchain technology in corporate governance.
- Not – Blockchain NOT other technology used for corporate governance in the banking sector.

5.3.2.3. Screening Strategy

Within the searching process, a number of articles 202) were retrieved from different databases including SAGE, Wiley Online, Scopus, MDPI and Google Search Engine, using different words and phrases. Reviewing all of the searched studies was not possible in the research work due to time issues and limited scope of detailed analysis. Thus, screening of the articles as per the PRISMA model was conducted to exclude articles that were found less subject-relevant, duplicate and not aligned or matched with inclusion and exclusion criteria (Buntins et al., 2019). Under the screening strategy, 13 duplicated articles were removed, and relevant records were retrieved for screening after this stage. After this, around 97 more articles were excluded by topic relevance. Furthermore, the Critical Appraisal Skills Programme (CASP) checklist was used within the screening strategy. It integrated 10 questions valid for the systematic review, such as the validity of results, key results and general application of results (Boland et al., 2017) 48 articles were excluded based on this checklist from the articles identified in the PRISMA model. A total of 44 full–text journals were included and considered based on eligibility. Further, 5 articles were excluded for accessibility restriction reasons. Finally, 39 articles were selected and reviewed with the help of a systematic review method, including authors' detail, publication information, methodology/sample, findings, implications and further directions /limitations in the dissertation.

Figure 5:10 *PRISMA Flow Diagram*



- *Author's Own*

5.3.2.4. Data Analysis

Secondary data analysis of the data collected through a review of the chosen articles was performed based on thematic analysis. The thematic analysis procedure for this essay was aided by inferring familiar and different facts in the form of patterns from the existing information in the literature (Butler-Kisber, 2010). Furthermore, the thematic analysis method was chosen to study the information presented in the context of blockchain technology in the banking sector. For

this purpose, this study employed a systematic approach to thematic analysis, which involved several steps. These steps included becoming familiar with the data, generating initial codes, searching for themes, reviewing and defining the themes, and finally, analysing the data within the identified themes to draw a conclusion (Braun & Clarke, 2022).

5.3.2.5. Ethical Issues

In the primary research, ethical issues are more related to participants' interests, while in the secondary research, it is related to the end-users and scholars. This essay is secondary-based, not primary-based, and therefore, the following secondary-based ethical considerations were followed:

- Plagiarism - This work rigorously complied with plagiarism norms defined in the general business research context and by the university's demarcated norms. Findings from the published studies were demonstrated with their own inference to avoid academic misconduct by copying facts and ideas of the other scholars.
- Credibility –Research findings were cited with true evidence and sources because using incorrect data sources is a kind of academic misconduct. This ethical issue is considered and avoided through referred data findings (Farrimond, 2012).
- Authenticity and Relevancy – Another key issue in the secondary data is related to authenticity and relevancy; therefore, in this essay, information from the existing sources was truly presented from recent sources. Data falsification issues were avoided by presenting supportive facts from a number of relevant and fullypublished academic sources, such as journals, books and banking firms or institutions' reports (Hammersley & Traianou, 2012).

5.3.2.6. Limitations

The information about blockchain technology in the context of the corporate governance of banking institutions was gathered through the secondary methodology. In relation to this, the lack of real experiences of banking employees and new data about technology based on real experience is the major limitation.

A smaller number of scholarly articles were found in the identification process because of the limited-search databases. In order to gather more relevant and authentic sources, more search databases should have been included.

As blockchain technology is new so there is a lack of information on the internet and scholarly websites as well as fewer research studies on blockchain technology and corporate governance.

Quality literature and theory were collected and integrated into this work, providing the advantage of detecting patterns and themes, but the lack of descriptive and quantitative data analysis based on the standard statistical output can be a limitation (Goodwin, 2012).

5.3.2.7. Summary

On the basis of aspects mentioned and discussed in the research methodology, the present essay used the thematic analysis descriptive research design and adopted the inductive research approach. The data was collected from existing literature sources and in order to collect the most relevant and appropriate data sources, inclusion and exclusion criteria were applied. The search strategy was backed with OR, AND and NOT aspects so that the relevant scholarly articles can be shortlisted for screening; in order to finalise the literature sources, the PRISMA framework was found to be effective.

5.3.3. Thematic Analysis

5.3.3.1. Theme 1: Impact of Digital Transformation on Banks' Performance

Digital transformation refers to an increase in the adaptation and implementation of information technology within organisations. It alters the way in which an organisation operates as well as the manner in which it produces its goods and services. It is therefore deemed vital to understand how the digital transformation of a firm impacts the functioning of a company, particularly when it comes to evaluating the influence that this has on bank performance. However, with the absence of structured data monitoring of digital transformation at an organisational level, significant obstacles arise that prevail in determining how the bank performances are correlated with the digital transformation.

When assessing the influence of digital transformation on banks' performance, it has been contended that the implementation of digital technology and its integration in banks does not appear to enhance their performance. This has been referred to as the profitability conundrum. This argument has been made on the basis of theoretical concerns that are derived from the competition in the field of information systems. This research, by examining digital transformation, found it to be openly accessible to all the market participants, which will ultimately lead to an increase in the productivity of

organisations but will have no other impact or bearing on the level of productivity that is achieved by a business. This confirms that there is no such evidence or hypothesis presenting any practical application of correlation between bank performance and digital transformation. In addition to this, Xin and Choudhary (2018) stressed the significance of implementation of IT and its failure to influence banking performance, wherein they observed that banks could even function faster via manual means, and digital transformation was not an actual means of enhancing performance. However, in other cases, such as doing manual chores that may be automated with a digital script, digital transformations were found to save time and money.

Chae et al. (2014) stated that the influence of digital transformation on banks' performance is arguable due to the restricted and limited availability of structured data on the digital transformations for many businesses, which indicates the reason why the correlation between bank performance and digital transformations has been disregarded for such a long period in the secondary sources.

Furthermore, Xin and Choudhary (2018) and Zhang et al. (2019) assessed the digital transformation initiatives of banks in the US that are publicly traded on the New York Stock Exchange, and analysed their digital technology reporting to determine the level of success in their efforts to transform digitally. They revealed that there is no association between an increase in digital transformation reports and an increase in bank performance. This research did discover a correlation between an increase in digital transformation and increased performance, but subsequent analysis of respective dynamics revealed that activities related to bank digital transformation are associated with high-level efficiency but do not indicate that banking firms' profitability has increased in the last 5 years.

Discussion evolved from the findings of Li et al. (2020) presented a separate analysis that demonstrated the validity of the measures by demonstrating how the digital transformation of the banking firms was related with the variables of decreased personal expenses and increased patenting activities of banks.

Furthermore, on the basis of the analysis of this particular theme, Deloitte (2021) reported that one of the most difficult aspects for banking firms in the past decade was the limited potential capabilities for management and the need

to update the information system infrastructure. Hence, it is reasonable to anticipate that the challenges that are associated with the information system infrastructure will be putting a strain on the performance of banks.

The findings of Haralayya (2021) evaluated those digital transformations in commercial banks could benefit them in terms of performance. This has been observed in the research conducted for the purpose of measuring the level of efficiency of transactions of the commercial banks by Jatic et al. (2017), where during the time period from 2012 to 2015, the number of customers across different banking branches in the UK were found to be decreased nearly by 30%, in comparison to the time period of 1992 to 2013, when the number of US banking transactions were reduced by 45%. This shows that digital transformations offer banks an opportunity to serve multiple customers single-handedly and improve overall performance. Besides that, digital transformations are turning around working methods of employees and saving human resources and execution time of transactions, as per the observations of Kuchciak and Warwas (2021). Still, in many countries, the digital transformation of the banking industry is still very challenging, especially for corporate and commercial banks, because it requires high capital investments along with an advanced application of technology and science, and requires the development of high-end technology, infrastructure, and workflow to direct automation of manual functions.

5.3.3.2. Theme 2: Role of Blockchain and Digitalisation in Banking Corporate Governance, Business and Operations

Since Satoshi Nakamoto published a white paper on the electronic peer-to-peer cash system and Bitcoin in 2008, blockchain technology has attracted the attention of tech experts and researchers due to its potential for disruption in the areas of operational efficiencies, transparency, data security, and value safeguards, as well as its ability to facilitate value exchange and improve customer experiences (Deloitte, 2017).

One of the common themes that was explored in making an in-depth review of the secondary data highlighted the role of blockchain technology in the business and operations of banking. Digital transformation has become a central outcome of the rapidly developing Internet infrastructure, whereby the former has led to bringing holistic transformation in the processes and technological elements for delivering efficient and effective services. In this regard, blockchain technology is erupted as a disruptive technology in ensuring digital transformation. The review of the secondary evidence

has revealed that it is evident that the banks are constantly searching for new ways to undertake transactions quickly to improvecustomer services, along with ensuring cost efficiency and transparency in operations for regulators and customers. In this, the blockchain constantly offers banks a solution for eliminating intermediaries, facilitating real-time execution of transactions, and maintaining an immutable log of transactions. This is reducing Turn Around Time (TAT) for banking transactions, and manual work costs, and leads to improve customer satisfaction and service (Shah & Jani, 2018; Woodside et al., 2017).

With regard to the role of blockchain technology in banking organisations, secondary evidence has highlighted distinct roles. A qualitative review undertaken by Buitenhek (2016) has highlighted, in the banking context, that blockchain is applied to a variety of activities, including securities and trade settlement, e-identity, internal transactions and connecting devices. Blockchain helps in reducing cost, bringing greater simplicity, automation, and creating new opportunities, along with improving transparency in the banking processes and bringing greater operational efficiencies for the banks and their customers. The settlements process has also been improved, which suggests that the time of settlements for products like syndicated loans can be reduced from 20 days around to only 10 minutes, which helps to reduce the risk of freezing of capital. Kirbac and Tektas (2021) also claimed that blockchain technology has allowed the greater transfer of data and assets for distinct purposes, essential to record transactions securely in the digital era. In banking businesses, the use of blockchain technology is playing a vital role in tracing orders across distinct touchpoints, optimising applications and processes, improvising system integrations, fostering transaction integrity and visibility, and building competitive advantages (Peter & Moser, 2017). Hence, it is playing an important role in fostering digital transformation with its distributed structure.

Shah and Jani (2018) explored in detail blockchain technology in the banking and finance industry of India, making an in-depth review of existing studies, and found that the key benefits of blockchain to the banking industry encompass real-time settlement of recorded transactions, removing frictions, enabling direct transactions between the parties without any involvement of a third party, saving cost, time and efforts, and containing a precise and verifiable record of a single transaction. Blockchain is also playing important role in banking operations and processes pertaining to payment by enabling automated documentation, real-time settlement of transactions, fraud-proofing, and tracking of transactions on a

real-time basis. Peter and Moser (2017) added some distinct points by highlighting that in banking, blockchain technology is assisting in digitising and authenticating of records which can result from trade transactions, secured by the digital records of data visible to distinct participants of the transaction. Also, the smart-contracts element of the blockchain has enabled compliance with upfront enforcement in place of verification post-transaction by fostering real-time transactions and greater transparency.

The review of the secondary data evidence highlighted that blockchain technology is widely applied in banking and financial services in numerous ways. Krishnan et al. (2020) pointed out that blockchain technology's smart-contract services are helping in carrying out financial transactions without any intermediary and holding smart bonds. Along with this, the decentralised ledger of the technology has enabled real-time verification and processing of cross-border transactions across distinct time zones and point-of-sale systems, allowing users and merchants to accept cryptocurrency as payment; lending and borrowing money in a speedy, transparent, secured and verifiable manner; and lowering the cost of trading of securities in the stock exchanges. A pivotal role of technology can be seen in banking activities such as trade finance, cross-border payments, FX trading, capital market operations, and monitoring of consortium accounts. The secondary data evidence and its in-depth analysis in the research also highlighted that the use of blockchain in banking would not offer priority to a single person, who can hold control and undertake decisions, rather each action is recorded in the technology and the data is made available to every participant of the technology. This plays a crucial role in fostering transparency and trust in financial transactions among customers. Along with this, the non-alterable and indestructible nature of blockchain technology also makes it crucial for banking organisations. This helps to strictly avoid any change or deletion of the information in the blocks of datasets, and it can be accessed only by the individual having great computational power (Golosova & Romanovs, 2018).

The review of secondary evidence has also highlighted that regardless of the increasing integration of blockchain technology in banking operations, the integration and appropriate use of the technology is still at a nascent stage, and need to prove itself in practise (Garg et al., 2021; Shah & Jani, 2018).

Similarly, Kirbac and Tektas (2021) have pointed out the integration of blockchain technology is not able to play the expected roles in banking organisations. This has been due to several challenges associated with blockchain technology, including scalability, privacy and security issues, software problems and cyber-attacks, challenges in utilisation, high investment costs, ineffective legal regulations, and a dearth of knowledge among human resources. The review of the secondary evidence also revealed various disadvantages or challenges faced by banking organisations in using blockchain technology. In this regard, it was observed that because the use of blockchain technology demands significant power to assess the hash code of the next block, the technology limits the high throughput rate and lowers latencies. Another disadvantage of the technology for banking and financial institutions is the abandonment of the current network for starting and creating the new one (Golosova & Romanovs, 2018). This has been mainly due to its permissionless and self-governing characteristics, whereby the decentralised regulation and implementation of the systems have remained problematic by diluting the regulation concept. In addition, there are issues with efficiency, specifically regarding the efficiency of single transactions. This is impacting both the technology and the level of centralisation.

Currently, each transaction and clearing process requires verification from all nodes in the network simultaneously. This is significantly slowing down the speed of transactions and causing negative effects. Furthermore, a decrease in single transaction efficiency would lead to an enhancement in transaction security. The simultaneous execution and clearing of these transactions would effectively resolve the issues associated with subsequent reconciliation, leading to a significant enhancement in the operational efficiency of banks (Zhang et al., 2019).

In addition, auditing standards make it impractical for the profession to implement any new technology or methodology that has not been mandated or approved by the standard-setting committees (PWC et al., 2019). According to Hussein et al. (2016), the auditing profession will face the challenge of modifying existing auditing standards in order for disruptive technologies to prevail. It appears that the reluctance of external auditors to implement continuous auditing is due to current auditing standards. The standards continue to be supported by traditional auditing procedures, which were effective when database sizes were small but ineffective in today's real-time digital economy. Obviously, auditors will no longer perform certain responsibilities. Long term, it is likely that the profession's emphasis will shift from data analysis to emotional intelligence, and auditors will be expected to exhibit increased emotional intelligence. As administrative and

routine tasks are automated by technology, accountants and other professionals can focus on value-added tasks (ACCA, 2019).

To add value for their employers and clients, it is suggested that future professional accountants will require an optimal and evolving combination of professional competencies, a collection of technical knowledge, skills, and abilities, combined with interpersonal behaviours and qualities (ACCA, 2016). By 2020, all professional accountants will be required to develop and calibrate professional quotients suited to their position and career stage. Each accountant's professional quotient will reflect their competence and talent in areas of: technical skills, ethics, and experience will be combined with intelligence and digital expertise; interpersonal behaviours, skills, and characteristics will be reflected in creativity, emotional intelligence, and vision quotients (ACCA, 2016).

There are cross-cutting challenges that necessitate guidance and possibly regulatory supervision, such as challenges concerning 1) cross-jurisdictional harmonisation, which necessitates collaboration between regulators and legislators on a regional and global scale; 2) information security and privacy; although DLT provides greater protections against potential external assaults, enhanced security, and improved conformity via digital identity and digital KYC, the anonymity of users may encourage illicit AML and terror-financing activities; 3) scalable design and interoperability; and 4) unfair competition, as the development of blockchain-enabled applications, particularly by consortiums in a permissioned system, could potentially raise concerns regarding unfair competition in a number of areas relating to new entrants, the prospect of market dominance, and the risk of collusion and market manipulation between participants.

5.3.3.3. Theme 3: DLT/Blockchain Technology Governance Frameworks in Banking and the Decentralised Autonomous Corporate Governance

The examination of the selected literature on DLT or the blockchain technology corporate governance framework revealed that the incorporation of blockchain has served to be highly beneficial for industries to enhance their business processes. It has been further noted that there are also several blockchain industrial consortiums that have been established for its growth and to ensure the use and optimal dissemination of this technology. While in countries like the US regulatory flexibility is allowed for the promotion of innovation, in others, like China, a more cautious and conservative attitude is practised. In this context, it was observed that the regulatory frameworks associated with the application of DLT lack

adequate clarity because of it being in the early stages of technology, while the stakeholders continue to demand implementation of the rules that can ease the establishment of a stable playing field (Ibrahim & Turby, 2021). The literature also asserts that the DLT holds the potential to transform the processes of business in several sectors that are dependent on detailed paperwork procedures and concurrently help to increase transparency and security and reduce costs.

Every blockchain holds a software repository at its core that secures the source code that focuses on the implementation of the protocol. Today, thousands of varied blockchains are being developed wherein majority of the forks of the source code are from well-established open-source blockchains like Ethereum and Bitcoin. The software protocol of a blockchain involves details regarding the ways in which transactions are performed, the speed at which the new data blocks are incorporated into the chain, and the size of the data blocks. The people associated with the blockchain project are required to determine the ways in which updates in the software protocol are undertaken. These updates are required to be coordinated and this process can be effectively facilitated through the process of governance. Blockchain governance is described in the literature as the process of directing, controlling, and coordinating stakeholders in a particular blockchain project, enabling them to collectively contribute to (Pelt et al., 2021). Moreover, because of the decentralised feature of blockchains, managing their governance is different than that of the prevailing governance structure for banks.

A typical blockchain project does not require the presence of a CEO or a corporate headquarters. Rather, it depends on a globally distributed network of developers who lay down the software protocol. However, it is this feature of the blockchain that leads to a major challenge, which is the implementation of a code by the developers of blockchain that helps in the distribution of power amongst the blockchain stakeholders.

The governance of blockchain projects is also claimed to be highly essential for its sustainability because it allows stakeholders to examine and take relevant decisions regarding the evolution of blockchains. In addition to that, it is asserted that robust blockchain governance is also required for the successful implementation of blockchains and for their potential to adapt, interact and transform. The huge size of blockchain projects further makes governance crucial and relevant to manage and coordinate the overall community towards a consistent goal (Pelt et al., 2021). Janssen et al. (2020) further argues that blockchain is dependent on collaborative governance to deliver maximum trust in the markets and to ensure

that all the major stakeholders operate as per the agreed rules. The absence of a governance framework serves as the major cause for the rise of criminal activities and cybercrime in blockchains. Such governance undertaken with the help of procedures, policies, mechanisms and enforcements is essential for realising the real benefits of blockchains for society (Janssen et al., 2020).

Technology and regulatory support are also important for law enforcement agencies to monitor and trace the perpetrators of money trafficking and associated fraudulent activities. While regulation deals with laws that are defined for the purpose of controlling behaviour, governance focuses on collaboration, stewardship and incentives to ensure common interests. In this regard, it is essential for governments to focus on regulating blockchain technologies and simultaneously operate as collaborative peers with the other members of the community. This can be undertaken through participation in the governance ecosystem and not though enforcement by top-down regimes of control. Moreover, for the adoption of blockchain technologies, market participants must incorporate adequate provisions regarding the liability of respective parties, rules for the approval or rejection of authorised participants, relevant laws and correction processes in the event of disputes. In addition, such governance frameworks must be customised as per features and functions of blockchain technologies. Such governance is also required to focus on addressing the risks relating to the manipulation of the market and associated illegitimate practises. Further, some users might also be able to access the recorded information from blockchains because of the absence of adequate safeguards and utilise it for unfair activities like front-run competition or price manipulation (Tharmakulasingham, 2021). This indicates that there is a need for an effective balance between the level of transparency and the need for the protection of sensitive information through rules of privacy.

The decentralisation and accessibility to the blockchain network by the associated partners serves to be useful in tracking goods, bills and payments that lead to a rise in the speed and reduction of counter-party risks. The decentralised nature of technology is also helpful in supporting and triggering activity and collaboration between parties while facilitating a reduction in the susceptibility of data being hacked, altered, lost or damaged.

However, the literature asserted that the legislators tend to encounter several challenges because of the regulations associated with DLT in trade finance as an outcome of the lack of adequate knowledge and awareness regarding technology

in different sectors where it is expected to be executed, in addition to the lack of knowledge about the application of such technology. Moreover, in terms of governance, absence of central authority is also a serious concern that can govern and be held liable particularly when there is a concern regarding the participants and their role, manner in which loss of private key will affect the participants and the mechanism to expel the non-compliant members (Tharmakulasingham, 2021). On the other hand, in conventional centralised authority, implementation of laws is not convenient and quick and there is a need for agreement regarding the ledger, which further demands additional coordination and effective solutions for the creation of legal and technological trust. There are some other challenges such as blockchain-based trade finance that require the implementation and adoption of a data protocol and standard that has the potential to populate the key specifications of the process. In addition to that, some additional questions also arise after the creation of a standard. These questions are usually related to the manner in which sellers, buyers and additional trusted third parties or intermediaries' interface with the network (Ibrahim & Turby, 2021).

Due to efficiency, security, and privacy concerns, the DLT that will likely be applied to financial services will be 'permission-based' as opposed to Bitcoin's permissionless system. A permission-based framework requires rules to approve or reject participants, such as minimum capital requirements, business conduct rules, and risk management processes. In addition, rules will be required to regulate both permissioned and non-permissioned interactions between participants. Examples include the liabilities of the respective participants in the event of fraud or error, correction mechanisms and penalties for rule violations, the intellectual property associated with the technology, and the territoriality of the law that is likely to apply to the network. It would also be necessary for the participants to reach an agreement on their compensation model. In addition, the governance framework should specify the entity or group of entities that would be held liable for the network's activities vis-à-vis third parties, including local regulators and consumers.

Businesses that operate without a central authority figure are called decentralised autonomous organisations, or DAOs. The firm as we know it may become redundant as the primary organisational vehicle for economic activity with the introduction of smart contracts. The DAO asserts governance autonomy due to the fact that its rules and decision-making mechanisms are codified in code, with little to no human intervention. Given the potential for divergent interests among board members and shareholder risk preferences, this structure may be able to address a shortcoming of more

traditional forms of governance (Lafarre & Van der Elst, 2018). By design, DAOs function similarly to a ‘town hal’ where all investors get a chance to speak their mind (David Adlerstein, 2017). In 2016, Slock. launched the first decentralised autonomous organisation, or DAO, on the Ethereum network, successfully raising 150 million USD. It didn't have a CEO, CFO, or HR department because everything was handled automatically by computer code and smart contracts.

However, the 55 million USD hack in 2017 on the original DAO highlighted the network’s weakness and brought up questions of culpability for value destruction. The majority shareholders” decision to recover the stolen monies by violating the code’s immutability split the developer/shareholder community and eroded faith in the system and the idea that ‘Code is Law’. Due to the lack of regulation, fraudulent ICOs have further tarnished blockchain’s image.

The ‘crowd’ concept of blockchain governance is being tried out. The question therefore becomes whether a rule-making system created by elite developer communities can totally replace a transparent democratic discussion on governance, fundamentally a political process. As DLT is adopted more widely in the commercial world, it will run up against preexisting laws. In order to provide transparency, accountability, and the safety of investors and shareholders, blockchain will need to develop and create a more robust governance framework. It will also need to understand the societal and political setting in which it functions, ensuring that no people or groups are harmed by the implementation of technically sound solutions.

5.3.3.4. Theme 4: Strategies and Governance Models to Overcome Challenges Encountered by Blockchain and Distributed Ledgers

Managers, shareholders, regulators, and other stakeholders may see their authority altered under a blockchain-based form of corporate governance. Our long-held beliefs about how the economy works, as centred on the vertical company, continue to be challenged by the shift from a centralised world of corporate hierarchies to a dispersed one. Management may find it more efficient and cost-effective to have access to market information and formulate strategy through disintermediated corporate governance structures and practises. However, efficiency improvements may be impeded by the platforms and the nodes’ capacity to recover rent for their services, in a manner that is proportional to their market power. However, in order to implement these changes, the status-quo organisational culture will need to undergo a dramatic transformation (Fenwick et al., 2017).

The review of previous literature on blockchain governance revealed that blockchains are decentralised digital network protocols governed by a complex interplay between stakeholders such as token holders, network validators, miners and node managers, core and application developers, and founders. Each of these stakeholder groups has a vested interest in the protocol and faces starkly different incentives when deciding whether and how to modify it. Many additional stakeholders have an interest in the network's construction and change but do not actively engage in it. These organisations include regulatory bodies, activists, players in rival and complementary blockchains, and other portions of the technological stack. The blockchain governance problem is determining how to design and develop mechanisms that balance the interests of all stakeholders while ensuring the network's success, however that success is defined (De Filippi & Loveluck, 2016).

Whether governance institutions have been explicitly designed or not, all blockchains have governance. Despite the fact that the efficacy of these governance systems varies (Yeung & Galindo, 2019), governance is a descriptive rather than normative characteristic. Blockchains can be viewed as competing constitutional rule sets, in which they compete on rules for making rules (Alston, 2019). In this way, blockchain governance is concerned with the manner in which decisions are made, rather than the decisions themselves – who chooses and how decisions are made, rather than what is chosen (Hsieh et al., 2018; Narayanan et al., 2016).

Stakeholder groups have often been narrowly defined in governance talks around blockchains, either implicitly or explicitly. Specifically created governance systems are very limited. With such clear governance, EOS and Tezos, two blockchain protocols, provide token holders the ability to vote on delegated validators and change requests, respectively. However, token owners are not the only stakeholders that could be impacted by governance choices. By using governance analysis, token holders might be separated into those who hold them primarily for speculative purposes and those who want to utilise them as a medium of exchange. The judgments made by the protocol can be influenced by founders and founding foundations. There are two types of developers: those who are creating apps that use the protocol as an infrastructure layer and those who are the protocol's core developers. Token holders, huge over-the-counter dealers, and miners are examples of economic full nodes that may have different stakeholder interests. A stakeholder is a manufacturer of hardware that supports a chain.

In contrast, the contract method decides who is a shareholder based on property rights, such as residual rights to income (Alchian & Demsetz, 1972) or residual control rights (Grossman & Hart, 1986). In this method, stakeholders are all investors who make transaction- and/or firm-specific property with the fair hope of a return on investment through interaction with the firm. In this case, the group of valid stakeholders includes people who have both verbal and implicit contracts with the company. Implicit contracts are those that aren't written down but are known to exist by both sides. Implicit contracts acknowledge the co-creation of value and the assumption that investments will pay off. Such informal deals are common in the company and are hard to understand even written contracts without knowing the unspoken agreements they are based on. When this idea of unspoken contracts for the co-production of economic value is taken into account, the number of parties is greatly reduced. Implicit contracts are agreements that are hard to understand from the outside. In fact, because implicit contracts aren't written down and are based on norms instead of clear agreements, they make it hard to figure out what an organisation's true economic value is and to look for general rules that might apply to all of them. Some 'outputs' of a business, like teaching workers, are neither priced nor written down in a clear way.

Blockchain networks have implicit contracts, and the roles that leaders, organisations, and developers play make this most clear. But in a business, it is the job of management to weigh and balance the unspoken contracts. Stakeholders can ask management to pay more attention to their needs, or they can punish the company by hurting its image or not making any more investments if they are not happy. Managers of a firm have the freedom to decide how to share income with different investor groups, figuring out and reacting to implicit contracts as needed. They can't do this in their own best interests because the deal with owners forbids this kind of opportunistic behaviour. By design, there is no 'management' in an autonomous group. No one interest group has the power to organise implicit contracts. This guards against a type of rent-seeking behaviour that happens when the relationship between the owner and the manager breaks down. But it is not clear how parties can talk about how to divide up the value that comes from unspoken contracts.

However, the examination of prior literature chosen by the researcher in accordance with the searching and screening strategies leads him to the conclusion that, in order for banking institutions to utilise blockchain and distributed ledger technology effectively, banks should adopt one or more of the three governance models suggested for blockchain/DLT.

Where a financial institution would profit from access to shared data among members, the consortium governance model works effectively. Currently, blockchain-powered Know Your client (KYC) utility consortiums comprise asset services who exchange compliance and AML verification data for client digital onboarding whereby the association (consortium) performs KYC for onboarded customers, while all associated banking institutions and other related stakeholders endorse and validate the information and share access to the KYC profile, thereby improving operational efficiency and lowering onboarding costs (Deloitte, 2017).

Furthermore, the governance model emphasises the development of a distinct organisation (joint venture) by banking institutions inside a network, with the goal of pursuing blockchain activities that maximise financial profitability. When several stakeholders from various industries are involved, this technique works effectively. For example, in terms of banking operations and business, this approach works effectively for international trade activities, including cross-border transfers, Letters of Credit (LCs), and Letters of Guarantee (LGs). Banking institutions, central banks, exporter and importer businesses, and others can set up a distinct organisation with representatives administering and growing private blockchain/DLT on their behalf. The entity retains rights on behalf of the parent entities, and revenues from trade finance operations are dispersed equally among the entity's owners (joint venture). According to Deloitte's 2017 Report, this sort of blockchain governance model is presently being created between fintech enterprises and financial institutions (Deloitte, 2017).

Notably, the consortium and joint venture governance models are the most preferred blockchain adoption approaches for banking organisations researching and implementing blockchain and distributed ledger technology services and procedures.

In the statutory governance model, the regulator provides transparency, has authority over the process of establishing standards and monitoring compliance, and ensures that the standards comply with data privacy regulations, thereby protecting the rights of all participants with minimal risk. For regulatory reporting, the statutory model is a viable choice, by which private DLTs can serve as shared data repositories where financial data can be accessed and retrieved by banking institutions and regulators. However, these implementations must be guided by regulators, unless banking

institutions agree to use a distributed ledger technology (DLT) to store and share information, which could persuade regulators to employ the technology.

A suitable legislative and regulatory environment framework must be in place for each of the three aforementioned governance models to support and embrace such activities since they are based on association and private partnerships between corporate stakeholders within a network through the creation of consortiums and separate legal entities. More particularly, due to the ambiguity surrounding the use of smart contracts and their potential to function as legal platforms on blockchains, legislation and laws relating to smart contracts should be explored.

The regulatory and legislative framework of blockchain technology can be developed through continuous research and development and the creation of regulatory sandboxes to explore and experiment the potential actions of blockchain and distributed ledger technology without clashing with the regulations of existing supervisory authorities. Thematic sandboxes as Regulatory Technology (RegTech) can therefore be viewed as an efficient means of promoting blockchain and distributed ledger technology as well as particular policy priorities.

5.3.3.5. Theme 5: Comparative Investigations across countries: Benefits and Risks

The legal status of digital trading currencies and especially cryptos varies from country to country yet does not have any defined or universally accepted rules; some countries have given legal status to the use of cryptos, while other countries have strictly banned cryptocurrency usage. In particular, different government departments, courts and agencies of different countries have given different statuses to cryptocurrencies. The findings revealed that a positive approach was taken by the US regarding acceptance as well as use of crypto. At the same time, various government departments in that country are also making significant efforts to reduce and prevent crypto usage for illegal purposes. Dish networks in the US have already started to accept payment in the form of crypto while it is also making its way into the country's derivatives markets, providing major proof of the increasing acceptability and legitimacy of crypto in the US (Thakur & Banik, 2018). In a similar manner, other developed countries like the UK, Spain, Switzerland, Thailand, Canada and other EU countries have made crypto-like Bitcoin legalised as an exchange medium. In all the aforementioned countries, people are allowed to use cryptocurrency for the purpose of purchasing or exchanging anything.

The benefit associated with the use of cryptocurrencies in these countries is that it provides a secure, convenient, and fast processing payment system. People are allowed to create digital wallets easily without the need to fill out bank application forms, KYC forms and getting their background checked. The infrastructure of cryptocurrencies also eliminates middlemen and, in turn, makes transactions happen at a lower cost in comparison to money transfer products and conventional banking. Another potential benefit associated with cryptocurrencies by countries is that it does not affect the purchasing power of people because of inflation and facilitates decentralised (peer-to-peer) payment anywhere and anytime in the world (Yussof & Al-Harthy, 2020). However, findings by Alqaryouti et al. (2019) suggest the most potential benefit of cryptocurrencies is that their acceptance and legalisation by countries facilitates instant money transfer while also requiring cheaper transaction fees, helps transact money easily, increases security and control due to decentralised transaction system, facilitates money control and eliminates central authority from the transaction process, which together is positively influencing the cryptocurrency use behaviour of the governments of many developed nations.

In contrast, the government in China completely banned cryptocurrency operations in 2017. Although Bitcoin trading was not illegal in China earlier, no clear regulations or rules were issued by Chinese banks like the People's Bank of China (PBoC) or other government institutions on the legalised usage of cryptocurrency. The PBoC banned the mining and ownership of cryptocurrencies anticipating that it could give rise to the use of funnel money for illegal purposes (World Economic Forum, 2022). Security threats have been identified as a major risk of legalising the use of cryptocurrency. Given that crypto is a form of digital currency, governments anticipate that malicious users and hackers may exploit the cryptocurrency system to their advantage by gaining unauthorised access to cryptocurrency transactions and obtaining the methods for creating cryptocurrency. The Chinese government employs hackers to obtain the ability to generate counterfeit or duplicate cryptocurrency, as well as to pilfer the authentic currency by manipulating users' account balances. Besides, it is expected that as the prices of cryptocurrency fluctuate significantly, it might not affect bigger investors; however, it might make small investors face huge losses with the plunging of the value of cryptocurrencies (Hasan et al., 2020).

Apart from that, money laundering has been identified as another major risk associated with legalising the usage of cryptocurrency by many countries. The cases of money-laundering have been expected to occur more in transactions allowing users to exchange their cryptocurrency for authorised currency. This is evident from the fact that more than 7,000

cases have been reported by Japanese police related to suspected money-laundering in 2018, which was ten times higher than the same period in 2017 (Japan Times, 2019). This increase in the money laundering cases linked to digital currencies and especially crypto have made different countries' governments think that its legalisation could result in increasing the movements of unlawful and illegal transactions of cash, which in turn would hamper their entire financial stability. As a result, not only China but dozens of other jurisdictions and countries have also banned cryptocurrency use in the past few years, including Oman, Algeria, Iraq, Qatar, Tunisia, Egypt, Bangladesh and Morocco. In fact, the projected findings reflect that trading in digital currencies has been implicitly banned by governments of forty-two nations, including Bolivia, Bangladesh, Algeria and Bahrain, by putting strict restrictions and regulations on banks' ability to trade in cryptos and imposing restrictions on cryptocurrency exchanges. The number of jurisdictions banning the complete or implicit use of crypto has doubled in the last four years, and it is anticipated that its use could not only increase illegal transactions but would also result in destabilising the countries' financial systems.

In China, the use of crypto was banned in various stages; the government first prohibited its transactions by financial institutions, then all types of mining of cryptos and finally, it outlawed cryptos completely in 2017. The ban on the legal use of digital currencies has been made in several countries, reasoning that it could generate risk for people due to money laundering and fraud and that the process of crypto mining could also cause a significant threat to the environment. As a result, China has accepted the Yuan, the country's own digital currency, as a medium of exchange (Quiroz-Gutierrez, 2022). Apart from this, there are also some countries that have not completely banned or legalised cryptocurrency usage, like India. The projected findings from the perspective of India reflect that the Indian government has neither illegalised nor legalised crypto use, which creates significant confusion among the country's population on whether or not to trade in digital currencies. Although cryptos have been gaining significant popularity among investors and analysts in India because of their benefits like immediate settlement, easy transfer of funds and decentralised (peer-to-peer) and safe transaction facilities, it has not been given a legal status (Ray, 2022). In general, cryptos have not been recognised by the Indian government and are not regulated, controlled, and managed by the Reserve Bank of India (RBI); similarly, the Indian government has not imposed any law or regulations prohibiting the usage of crypto usages in the country.

Hence, based on projected findings, it could be said that cryptocurrency in India is being used by people just like any other assets traded without any government law such as real estate, gold, or other commodities. Although the banks, payment systems and non-banking financial systems in India were prohibited from dealing in crypto in India by RBI in 2018, the judgment by the supreme court in 2020 has supported the idea of dealing in crypto, providing multiple opportunities to investors as well as crypto market exchanges (Times of India, 2021). At the same time, the projected findings also suggest that the successful adoption of cryptocurrency would be difficult for India and other developing nations because of their lack of knowledge related to the Internet, cryptocurrency and online financial activities and trading, which is also recognised as a major factor responsible for increases cybercrime in India (Singh & Faisal, 2019) and hence the strict policy, regulations and rules on cryptocurrency use is needed in India for its growth.

On the other hand, in Qatar, the Qatar Central Bank banned the trading of Bitcoin in 2018 under the Circular No.: 6/2018, claiming it to be illegitimate activity involving a high level of risk and persuading all the banks operating in Qatar not to exchange or deal in Bitcoin or open an account to transact it, send or receive any money transfers for selling or buying this currency (Ibrahim & Turby, 2021). It also issued penalties to those who violated the circular. This also served as the first warning imposed on the financial institutions in Qatar. Moreover, in 2020, it was also declared by the Qatar Financial Centre Regulatory Authority (QFCRA) that crypto asset services might not be undertaken in or from the centre of Qatar financial services and that a penalty would be imposed on the firms that delivered such services. The ban also covers the transfer or exchange of virtual assets or exchange between fiat currencies or virtual assets. These regulations have led to a significant reduction in the alternatives to trade with digital currencies in Qatar (Ibrahim & Turby, 2021).

Certain jurisdictions have already begun to consider how the technology works with their industrial and innovation strategies, how it could enhance government service delivery, and how it could support broader social and economic goals. The United Kingdom was an early adopter in 2016, with a detailed report highlighting blockchain’s potential to redefine the relationship between the government and its citizens in terms of data sharing, transparency, and trust (Walport, 2016). Since then, other jurisdictions have taken up this mantle, with major economies such as Germany and Australia and organisations such as the European Commission establishing blockchain strategies, some of which include the provision

of research grants and, in the case of the European Commission, the development of public digital blockchain infrastructure to support innovation and drive interoperability between countries.

5.3.4. Outcomes

Multiple studies examined digital transformation and blockchain technology in banking, and the crucial role of blockchain technology. Blockchain technology will bring efficiency, transparency, cost-effectiveness, real-time execution of transactions, and automated processing to trade finance, cross-border payments, foreign exchange (FX) trading, capital market operations, and monitoring of consortium accounts. Scalability, privacy and security concerns, software issues, lax regulation, and cyber-attacks are just a few of the challenges or drawbacks associated with the implementation of this technology in banking institutions.

It has been observed that the impact of digital transformations on the performance of banking companies has been ineffective over the past several decades. It is anticipated that a lack of adequate information-system infrastructure, IT expertise, and capital investment will emerge as the most important reasons for this ineffectiveness. In addition, the application of digital technologies has altered the financial performance of banking firms. With the upgrade of capital investments and other resources, the evaluation of digital transformation has a positive effect on performance. The association between digital transformation and banking firm performance has been misunderstood, as has the extent to which it could legitimately serve to enhance firm performance.

As a result of the risks and benefits associated with crypto usage, some nations have legalised it while others have outright banned it. However, there are countries such as India that have neither legalised nor prohibited crypto usage. Therefore, a comprehensive study of the benefits and risks associated with the use of digital currencies is essential for making the crypto infrastructure more secure and user-friendly.

The biggest possibilities we see are improvements to KYC processes, transaction speeds, and security, as well as cost reductions, smart contracts, transparency, and the chance to increase the number of deals a bank can handle. In the same way that big data, blockchain, smart contracts, AI, and other new technologies are changing the traditional audit (both internal and external), compliance, and risk functions, they are also helping to solve the agency problem by lowering and, in some cases, getting rid of

transaction costs, information asymmetry, and opportunistic behaviour. This means that, in countries with a one-tiered board model, the monitoring function of the board of directors needs to change.

In contrast, we find that modern banks that are considering using blockchain technology face significant obstacles in areas such as setup and running expenses, standardisation needs, currency stability, security, law, regulation, and scalability. The lack of academic research-based interest in this topic is concerning, despite the fact that the bulk of these issues may be addressed by substantial study and development. To encourage more academics, researchers, and bankers to delve into this topic and find solutions to the challenges at hand while improving upon the existing opportunities of blockchain technology in banking business and governance structure, this essay is intended to serve as a means of easily identifying existing research gaps for blockchain in banking.

According to our analysis of the relevant literature and working papers, blockchain technology is an effective instrument for stakeholder involvement as a fundamental component of corporate governance, in line with the opinions of Lafarre and Van der Elst (2018) and Yermack (2017). Since all participants on a blockchain network may view transactions, corporate raids, and management trades, this technology has the potential to increase transparency of ownership. Real-time accounting and auditing are the next big thing in bookkeeping and the elimination of double-entry bookkeeping, thus resulting in the elimination of traditional auditing and agency issues via the proper use of blockchain technology. This technology is also involved in efficient and fair shareholder meetings, which makes it easier for digital voting by shareholders and makes it harder to manipulate board elections (as occurs in countries with less ownership concentration).

The six major pillars of corporate governance are as follows: 1) Power separation via permissioned distributed ledger technologies Shared distributed ledgers facilitate 2) transparency, 3) accountability is ensured by the immutability of blockchain records, 4) peer-to-peer communication via blockchains facilitates 5) equity governance and fairness via smart contracts, and 6) effective automation and digital platforms cut costs and open up new revenue streams, ensuring financial sustainability.

It is important to remember that bad corporate governance is the main cause of corporate scams and financial crises. Most of the failure and ineffectiveness of corporate governance systems comes from the fact that the business chain is getting more complicated and there are more and more middlemen. Due to a complex network of people who handle money, the gap between

families who own money and companies who spend it has grown to a point where it is impossible to track. Blockchain technology makes it possible to have better company governance. Its main goal is to get rid of some or all middlemen.

Dealing with DLTs in banking and business will probably require a rethinking of some basic legal concepts and a retraining of lawyers, regulators, and policymakers, who will need to learn new technology-related skills to understand a new world of decentralised, autonomous businesses governed by automated relationships.

The researcher urges central banks, financial services authorities, and banking institutions to use blockchain technology in banking operations and corporate governance to its fullest potential. This can be done through continuous research and development and the creation of regulatory sandboxes where blockchain activities can be tried out without crashing into current rules and regulations.

Banking institutions are known as a ‘central neuron’ in the economy because they connect different groups of people within their network (employees, retail and corporate customers, shareholders, debtholders, creditors, suppliers, financial institutions, the government, and the community). In order to use new technologies, banking institutions will need integrity frameworks, consistent and common data standards, which are important for making sure that digital information (like signatures) is correct. The result of these technological advances will be international cooperation in areas like cross-border payments and international trade, which need a more cooperative environment across countries and, in turn, the legal recognition of electronic records.

In conclusion, it is evident that there is no consensus within the financial industry regarding the viability and utility of blockchain technology. However, the opportunities presented can easily outweigh the challenges once the industry reaches consensus on the best way to move forward and regulators recognise the benefits this disruption can have on global banking. Big data will persist, as will blockchain technology. In a time when innovation determines survival in a highly competitive and volatile market, banks must decide whether they will innovate and bank with blockchain or risk falling behind and losing their competitive advantage in a rapidly advancing technological environment.

Blockchain faces challenges of scalability, security, and mass adoption. With respect to its governance, the system is struggling to transition from a techno-libertarian model to one that can accommodate friction with the real economy. Yet for

optimal governance, the deliberation process cannot take place in isolation. Innovators and regulators need to engage with each other to learn and shape the future of technology in a way that benefits all parties, and society as a whole. Aware of the potential and the magnitude of the challenge, regulators in advanced and emerging markets, are actively observing the space and testing policy options Ideally, a global multi-stakeholder process should be put in place to pursue a uniform, rules-based system across national jurisdictions. But as the Internet has shown, implementing a global coordination mechanism can become mired in geopolitics, making the prospect of a global arbiter seem distant. Less ambitious scenarios for transnational cooperation are underway to develop public standards for the code, with international agencies working on some aspects of standards harmonisation and for regulatory sandbox coordination. Whatever process is selected, a purely technological, amoral model cannot ensure the governance and sustainability of the blockchain ecosystem without acknowledging the real political and social pressures surrounding any change as fundamental as the one blockchain promises to bring about.

5.4. Empirical Assessment of the Fourth Industrial Revolution, Digitalisation and the Future of Banking Corporate Governance: Evidence from G7 Countries

5.4.1. Introduction

During the next decade, significant facets of banking governance and risk management can be (and are already being) executed using cutting-edge digital technology. The early adopters, specifically major international banks and financial institutions such as JP Morgan and Deutsche Bank, prove that utilissation of digital technology in banking governance will require legal, regulatory, and judicial adaptations. This section discusses digital innovations and technologies, including their potential widespread application in a number of banking governance and sustainability areas, and provides an overview of how these developments affect what banking institutions and relevant regulatory agencies should be aware of and how major aspects of banking governance and risk management can be (and have been) conducted on innovative digital technology over the next decade. This section specifically investigates the characteristics of cutting-edge digital technology, such as blockchain/decentralised ledger technology (DLT), big data analytics (BD), artificial intelligence (AI), Internet of things (IoT), and cloud computing, as well as digital channel adaptations, and how the adoption of that technology may affect the banking system's corporate governance, stability, profitability, and operational efficiency. This section reflects empirically on implications for central banks, shareholders, banking boards of directors, and executive management, including those that run banking audit and control functions.

According to the World Economic Forum, corporate governance is facing new challenges as a result of the Fourth Industrial Revolution (4IR), in which a lack of effective governance in relation to the complexity of fast technological developments may generate risks and uncertainties for investors and innovators, jeopardising the financial system across the economy (World Economic Forum, 12th edition, 2017). Furthermore, the research states that the quality of governance in terms of establishing norms, standards, and institutional procedures is seen as a critical component that has the ability to maximise the advantages and reduce the dangers of creating and implementing digital technologies.

Since this essay aims to shed light on the general characteristics of banking's future corporate governance as well as the anticipated effects of developing digital technologies and innovation on banking governance practises, stability, and performance, the following research questions have been developed:

- R.Q.1: To what extent do emerging digital technologies and digitalisation have an influence on corporate governance practises and transparency of banks in G7 countries.
- R.Q.2: What is the impact of advanced information and communication technologies and digitalisation on the G7 banking system's financial sustainability?
- R.Q.3: How do emerging digital technologies and digitalisation affect G7 banks' sustainability in the presence and absence of duality of CEO/chairperson roles?

5.4.2. Potential Contributions

Despite the topic's importance today, there is little empirical data on how digitalisation and technical improvements affect banking corporate governance and stability in G7 nations. While there are numerous research-based investigations into the subject, including those by the Basel Committee on Banking Supervision (BCBS), the World Bank, the G20 Think Tank, the International Financial Stability Board (FSB), the Bank of International Settlements (BIS), and the G20 leaders' agenda, only a small number of studies have conducted empirical work based on questionnaires and interviews, among other research-based investigations. (i.e. interpretivism).

This essay aims to fill that gap in the literature by empirically examining the effects of new digital technologies in terms of communication, technological infrastructure, data and machine connectivity and banking Internet-protocolled services on banking corporate governance mechanisms (board of directors, audit committee, transparency, and duality of CEO/chairperson), in connection with stability measured by CAR, liquidity, bankruptcy (Z-Score), and credit risk profitability measured by return on equity and cost to income.

5.4.3. The Role of Emerging Digital Technologies and Digitalisation in Financial Intermediation and the Future of the Banking System

The financial industry has been significantly impacted by the digital revolution, and more specifically the arrival of technical advances like decentralised ledgers, machine learning, and artificial intelligence (Carletti et al., 2020; Goldstein et al., 2019). This transformation is creating new business models, opening up new markets, diversifying financial services and products, and lowering costs (Financial Stability Board (FSB), 2019; Stiglitz, 2017).

Players in the financial sector are growing as a result of this revolution, with fintech firms taking on a key responsibility of providing credit services more quickly through innovations geared towards customer-centric business models (Pousttchi & Dehnert, 2018) thus improving borrowers' customer experiences (Allen & Berg, 2020) and increasing financial inclusion levels by making credit easier to access (Maskara et al., 2021). The existence of these players and their innovative, technology-driven business models have a big impact on the financial sector as a whole and the banking sector in particular (Vives, 2019).

Information and communications technology (ICT) and the rise of digital innovation throughout financial services have drawn the attention of numerous academics conducting study on the banking sector (Casolaro & Gobbi, 2007; Hasan et al., 2020). The eminent economist Robert Solow once quipped that 'You can see the computer age everywhere but in the productivity statistics.' (Solow, 1987, 36) The Solow Paradox was born out of this, and its underlying philosophy is still relevant today because studies on technology adoption have a tendency to concentrate on measuring productivity in the industrial sector, and research on banking corporate governance has produced conflicting results regarding whether the impact of information and communication technology on the banking sector is deemed positive due to the paucity of data (Ho & Mallick, 2010; Shu & Strassmann, 2005). Even now, the true effects of information and communication technologies on economic development and the banking sector are still unknown, and there is scant research demonstrating a connection between technical development and effective corporate governance.

The limited evidence may be attributable to the various research methodologies and disagreements regarding the most suitable indicators for measuring technological development and advancement. While scholars such as Berger and Mester (2003) assert that credit efficiencies are improved by these technologies, thereby reducing default/insolvency risks due to improved information availability, Beck et al. (2016) describe the negative impact that innovations and financial technologies have on risk exposure and overall performance.

Banking business models rely heavily on collecting client information for decision-making. Repayment information leads to appropriate loan portfolio monitoring, in addition lending data can aid underwriting (Drucker & Puri, 2005; Kroszner & Rajan, 1994; Parlour et al., 2020) and established communication channels enable cross-selling of financial and supplementary products

to customers (Stiroh & Rumble, 2006). The capacity of digital financial entities to collect and process non-financial data has a significant impact on the efficiency of financial intermediation (Boot et al., 2021).

Digital technology within the banking industry is increasing the threat of entry from ‘digitally native’ entities, whose operating models are impacting the integrated business model of traditional banks. Banks are typically vertically and horizontally integrated, where their balance sheet is used as the base for directly interacting with customers and offering loans and deposits (vertical) while offering services that are not directly related to the balance sheet but have communication and information synergies (horizontal). Banks therefore become challenged on horizontal and vertical levels due to innovations in information technology which enable the entry of companies that have direct access to customers with little-to-no dependency on balance sheets.

Information and communication concerns such as moral hazard, adverse selection, and ‘matchmaking’ are a top priority for financial institutions. Communication frictions are resolved by investing in channels and maintaining strong customer relationships, whereas information frictions are resolved by taking the lead in screening investment opportunities and monitoring risk on behalf of depositors (Diamond, 1984) and by collecting data due to continuous interactions with customers, which leads to improved efficiencies (López-Espinosa et al., 2017) institutions achieve this by deploying capital (Holmstorm & Tirole, 1997).

The financial sector has undergone several phases of technological development. Informational innovation in the 1980s and 1990s resulted in techniques such as passive investing and credit scoring, while communication innovation resulted in ATMs in the 1970s and online/mobile banking in the 2000s, thereby maintaining the stability of banks (Philippon, 2015). While past innovations led to fundamental changes in the operating models of financial institutions, future innovations are anticipated to result in more radical measures and enable central banks and banking institutions to adopt a framework for dynamic effect corporate governance.

Financial institutions are able to exert influence on their respective markets with the help of sophisticated information and communication techniques. They allow for the cross-selling of complementary products and services (Puri et al., 2011), capturing information while competitors undergo adverse selection (Rajan, 1992) and allowing ‘spatial capture’, which allows banks to price discriminate (Agarwal & Hauswald, 2010; Armstrong & Vickers, 2019).

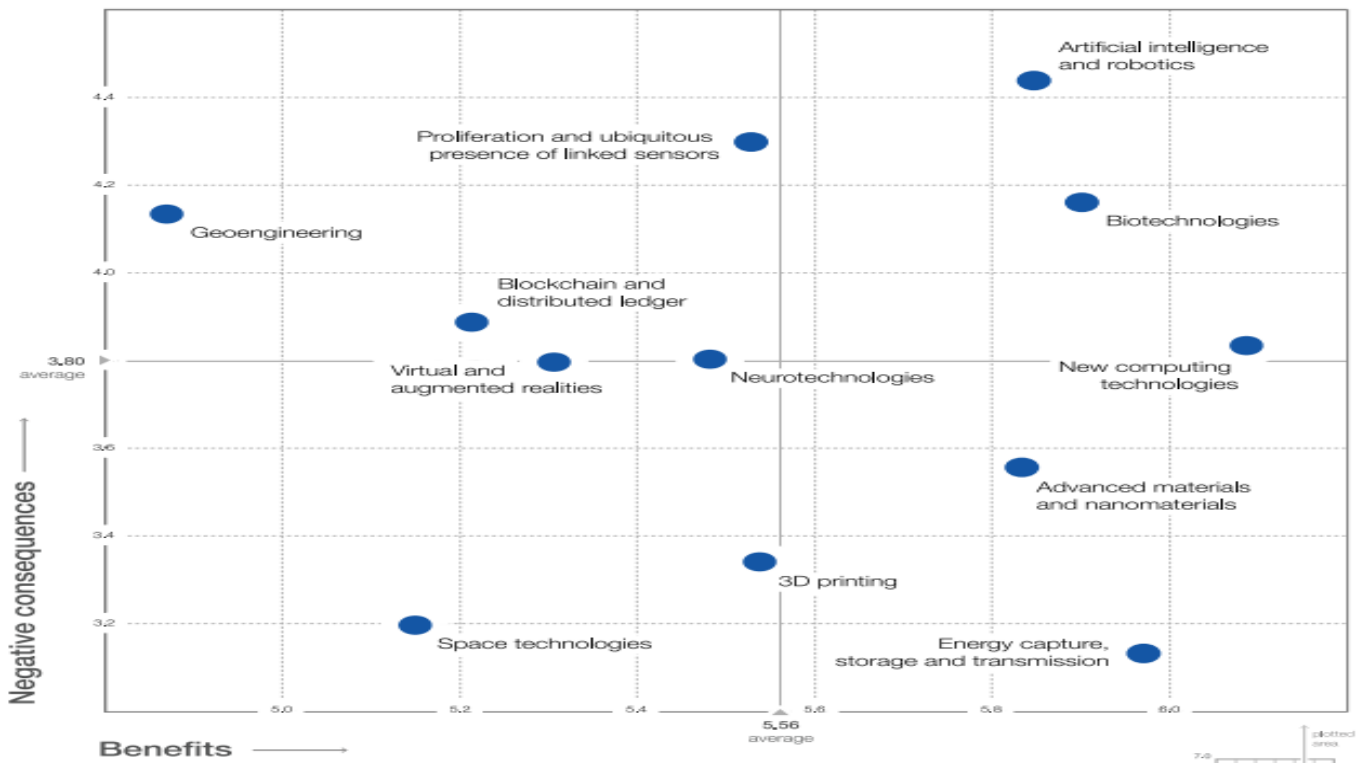
Prior literature heavily emphasised the role of information in financial intermediation; however, recent developments suggest that the importance of communication is growing. Digital financial entrants utilise online communication channels such as mobile applications and direct marketing tools to increase efficiencies, improve consumer experience, and keep costs low. Neobanks (such as Monzo and Revolut) are also making strides in the communications industry by offering user-friendly interfaces on their channels, thereby enhancing consumer convenience.

Digital financial entrants extend beyond banking and credit lending (D'Acunto et al., 2019). A growing number of digital firms are invading various financial arenas, such as payments and trading of capital market instruments (equities, fixed income), with mobile applications, causing market disruptions and generating intense competition. Other financial competitors, such as peer-to-peer (P2P) platforms, enable informed decision-making through the use of sophisticated information and communication technologies that enable the collection and exchange of data, thus complementing traditional banks (Yu et al., 2018). The characteristics of these digital platforms enable network externalities, which reduce contestability (Rochet & Triole, 2003).

When it comes to the informational aspect, multiple innovations are witnessed in the collection and processing of information. The complementary nature of financial and non-financial data of a client enables a more accurate risk assessment. The Internet allows financial entities to capture customers' non- financial data such as shopping behaviour, ratings, and browsing history. This 'digital footprint' is easy to collect and may be as useful as credit scores when assessing a client's risk (Berg et al., 2019).

The process of codification is one such innovation that allows for data collection. It converts 'soft' information into 'hard' information, which is then transmitted (Liberti & Petersen, 2019). Analytical tools such as machine learning and AI are subsequently used to generate insights to facilitate decision-making (Philippon, 2020). Innovations in information and communication are enabling financial intermediaries to become more operationally stable, thereby allowing them to become forward-looking and capable of fostering consumer loyalty (Guiso et al., 2008; Hart, 1995; Thakor & Merton, 2018).

Figure 5:11 *The Benefits and Risks of Emerging Technologies*



- *Source: Global Risks Report, 2017 and Global Risks Perception Survey, 2016, World Economic Forum.*

5.4.4. Corporate Governance and Decentralised Ledgers

The definition of corporate governance varies based on its context and use. In its essence, corporate governance explores the relationship between key stakeholders within the institution: shareholders, directors, officers, and any other stakeholders with contractual rights to the institution. Research within this context has explored the term and the relationship among internal stakeholders by showcasing the conflicts that arise among these constituents.

In other contexts, corporate governance is also defined by the legal structure through which the stakeholders interact when working within the firm. This includes operating the business, controlling its resources, and managing its direction. Within this context, corporate governance is outlined in corporate laws as well as federal and state securities regulations. These structures are put in place to clearly define the roles among the stakeholders, set authorities for decision-making processes and mediate any conflicts that may arise.

For this essay a wider definition for corporate governance is utilised, which integrates both previously mentioned definitions, thus exploring the impact of digital technology while assessing the banking system's transparency, stability, and performance. This essay will specifically explore the impact of innovative digital technology on corporate governance in terms of board and audit committee characteristics, transparency, stability, and profitability, as these areas may potentially implicate any related legal and regulatory structures.

The legal frameworks and structures of corporate governance are dynamic to a certain point and continuously evolve to take into consideration new market requirements. Regulations are frequently revisited by legal advisers, legislatures and regulatory entities to ensure that any conflicts/tensions among stakeholders are addressed. Some stakeholders, however, criticize this approach claiming that this incremental approach is insufficient for establishing a solid corporate governance framework and instead advocate a full revamp to address all issues.

Considering the structure of corporate governance and the nature of information technology such as blockchain, smart contracts, machine learning and artificial intelligence, the researcher is interested in exploring the possible application and synergies among the two elements. Corporate governance is a logical application for blockchain as corporate information includes record-keeping such as compliance reports, and transactional data such as stock transfer records, all of which can be registered and stored through blockchain technologies.

5.4.4.1. Theoretical Perspective of Corporate Governance and Blockchain

This research employs agency and stakeholder theories to examine the impact of blockchain-enabled accounting and AI-enabled auditing, and how they contribute to ensuring the integrity of the banking system. Consequently, the original data must be uploaded accurately and correctly to the blockchain, which requires the participation of trustworthy parties. By decreasing information asymmetry and allowing stakeholders to make decisions collectively, trust and credibility are enhanced.

5.4.4.1.1. Agency Theory Perspective

The implementation of digital technologies such as blockchain and AI in accounting information control may limit agency problems and reduce information asymmetry, as these technologies facilitate the sharing and verification of information, as well as the detection of outliers. The capacity of smart contracts to automate

procedures also reduces managers' opportunistic behaviour. Managers typically have access to more information than other stakeholders, allowing them to manipulate the data to maximise their own interests at the expense of others (Godfrey et al., 2003). Information asymmetry exists when managers withhold, hold privately, or reveal information strategically to influence the outcome of a transaction or decision (Williamson, 1979). Agency theory can be utilised to highlight 'the conditions of uncertainty that lead to potential information asymmetries between the executives who manage the firm and external investors' (Walker, 2013, 448). Multiple global financial scandals have been caused by information asymmetry (Cuevas-Rodríguez et al., 2012; Lubatkin et al., 2005); consequently, accounting and auditing practises must mitigate information asymmetry.

Since Jensen and Meckling (1976) extended the work of Berle and Means (1932) and theorised the principal-agent relationships, scholars of corporate governance have investigated a variety of internal and external monitoring and control mechanisms (which were discussed extensively in Essays 1 and 2 of this research paper). Internal governance mechanisms are primarily concerned with boards of directors, board composition, board size, board independence, ownership structure, and managerial incentive mechanisms, whereas external governance mechanisms address issues pertaining to the external market and laws and regulations.

5.4.4.1.2. Stakeholder Theory Perspective

Previous literature has depicted how digital technologies such as blockchain, smart contracts, and AI technology can resolve the problems of current accounting practises, thereby highlighting areas where organisations should exercise caution.

Current accounting practises hinder external financial stakeholders' ability to observe firm transactions and accounting processes (Yu et al., 2018). Accounting literature has focused on the interpretation of financial reporting standards by consumers but has neglected to include a diverse group of stakeholders. Therefore, Moll and Yigitbasioglu (2019), Vasarhelyi and Moffitt (2013), and Yermack (2017) recommended that the present model for information disclosure be replaced with a disaggregated method.

The stakeholder theory posits that businesses are part of a larger ecosystem and decisions cannot be made in isolation, thereby fostering a more open and inclusive relationship with all key stakeholders (Freeman, 1984,

1994). Dai and Vasarhelyi (2017) propose that utilising a blockchain-enabled accounting ecosystem in which all key stakeholders, including managers, accountants, and investors, can actively collaborate to verify transactions results in a more inclusive and robust ecosystem. The distributed nature of blockchain technology and the application of artificial intelligence enable this collaborative and interactive environment among a diverse group of individuals.

- **Hypotheses Development**

Based on the discussion of previous literature and the above thematic analysis conducted on the role of digital tech and transformation in the banking business, the following hypotheses have been developed in order to empirically assess the relationship between digital tech and the banking corporate governance and sustainability matrix:

H01: *The impact of technological advancements and digitalisation on BOD size (BODS) is negative and statistically significant.*

H02: *Technological advancements and digitalisation have a positive and statistically significant effect on BOD meeting frequency (BODMF).*

H03*: The digital technology and innovation negatively and statistically significantly impacts audit committee size (ACS).*

H04*: Technological advancements and digitalisation have a statistically significant and positive influence on the frequency of audit committee meetings (ACMF).*

H05a: *Information and technological development have a significant positive effect on the Environmental Social Governance Disclosure Score (ESGDS).*

H05b: *Information and technological development have a significant positive effect on the Environmental Social Governance Disclosure quality – transparency (ESGDS) in the presence of CEO duality versus separation.*

H06: *The impact of technological advances and digitalisation on CEO duality (CEOD) is negative and statistically significant (decreases the practises of separation of CEO/chairman roles).*

H07: *Digital transformation has a significant positive impact on Z-score.*

H08: *Technological advancements and adoption have a positive and significant impact on the ratio of liquid assets to gross domestic product (LL.GDP) held by banks.*

H09a: *Digitalisation and technological advancements significantly positive impact on return on equity (ROE).*

H09b: *Digitalisation and technological advancements significantly positive impact on return on equity (ROE) in the presence of CEO duality when compared to separation-of-role banking environment.*

H10a: *Technological advancements and adoption have significant positive effect on the capital adequacy ratio (CAR).*

H10b: *Technological advancements and adoption have significant positive effect on the capital adequacy ratio (CAR) in the presence of CEO duality when compared to separation-of-role banking environment.*

H011a: *The technological advances and digitisation have a negative and statistically significant impact on asset quality (AQ).*

H011b: *The technological advances and digitisation have a negative and statistically significant impact on asset quality (AQ) in the presence of CEO duality when compared to separation-of-role banking environment.*

H012a: *The impact of technological advancements and digitisation on management efficiency (CTI) is negative and statistically significant.*

H012b: *The impact of technological advancements and digitisation on management efficiency (CTI) is negative and statistically significant in the presence of CEO duality when compared to separation-of-role banking environment.*

5.4.5. Data and Methodology

5.4.5.1. Sample Population and Quantitative Data Collection Methods

This research focuses on data of G7 countries in two aspects: 1) country-specific data and 2) bank-specific data. The following subsections provide the data collection process for the aforementioned two data sampling approaches in more detail.

According to the IMF Outlook database, April 2023, and the World Bank, the G7 countries'(GDP) reached USD 42.78 trillion and accounts for approximately 44.4% percent of the world's GDP in 2021 (expected to reach 43.5% in 2023). This is relevant for establishing the significance of the study and the significance of the population sample. In addition, the G7 total banking assets share of GDP accounted for 120% of the G7 GDP in 2021. This demonstrates the magnitude of their economic impact at the local, regional, and global levels. As a result, it is even more crucial to investigate the impact of technological advancements and innovation on banks' corporate governance frameworks and practises in significant advanced markets, as the group has a direct impact on global economic activity.

5.4.5.1.1. Country-Specific Data Sampling, Variables

The country-specific data was gathered from various reliable online databases, namely the World Development Indicators WDI (2022); The Global Economy Database (2022); Global Financial Development Database (2022); International Telecommunication Union (2022), OECDstat (2022); UNCTADstat (2022); and the Global Centre for Digital Business Transformation/World Competitiveness Centre (2022), which is considered a highly reliable data source as it gathers inputs from different official sources such as the World Bank, World Economic Forum, United Nations, the Organisation for Economic Cooperation and Development (OECD); and the Institute for Management and Development (IMD) online databases. Data observations were gathered from member countries across the G7 over spanning period of 12 years (2010–2021). The data was checked and validated for any inconsistencies or outliers, and it was revealed that the sample was ready for use in our analysis. Additionally, the sample consisted of equally distributed observations. Thus, no bias was found.

Financial innovations are categorised as products, processes, and financial system/institutions (Tufano, 2003) and are grouped into five main pillars: credit-generating instruments, equity-generating instruments, liquidity-generating innovations, price-risk-transferring innovations, and credit-risk-transferring instruments, according to the Bank for International Settlement's report authored by Auer et al (BIS, 2021).

Credit-generating innovations offer borrowers a greater depth of credit allocation, thus increasing borrowings, while equity-generating instruments tend to boost the capital base of financial companies (Abor et al., 2018). Liquidity-generating advancements increase the liquidity of the financial market, thus allowing for new

sources of funds and permitting stakeholders to bypass constraints imposed by regulatory bodies. Price-risk-transfer innovations enable consumers to limit their exposure to market volatilities such as exchange and inflation rates, and credit-risk-transferring instruments provide methods that allow banks and other financial institutions to transfer their default risks.

When it comes to processing innovations, these advancements are meant to enhance the delivery of financial services by offering digital channels to replace traditional banking. A solid information and communication infrastructure complements such innovation, enabling the introduction of online/SMS banking and ATMs, among others. Blockchain technology is also considered as an innovation under the "process" category, as it enables distributed public ledgers to store encrypted data (Schilirò, 2020) thus ensuring high efficiencies by creating a more open and robust environment for secured data sharing.

New product developments within financial institutions, such as premier banking, special deposits, and mobile money, constitute product innovations. In the payments industry, for instance, mobile and web-based payment platforms, such as Alipay, Android Pay, Apple Pay, M-Pesa, PayPal, and Samsung Pay, enable end users to pay for goods and services online or via handheld devices, potentially reducing transaction costs compared to more conventional payment methods. The goal of digital currencies, such as Bitcoin and Litecoin, is for households and businesses to use them to pay for actual economic transactions. Additionally, loans can be granted in digital currencies. Crowdfunding, on the other hand, connects investors with borrowers or equity issuers via an internet-based platform; this can be viewed as a way to pool funds and streamline the sharing of information outside of traditional financial intermediaries, although the degree of effectiveness in this regard may vary across platforms.

Across a range of economic functions, financial institutions are investigating applications for DLT – for cross-border interbank payments, credit provision, capital raising and for digital clearing and settlement. The potential gains cost for customers may be substantial, in the area of remittances. The ability to transfer and to record the ownership of digital assets and immutably store information are considered advantages of the technology that may help to reduce information asymmetries.

Other innovations aim to modify how the market receives information and services. Smart contracts can be used to automate business processes and transactions, thereby reducing transaction costs. Several applications of big data capitalise on the value of information to improve credit risk assessments, investment returns, and insurance contract pricing. Robo-advice and e-aggregators may seek to improve the financial advice services and overview of financial products available to users via digital channels, necessitating increased mobile broadband, data, and voice connectivity and communication, capitalising once more on the availability of information. fintech can be used by internal auditors, regulators, and administrators across the entire spectrum of financial services, for instance, to reduce the costs of regulatory and control reporting (internally and externally) or to identify risks early on.

AI is a key contributor to digital globalisation. It combines multiple technologies to bring about superior advancements and can be classified into five broad categories: (1) virtual assistants (2) computer vision (3) natural language (4) robotic process automation, and (5) advanced machine learning. AI and machine learning highly enhance efficiencies, as the technology entails transferring human knowledge and past experiences into digital form, thus presenting the most optimal decisions based on algorithms (Zhao, 2021).

While there are multiple concerns regarding the consequences of implementing AI and other digital technologies, specifically the replacement of human labour, it is difficult to dismiss the productivity gains, which are expected to improve business across multiple industries, thereby boosting demand and employment.

Scholars have forecasted the adoption and benefits of AI technologies. Zhao (2021) expects that by 2030, 70% of companies will have adopted at least one type of AI technology. Bughin et al. (2018) believe that AI has the potential to increase current GDP by over 16%, reaching around 13 trillion USD by 2030.

In terms of digital globalisation, fintech is among the prominent players. Multiple areas of finance, including investments, risk management, payments, customer interface and data security, and monetisation, are presently utilising financial technology (Arner et al., 2015). In developing nations, there is a high rate of adoption

because economic requirements and regulatory forces are bolstering their expansion. Digital finance has the potential to expedite social development and facilitate digital globalisation.

When measuring economies' level of innovation and technological adoption, Idun and Aboagye (2014) and Laeven et al. (2015) used the speed of adopting credit information sharing systems as a measure for financial innovation. Other studies used patents' impact and research and development expenditure.

Digital technology within business environments refers to innovations such as data analytics, artificial intelligence and the Internet of things (Ritter & Pedersen, 2020). Their rise and utility are facilitating heavy competition; thus, it is critical for companies to quickly adopt digital innovations and intelligent technologies in order to remain relevant within the market.

To ensure the proper execution and implementation of digital transformation within an economy, each participant in the financial sector must have a framework in place to achieve predetermined goals. To ensure appropriate supervision, intermediaries must first acquire the required knowledge and operational scope. Additionally, banks should compete equitably with fintech companies in terms of regulatory requirements. The regulatory environment should also facilitate the development and expansion of financial technology startups.

As fintech provides innovation and automation within traditional financial services, its ability to enhance efficiencies in the form of cost reduction, faster processing, and data transmission leads to improved transactional lending (Liberti & Petersen, 2019). What started as applying digital technologies to back-end processes now progressed to utilising information technologies such as AI, blockchain, big data and IoT (Song et al., 2021).

Artificial Intelligence is considered to be IT systems that perform functions requiring intelligence when performed by people, according to the Financial Stability Board (2017). Certainly, AI is considered as one of the most disruptive and significant technologies of modern times. The technology basically reveals optimised decisions based on the information available and through tools such as algorithms (which are based on pre-set instructions) (Nadikattu, 2016). Ransbotham et al. (2018) assert that AI integrates human intelligence in computer technologies.

- Big data, as defined by the Financial Stability Board, refers to the massive volume of data generated by the increased use of digital tools and information systems (Financial Stability Board (FSB), 2017). In addition, it is defined as high-volume, high-velocity, and high-variety information assets that necessitate innovative, cost-effective forms of information processing for enhanced insight and decision-making (Gartner, 2013). Big data is characterised by the three Vs (volume, variety, and velocity), as described by Alles and Gray (2016).
- Cloud computing: An innovation in computing that allows for the use of an online network ('cloud') of hosting processors so as to increase the scale and flexibility of computing capacity. Cloud computing has made possible the analysis of very large datasets (big data), and a number of specific fintech applications (FSB, 2017).
- Internet of things: Software, sensors and network connectivity embedded in physical devices, buildings, and other items that enable those objects to collect and exchange data and send, receive, and execute commands (FSB, 2017).
- Mobile and web-based payments: Applications that allow consumers to conduct transactions through their mobile phone or tablets, improving efficiency and the customer experience (FSB, 2017).
- Distributed ledger technology (DLT): A means of saving information through a distributed ledger, i.e., a repeated digital copy of data at multiple locations, as in a blockchain. Current experiments with DLT applications in securities settlement aim to speed up settlement and reduce back-office costs while providing greater transparency of transactions and holdings (FSB, 2017).
- Smart contracts: Transactions or financial flows that are automatically triggered if specific events occur (FSB, 2017).
- Tokens: The digital representation of values, mostly linked to digital identification verification to ensure information security (FSB, 2017).
- Digital ID verification: A range of technologies used to confirm the identity of actors in financial transactions or other applications, to prevent fraud and to ensure the security of clients and counterparties (FSB, 2017).

- Crowdfunding: Equity and loan crowdfunding is the practise of funding a project or venture by raising monetary contributions from a large number of people. It is frequently carried out via Internet-mediated registries that facilitate the collection of funds on behalf of the creditor (lender) or issuer (equity).
- e-Aggregators: Also known as price comparison websites or comparison aggregators, providing Internet-based venues for retail customers to compare the prices and features of a range of financial products such as standardised insurance, mortgages, and deposit account products. e-Aggregators also provide an easy way to switch between providers (FSB, 2017).
- e-Trading: A broad category of financial market trading methods on electronic trading platforms and virtual marketplaces. This can include algorithmic or high-frequency trading among professional investors, and online investment, ‘social trading’ or ‘copy trading’ among retail investors (FSB, 2017).
- Fintech: Technology-enabled innovation in financial services that could result in new business models, applications, processes, or products with an associated material effect on the provision of financial services (FSB, 2017).
- Fintech credit: Credit activity facilitated by electronic platforms whereby borrowers are matched directly with lenders. These entities are commonly referred to as ‘loan-based’. Such electronic platforms can facilitate a range of credit obligations, including secured and unsecured lending, and non-loan debt funding such as invoice financing (FSB, 2017).
- Innovation facilitator: Public sector initiatives to engage with the Fintech sector, such as regulatory sandboxes, innovation hubs and innovation accelerators (FSB, 2017).
- RegTech: Any range of applications of fintech for regulatory and compliance requirements and reporting by regulated financial institutions. This can also refer to firms that offer such applications. There is also a close link with ‘SupTech’, or the use of fintech by supervisory authorities (FSB, 2017).
- Robo-advisors: Applications that offer financial services and advice by combining algorithms, and in some cases machine learning, to digital interfaces. These can function within applications of traditional financial institutions or operate as standalone firms and platforms.

Research regarding financial technology investments has often proven to be difficult due to the lack of available information. While some research, such as that conducted by Brynjolfsson (1993), has used IT expenditures on balance sheets to measure the extent of digitisation in an institution, other empirical research has used self-reported data, and surveys such as that of Tippins and Sohi (2003). Baker (2003), however, believes that this method leads to inaccurate results due to missing data from recipients' answers, and possible interpretation issues.

Other research, such as that conducted by Dong et al. (2020), has utilised dummy variables for measuring banks' digitisation investments, and more specifically the impact of adopting online channels on cost efficiencies and profitability, whereby the variable is 1 in case of adoption and 0 otherwise. Considering the dichotomous nature for measurement (i.e., 'this' or 'that'), the approach is criticised as it does not take into consideration that most banks may have some or a minimal form of digitisation (Council of Economic Advisers, 2001).

Text-mining techniques have been utilised by Barnewold and Lottermoser (2020) and Kriebel and Debener (2019) to determine a measure for digitisation, as this method is regarded as optimal for measuring diverse information containing multiple elements. Barnewold and Lottermoser (2020) for instance, analysed digitisation trends within the mining industry by collecting insight reports from 13 global consulting firms, revealing that AI, IoT, and big data are the key innovations being used in the industry, while redefining the degree of digitisation to include utilising technologies towards new services, in addition to investing in hardware and software.

Table 5:2 below describes the (dependent and independent) variables of this essay that will examine the impact of digital transformation and innovation on corporate governance performance of the G7's banking system.

Table 5:2 D*escription of Country-Specific Variables of G7 Banking System during 2010–2021*

Variable Type	Country Specific Variables	Ticker	Description	Literature Source
Dependent Variables: Banking Corporate Governance Indicators	Environmental, Social, and Governance Disclosure Score (Transparency Level)	ESGDS	The combined proprietary Bloomberg ESG disclosure score is determined based on the extent of a company's ESG disclosure. The score measures the extent to which a company publicly reports ESG data and is set from 0 (for companies that have no disclosure of any ESG data) to 100 (companies with a detailed disclosure for every data point). Companies that are not present in Bloomberg's ESG data will not be scored and their values will be represented as N/A. *Source: Bloomberg Online Database*	Siddique et al. (2021); Tunio et al. (2021)
	Board Size	BODS	The average number of BOD members of banks within each country included in the bank specific sample for each year. *Source: Bloomberg Online Database*	Adams and Mehran (2012); Bhatia & Gulati (2021)
	Board Meeting Frequency	BODMF	The average number of BOD annual meetings of banks within each country included in the bank specific sample for each year. *Source: Bloomberg Online Database*	Adams & Mehran, (2012)
	Size of Audit Committees	ACS	The average number of audit committee members of banks within each country included in the bank specific sample for each year. *Source: Bloomberg Online Database*	Bosch, (1995); Hermes et al. (2007)
	Audit Committee Meeting Frequency	ACMF	The average number of audit committee annual meetings of banks within each country included in the bank specific sample for each year. *Source: Bloomberg Online Database*	Sun & Liu, (2014)
	CEO Duality	CEOD	The percentage of banks within a country without CEO duality divided by the banks with CEO duality for each year. The higher the percentage indicates the banking system within that country is heading towards a separation of leadership roles and vice versa. *Source: Bloomberg Online Database*	Berger et al. (2016); Simpson & Gleason (1999)

Variable Type	Country Specific Variables	Ticker	Description	Literature Source
Dependent Variables: G7 Banking System, Efficiency and Stability Indicators	Z-Score	ZS	The index captures the probability of default of a country's banking system. Z-score compares the buffer of a country's banking system (capitalisation and returns) with the volatility of those returns. It is estimated as (ROA+(equity/assets))/SD (ROA); SD(ROA) is the standard deviation of ROA. ROA, equity, and assets are country-level aggregate figures. Calculated from underlying bank-by-bank unconsolidated data from Bankscope whereby a higher Z-score implies a lower probability of bankruptcy(insolvency). *Source: Global Financial Development Database (2023); The Global Economy Database (2021) and The World Bank Database (2022)*	Andries et al. (2017); Dedu & Chitan (2013)
	Return On Equity	ROE	Commercial banks' pre-tax income to yearly averaged equity. The numerator and denominator are first aggregated on the country level before division. Note that banks used in the calculation might differ between indicators. Calculated from underlying bank-by-bank unconsolidated data from Bankscope. *Source: Global Financial Development Database (2023)*	Zemzem & Kacem (2014); Zhang et al. (2020)
	Management Efficiency	CTI	Operating expenses of a bank as a share of the sum of net-interest revenue and other operating income. The numerator and denominator are first aggregated on the country level before division. Note that banks used in the calculation might differ between indicators. Calculated from underlying bank-by-bank unconsolidated data from Bankscope. *Source: Global Financial Development Database (2023)*	Mckinsy & Co (2023)
	Capital Adequacy Ratio	CAR	The capital adequacy of deposit takers. It is a ratio of total regulatory capital to its assets held, weighted according to the risk of those assets. *Source: Global Financial Development Database (2023)*	BaselII (2006)
	Banking Liquid Liabilities percentage of GDP	LL%GDP	Ratio of liquid liabilities to GDP. Liquid liabilities are also known as broad money, or M3. They are the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travelers' checks, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents. *Source: Global Financial Development Database (2023)*	Caporale et al. (2015); Kagochi et al. (2013); Kilinc et al. (2017)

Variable Type	Country Specific Variables	Ticker	Description	Literature Source
Independent Variables: Emerging Technologies & Digitalisation Indicators	Artificial Intelligence	AI	Indicates the extent of businesses within each country that use artificial intelligence across all economic industries including financial services and insurance. *Source: OECD.stat (2023).*	Author
	Internet-of-Things	IoT	The percentage of businesses using IoT *Source: OECD.stat (2023)*	Author
	Cloud Computing Services	CC	The percentage of businesses purchasing cloud computing services. *Source: OECD.stat (2023)*	Author
	Cloud Computing Services for Accounting and Finance	CC.FA	The percentage of businesses purchasing cloud computing services for finance and accounting functionality. *Source: OECD.stat (2023)*	Author
	Big Data Analytics	Big.D	Big data analytics is generating insights to facilitate decision making by gathering and analyzing large amounts of data. The measure indicates the proportion of businesses having performed big data analysis. *Source: IMD World Competitiveness Center (2022) and World Bank (2022)*	Author
	Digital Skills	DS	A measure of the percentage of available technological skills using digital devices to explore and create content. Optimal use of ICT is achieved when employing skills such as digital literacy, security, collaboration and communication. *Source: IMD World Competitiveness Center (2022)*	Author
	Digital Transformation in Businesses	DT	The percentage of digitalisation within businesses according to an executive opinion survey, based on an index from 0 to 10. *Source: IMD World Competitiveness Executive Opinion Survey (2022)*	Author
	Machine to Machine Mobile Network Subscriptions per 100 Inhabitants	M2M	Expressed as the proportion of M2M SIM cards on mobile networks per 100 people, this indicator provides a measurement of Internet of things component. The indicator shows SIM cards that have been given out for usage in equipment and gadgets that are not a part of a consumer subscription. *Source: OECD.stat (2023)*	Author
	Information and Communication Infrastructure and Connectivity	ICT.IC	Information and Communications Technology (ICT) infrastructure represents equipment and software necessary to implement and operate systems and networks for communications services as well as support applications, digital content, signaling, switching and e-commerce. It refers to	Author

Variable Type	Country Specific Variables	Ticker	Description	Literature Source
			national technical infrastructure interventions and is considered the backbone for international fiber, internal networks, Internet exchange points. *Source: International Telecommunication Union (2023) and the World Development Indicators (WDI, 2020)*	
	Mobile Broadband and Data Subscriptions	MBDS	This indicator is measured in number of subscriptions per 100 inhabitants. It describes subscriptions that advertise data speeds of 256 kbit/s or higher. It allows Internet access via HTTP and must have connected to the Internet via Internet Protocol (IP) during the last three months. Standard SMS and MMS messaging do not count. *Source: OECD.stat (2023)*	Author
	Internet Banking	I.Banking	The percentage of individuals (aged 16–74) using the Internet for banking. *Source: OECD.stat (2023)*	Author
	Enterprise Resource Planning System	ERP	Measure the extent of businesses purchasing resource planning system as a percentage of total businesses within a country. The system is considered a type of software based on relational database management systems used by businesses to manage daily operations, specifically accounting, procurement, supply chain, and risk-management activities. *Source: OECD.stat (2023)*	Author
	Internet Users as a Percentage of Population	IUPP	Individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV, etc. *Source: International Telecommunication Union (2023*)	Author
	Mobile Phones Subscribers Per 100 People	MPS	Subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. The indicator includes (and is split into) the number of post-paid subscriptions and the number of active prepaid accounts (i.e., that have been used during the last three months). The indicator applies to all mobile cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services. *Source: International Telecommunication Union (2023) and World Development Indicators (WDI, 2020)*	Author
	Electronic Participation	E-Partic	Is of the United Nations e-government knowledge database. The e-participation index is a measurement of online services usage to facilitate the e-information sharing, e-consultation, and e-decision making *Source: IMD World Competitiveness Center (2023) and the UNE-Government Knowledge Database*	Gupta & Das (2022); Kabanov (2022); Silal & Saha (2021)

Variable Type	Country Specific Variables	Ticker	Description	Literature Source
	Innovation Index	II	The Global Innovation Index includes two sub-indices: the Innovation Input Sub-Index and the Innovation Output Sub-Index. The first sub-index is based on five pillars: institutions, human capital and research, infrastructure, market sophistication, and business sophistication. The second sub-index is based on two pillars: knowledge and technology outputs and creative outputs. Each pillar is divided into sub-pillars and each sub-pillar is composed of individual indicators.	Pence et al. (2019); Rajput et al. (2012)
	Number of Patent Applications by Residents	PAR	Worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention – a product or process that provides a new way of doing something or offers a new technical solution to a problem. A patent provides protection for the invention to its owner for a limited period, generally 20 years.	Balsmeier et al. (2014); Ernst (2001)
	Research and Development Expenditures to Gross Domestic Product (GDP)	R&D.EXP.GDP	Gross domestic expenditures on research and development (R&D), expressed as a percent of GDP which consist of capital and current expenditures in the four main sectors: business enterprise, government, higher education and private non-profits, based on four pillars including basic research, experimental development, and applied research. *Source: World Economy (2023)*	Author

- *Author's Own*

Corporate governance is essential to providing adequate financial supervision because it ensures optimal stability and equilibrium throughout the entire banking system among all of its stakeholders, from customers to owners. Consumer protection laws govern the relationship between depositors and borrowers and the bank, whereas liquidation regulations govern the relationship between the bank and all depositors and creditors (Mayes et al., 2001). Proper corporate governance, especially in the banking system, ensures that credibility and transparency are achieved in the financial market, which fosters long-term investment security and sustainability (OECD, 2015).

In addition to enhancing comparability on a global scale, high-quality reporting increases transparency, credibility, and accountability. Reducing information asymmetry and uncertainty among stakeholders limits opportunistic behaviour through enhanced monitoring (Rahman & Masum, 2021), thereby fostering confidence among internal investors and external capital providers. High-quality reporting is required to provide financial and

nonfinancial information about a company, thereby influencing investment opportunities among multiple categories of stakeholders and contributing to greater economic efficiencies.

This essay measures the reporting quality of banks by utilising the environmental, social, and governance disclosure score (ESGDS). The score provides information about companies through reflecting their operations during a set reporting period, then accordingly provides their financial position at the end of said period (Shuraki et al., 2020).

Considering the significant function of the audit committee, which provides control within institutions and ensures the quality and accuracy of financial statements (Komnenic & Pokrajcic, 2012), this essay utilizes corporate governance mechanisms in relation to the characteristics of the board of directors, audit committee, and transparency measured by the ESG disclosures to investigate their relationship with digital technology and innovation.

The increasing adoption of technology-enabled innovations in the financial industry has a significant impact on the traditionally ‘manual’ audit function. Auditing expertise is becoming more essential to ensure the integrity of implementing automated systems and technological innovations (Adeyemi et al., 2014). These technologies enable the storage of accounting data in regulated, secure, and monitored environments, enabling auditors to employ business intelligence tools to facilitate appropriate decision-making (Ciprian-Costel, 2014). Among these are enterprise resource planning (ERP) systems, which utilise cloud storage to make e-data readily accessible to auditors, boards of directors, and other managerial stakeholders (Byrnes et al., 2018). These systems are contributing to the increased adoption of online transactions, but their implementation and quality are highly dependent on their intended use and the extent of managerial support (De Costa et al., 2019).

The Z-score index measures a bank’s financial stability by comparing banks’ financial standing in terms of capital and returns with their volatility, thus identifying the likelihood of default. A higher Z-score indicates lower risk, as the numerator represents the bank’s buffer to withstand unfavourable conditions and the denominator reflects the variability of the bank’s earnings. Multiple variations of the Z-score have been used in the other

empirical studies. Some studies use the standard deviation of the entire sample as the numerator and the return on assets and equity-assets ratio as the denominator (Cihák, 2007; Laeven & Levine, 2009). Others have estimated the Z-score using average ROA, equity-to-total assets, and the standard deviation of ROA figures (Bertay et al., 2013).

The phenomenon of global digitalisation is gaining momentum and is predominantly characterised by movements of data and information (data flow). In the process of digitalisation of economies, global data flows are growing and digital platforms are broadening their reach to include smaller countries (Schilirò, 2020), which has a significant impact on international trade and the flow of economic advantages. According to the McKinsey Global Institute (2016), international bandwidth has increased 45-fold since 2005.

Digital flows strengthen the digital globalisation process by transmitting information, ideas, and innovations, thus broadening participation in the global economy, and impacting global trade and investments where, according to the UNCTAD World Investment Report (2019), the digital economy greatly influenced global investments patterns, while transforming industries and sectors across the globe. Data and information nowadays are the 'new oil', as their flow impacts investment decisions, improves solutions that adopt AI, and have the ability to monetise opportunities, thus increasing global GDP.

According to the Connectedness Index (McKinsey Global Institute, 2016), China, Ireland, Saudi Arabia, United Arab Emirates, Singapore, the United States, Germany, and the United Kingdom, are leading in terms of digital transformation. China has one of the most active digital investment and start-up ecosystems in the world. While advanced economies are the most globally connected, data flows offer stronger economic benefits to developing countries.

On a more micro level, the global adoption of digital technologies is shifting the business models of institutions, changing how they conduct their operations across a global level, and leading to great efficiencies and cost reductions. Digital transformation is becoming increasingly necessary for private sector companies to remain competitive on a global scale, whereas in the public sector digital transformation is facilitating enhanced delivery, thereby increasing revenue.

The digital transformation and innovation are driven by economic growth prospects and stakeholder anticipations, whether consumers or investors. Previous research has demonstrated that a collective effort is required to ensure proper digital transformation, and that organisations on a micro level and nations on a macro level must reshape their mentalities in order to not only implement new technologies, but also make strategic use of existing valuable assets.

5.4.5.1.2. Bank-Specific Sample Population and Quantitative Data Collection Methods

The sample was collected from Bloomberg and Refinitiv online databases whereby banks were classified according to Global Industrial Classification Standards (GICS), which led to a 791-bank sample to be itemised as regional and diversified banks operating in the G7 countries. When this sample was scrutinised, only 371 banks offered sufficient data, with a total of 4,366 observations for each of the variables. From this reduced sample, banks were then eliminated if seven to nine years of the data was not available; as a result, 420 banks (mainly regional banks operating in the US) were excluded because of the unavailability of at least 70% of the study period. The study sample ends in 2021, including the period of Coronavirus pandemic.

Table 5:3 *Cross-Section Bank Specific Data Sample by Country and Sub-Industry Allocations*

Country	Total Number of Banks	Number of Regional Banks	Number of Diversified Banks
Canada	8	1	7
France	3	-	3
Germany	1	-	1
Italy	9	-	9
Japan	72	66	6
United Kingdom	9	1	8
United States	269	264	5
Total	**371**	**332**	**39**

- Author's own

To confirm the data integrity, a random sample of 20 banks' data was cross-checked between data extracted from Bloomberg and audited annual reports, which was found to reconcile perfectly.

Table 5:4 *Description of Bank-Specific Variables*

(371 across 7 Member Countries of G7 during 2010–2021)

Variable Type	Measure Name	Ticker	Description		Literature Source
Dependent Variables	Environmental Disclosure Score	EDS	A proprietary Bloomberg score, determined based on the extent of a bank's environmental data disclosure, as a pillar of Environmental, Social and Governance (ESG) data. The score measures the extent to which a bank publicly reports Environmental data and is set from 0 (for companies that have no disclosure of any environmental data) to 100 (companies with a detailed disclosure for every data point). Companies that are not present in Bloomberg's ESG data will not be scored and their values will be represented as N/A.	The scores are measured based on a pre-determined list of topics and data fields, and weights are set accordingly. Although the topics and data fields have been primarily selected based on industry agnostic frameworks across different sectors and regions, some topics may not be relevant to all industries. The topics within each pillar are weighted equally, and quantitative fields are allocated a greater weight than binary fields. This score does not measure a company's performance on any data point.	Siddique et al. (2022); Tunio et al. (2021)
	Social Disclosure Score	SDS	A proprietary Bloomberg score and addresses the "Social" pillar of the ESG data. Identical to the Environmental score, the social score measures the extent to which a company publicly reports social data and is set from 0 (for companies that have no disclosure of any social data) to 100 (companies with a detailed disclosure for every data point). Companies that are not present in Bloomberg's ESG data will not be scored and their values will be represented as N/A.		Siddique et al. (2022); Tunio et al. (2021)
	Governance Disclosure Score	GDS	A Bloomberg score based on bank's governance disclosure as part of environmental, social and governance (ESG) data. The score ranges from 0.1 for banks that disclose a minimum amount of governance data to 100 for those disclose every data point collected by Bloomberg.		Tunio et al. (2021); Xie (2019)
	Return on Equity	ROE	Net income/average shareholder equity in accordance with Bloomberg online database		Zemzem & Kacem, (2014); Zhang et al. (2020)
	Net Interest Margin	NIM	Net interest income/total assets generating interest income in accordance with Bloomberg online database		Chang et al. (2013); Sobhy et al. (2018)

Variable Type	Measure Name	Ticker	Description	Literature Source
	Management Efficiency	CTI	The Cost to Income Ratio (CTI), also known as the Efficiency Ratio, is a measure used to compare costs to revenues. The ratio is calculated in accordance with the below formula in accordance with Bloomberg online database	Mckinsy & Co (2023)
	Capital Adequacy Ratio	CAR	*(Core Capital + Supplementary Capital Ratios) / Risk Weighted Assets* measures the ratio of total risk-based capital vs risk-weighted assets. The ratio is known as Total Risk-Based Capital Ratio or Capital Adequacy Ratio (CAR) and as per the Bloomberg online database. • *Perpetual preferred stock ineligible for Tier 1* • *Perpetual debt and mandatory convertible securities* • *Qualifying senior and subordinated debt* • *Limited life preferred stock* • *Qualifying allowance for credit losses*	BaselII, (2006)
	Asset Quality	AQ	Total Non-Performing Loans (impairments)/Net Direct Credit Facilities This variable assesses the riskiness of assets, primarily the credit risk, held in a bank's portfolio and defined as the ratio of non-performing loans vs net loans. The higher the quality of a bank's assets (lower credit risk), the lower the ratio and vice versa.	Shukla et al. (2020)
Independent Variables	Innovation and Growth	IGR	Calculated by the researcher via dividing a bank Information & Technology Capital Expenditures relative total operating income	Deloitte (2020); Mckinsy &Co (2019); Zeba Bi (2023)
Split Variables	CEO Duality	CEOD	Person holds both CEO and BOD chairperson position	Berger et al. (2016)

- *Author's Own*
- *To clarify and distinguish between the governance disclosure score and the other corporate governance mechanisms used in this research. Please note that according to Bloomberg database the governance disclosure score is used to measure the transparency level for banks by measuring the amount of governance data and mechanisms a bank report publicly. Governance Disclosure score is a Bloomberg propriety disclosure score determined based on the extent of a company's Governance mechanisms disclosures. The score measures the extent to which a company publicly reports governance data and is set from 0 (for companies that have no disclosure of any governance data) to 100 (companies with a detailed disclosure for every governance data). While each of the other governance mechanisms was used as explanatory standalone variables whereby each is measured as per the description provided in Table 5:4.*

5.4.5.2. Quantitative Data Analysis Methods

5.4.5.2.1. Country-Specific Data Analysis Methods

To pursue a methodological process of examining and testing the research hypotheses in accordance with the deductive positivist approach, the statistical method of multiple regression for the aggregated industry panel data sample was utilised to examine the impact of each innovation measure on banking system transparency, stability and performance measures of G7 countries (as described in Table 5:4 above). The use of the multiple regression method is based on the rationale of accurately determining the variables' mutual relation to satisfy the assumptions and hypotheses considered in the study (Cronk, 2019). Given banks' information is observed across time and set into a panel data structure, the general equation of panel data regression modelling is as follows:

$$\Pi \boldsymbol{it} = \boldsymbol{\alpha} + \Sigma \boldsymbol{\beta}\ \mathrm{Xj}\ \boldsymbol{it} + \varepsilon \boldsymbol{it}$$

where Πit is the dependent variable which measures the banking system stability and economic development indexes for a country i at time t, with i =1. scalar α measures the constant term, and e is the residual term. X is the independent variable representing five innovation and information and communication technology (ICT) measures for a country i at time t.

- General Models for Country-Specific Sample (2020–2021): G7 banking system corporate governance characteristics as dependent variable and independent variables for emerging technologies adoptions measured by artificial intelligence, Internet of things, big data analytics, and cloud computing deployment in finance and accounting:

1) ACS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit
2) ACMF$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit
3) BODS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit
4) BODMF$\boldsymbol{it}$= $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit
5) CEO$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit
6) ESGDS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit

- General Models for Country-Specific Sample (2020–2021): G7 banking system stability and efficiency indicators as dependent variable and emerging technologies measured by artificial intelligence, Internet of things, big data analytics, and cloud computing deployment in finance and accounting:

    1) ZS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit
    2) LLGDP$\boldsymbol{it}$= $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit
    3) ROE$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + β1IoTit +β2AIit + β3Big.Dit + β4CC.F&Ait + εit

- General Models for Country-Specific Sample (2010 – 2021): G7 banking system stability and performance as dependent variable and independent variables for emerging technologies adoptions measured by mobile phone subscriptions, mobile, data, and voice subscriptions, information and communication infrastructure and connectivity, Internet banking, cloud computing, enterprise resource planning system, and innovation and growth ratio of banks:

    1) ACS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5CCit + β6ERPit + β7IGRit + εit
    2) ACMF$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5CCit + β6ERPit + β7IGRit + εit
    3) BODCI$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5CCit + β6ERPit + β7IGRit + εit
    4) BODS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5CCit + β6ERPit + β7IGRit + εit
    5) BODMF$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5CCit + β6ERPit + β7IGRit + εit
    6) CEOD$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5CCit + β6ERPit + β7IGRit + εit
    7) ESGDS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5CCit + β6ERPit + β7IGRit + εit

- General Models for Country-Specific Sample (2010 – 2021): G7 Banking System stability and performance as dependent variable and independent variables for emerging technologies adoptions measured by mobile phone subscriptions, mobile, data, and voice subscriptions, information and communication infrastructure and connectivity, internet banking, cloud computing, enterprise resource planning system, and innovation and growth ratio of banks:

    1) ZS$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5ICCit+ β6ERPit + β7IGRit + εit
    2) LL.GDP$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5ICCit+ β6ERPit + β7IGRit + εit
    3) CAR$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5ICCit+ β6ERPit + β7IGRit + εit
    4) ROE$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5ICCit+ β6ERPit + β7IGRit + εit
    5) CTI$\boldsymbol{it}$ = $\boldsymbol{\alpha}$ + βMPSit +β2MBDVSit + β3ICT.ICit + β4I.Bankingit + β5ICCit+ β6ERPit + β7IGRit + εit

5.4.5.2.2. Bank-Specific Data Analysis Methods

On the other hand, for the bank-specific data sample a simple regression statistical technique was utilised to investigate the relationship between the chosen dependent and independent data variables, specifically the innovation and growth measure and corporate governance characteristics related to reporting quality and transparency of banks operating in G7 countries. The use of the simple regression method is based on the rationale of creating association between a single independent predictor variable and a single dependent outcome variable as the simple linear regression model is considered a very efficient modality to set a correlation between two economic aggregated measures (Anghelache et al., 2019). Given banks' information is observed across time and set into a panel data structure, the general equation of panel data regression modelling is as follows:

$$\Pi\boldsymbol{it} = \boldsymbol{\alpha} + \boldsymbol{\beta}\text{IGR}\boldsymbol{it} + \text{e}\boldsymbol{it}$$

where Πit is the dependent variable which measures transparency and is estimated by the ESGDS, EDS, SDS, and GDS, for bank i at time t, with i =1. scalar α measures the constant term, and e is the residual. IGR is the independent variable representing the innovation and growth measure for a bank i at time t.

Given that there are three dependent variables and one independent variable, three linear models are presented. Therefore, the analysis was conducted using simple regression modelling using Gretl software and SPSS Modeler (data mining and text analytics). The following equations summarise these research econometric formulae related to the bank-specific data sample: General Models for Bank-Specific Sample (2010–2021): The environmental, social, and governance disclosures' quality (transparency and accountability towards stakeholders) as dependent variable and independent variables for information and technology investments in relation to their gross revenues as a measure of innovation and growth of banks in G7 countries:

1) EDS $\boldsymbol{it} = \boldsymbol{\alpha} + \beta$ IGRit + εit
2) SDS $\boldsymbol{it} = \boldsymbol{\alpha} + \beta$ IGRit + εit
3) GDS $\boldsymbol{it} = \boldsymbol{\alpha} + \beta$ IGRit + εit

Simple regression analysis was used to examine the relationship between one dependent variable and one independent variables by describing algebraically the regression lines, expressing the relationship between a single variable (Anghelache et al., 2019). Therefore, simple regression analysis was employed to test the presence and strength of associations between the dependent corporate governance variables related to disclosure quality and transparency (environmental disclosure score (EDS), social disclosure score (SDS), and governance disclosure score (GDS) and the independent innovation and growth (IGR) variable.

Additionally, the researcher conducted 6 simple regression models to investigate the impact of innovation and growth of banks in G7 countries with the aim of measuring the cost-benefit analysis of IT investments in relation to the dependent variables of risk and performance measures (financial sustainability measures, namely capital adequacy ratio, asset quality ratio, net interest margin, return on equity, cost to income ratio and the overall environmental, social, and governance disclosures' quality). Also, the regression modelling run node is SPSS

Modeler included a split variable of CEO duality in order to separate the regression modelling run into two sub models whereby one measured the impact of innovation and growth of G7 banks on their risk and performance indicators in the presence of dual leadership roles, while the other investigated the same but with the separation of dual roles.

1) ROE$\boldsymbol{it}$ duality * separation = $\boldsymbol{\alpha}$ + β IGRit + εit
2) CTI$\boldsymbol{it}$ duality * separation = $\boldsymbol{\alpha}$ + β IGRit + εit
3) NIM$\boldsymbol{it}$ duality = $\boldsymbol{\alpha}$ + β IGRit + εit
4) CAR$\boldsymbol{it}$ duality = $\boldsymbol{\alpha}$ + β IGRit + εit
5) AQ$\boldsymbol{it}$ duality = $\boldsymbol{\alpha}$ + β IGRit + εit
6) ESGDS$\boldsymbol{it}$ duality = $\boldsymbol{\alpha}$ + β IGRit + εit

Based on the above regression models establishment and in order to establish significance and confidence levels for the coefficients of the independent variables in predicting the dependent variable, p-value, which measures the significance level, was employed in this research on the following basis:

- A p-value less than or equal to 1.0% is indicated by three stars (***).
- A p-value greater than 1.0%, but less than or equal to 5.0% is indicated by two stars (**).
- A p-value greater of 5.0%, but less than or equal to 10.0% is indicated by one star (*).

Testing the assumptions of regression models plays a vital role in contributing to valid estimates. Failure to test these assumptions leads to over-/under-estimation and results in insignificant outcomes (Greene, 1993; Gujarati, 2009). Econometricians have stated that to predict the suitability of regression models in relation to the dataset, they must be assessed in accordance with five pre-defined diagnostic tests, namely linearity, heteroskedasticity, multicollinearity, autocorrelation, and normality, to confirm alignment with validation requirements. To determine the most reliable and appropriate estimation model in analysing the dataset used in this essay, the diagnostic tests and specifications discussed previously on the panel regression assumptions were conducted. Determining the appropriate regression model between the OLS and alternative fixed and random-effect

was based on the results of both the Breusch-Pagan multiplier test and the Hausman test. While the Breusch-Pagan null hypothesis states that the pooled OLS model is adequate (in favour of the random effects), it was rejected if the p-value was below 0.05; otherwise, the pooled OLS model was adequate. On the other hand, if the diagnostic tests suggested a violation of estimates, the Hausman test was utilised to determine the appropriate regression model between fixed effects and random effects. Therefore, the null hypothesis that the random-effects model is consistent was rejected if the p-value was equal or below the 0.05 level in favour of the fixed-effects regression model.

The statistical analysis in this essay was conducted using Gretl and SPSS Modeler Software, which are considered a powerful visual and command-line interface statistical package for econometrics and are used to build a variety of regression modelling. The SPSS Modeler also operates additional complex statistical models using machine learning algorithms while building artificial intelligence (AI) engines.

5.4.5.3. Summary

This section concludes with an overview of the strategy employed in the essay to conduct data analysis. Using the existing theoretical base, this research was able to identify and rely on the pre-existing theories on which the research hypothesis is based while adhering to the deductive positivist paradigm. The analysis method employed in this study was that of both multiple and simple linear regression modelling. The data sample, selection criteria, and dependent and independent variables are also described in this positivism methodological section. This empirical analysis relies on various reliable data sources in two aspects: 1) the macro industry-level data for G7 countries from 2010 to 2021 was gathered from GlobalEconomy.com (https://www.theglobaleconomy.com/), the International Telecommunication Union (https://www.itu.int/en/Pages/default.aspx), The Global Financial Development Database (https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database), The World Bank, OECDstat, and the Institute for Management and Development/Global Centre for Business Transformation online databases. 2) The micro bank level data for the period 2010–2021 was reliant on Bloomberg and Refinitiv online databases for 371 regional and diversified banks operating in the G7 nations, as defined by the GICS (Global Industry Classification Standard).

Various measurement methods have been employed to assess the influence of innovative ICT and digital transformation on banking governance, particularly in terms of transparency as a fundamental aspect of governance. These methods include evaluating the stability of banking systems at both the national/industry level and the individual bank level, as well as measuring innovation and growth through accounting-based indicators such as information technology capital expenditures and operating income at a smaller scale. In addition, the utilisation of the number of Internet and mobile users, number of patent applications, research and development expenditures as a percentage of GDP, and the innovation index for the macro level are considered globally as measures of digital access, as are information and technology advancements, adaptation, penetration, utilisation, investments, and transformation measures related to the topic. In order to assess banks' transparency level, the EDS, SDS, and GDS were used in this essay due to their effectiveness in measuring disclosure quality and the overall transparency level of banks.

5.4.6. G7 Country-Specific Findings and Discussion

In this section, we investigate how innovative technologies and digital transformation may impact the banking corporate governance, stability, and performance of G7 nations. We aim to answer the following questions: to what extent innovative technologies, digitalisation, and technological infrastructure impact 1) banking governance related to board characteristics, audit committee, and transparency as the core element for agency issues, 2) banking system sustainability and efficiency, across G7 countries. This section is divided into two sub-sections. Section 5.4.6.1 provides descriptive statistics, diagnostic tests of regression assumptions, and the results of the multiple linear regression based on a macro industry-level data sample over a period of 12 years (from 2010 to 2021). Section 5.4.6.2 presents descriptive analysis, diagnosis of assumption, and simple linear regression results and discussion based on micro bank-specific sample data.

5.4.6.1. The Impact of Technological Advancements, Innovation, and Digitalisation on Banking System Corporate Governance, Stability, and Performance)

Table 5:5 below shows the descriptive statistics of emerging technologies, corporate governance, and financial sustainability variables of the banking system in G7 countries during the period 2020– 2021. The Z-score which measures the bankruptcy level of banks registered a minimum of 11.83 and a maximum of 31.06 with a mean of 17.618. LL.GDP

reached a mean of 43.12%. Additionally, the, G7 banking system's equity capital relative to the risk weighted assets registered a minimum of 13.3% and a maximum of 21.7% with a mean of 18.5 indicating a well capitalised banking system as the minimum regulatory capital required by regulatory authorities stands at 8%. As for the profitability and management efficiency, the G7 banking system registered an average ROE of 6.9% while the minimum reached -4.1%, which% that might be due to the negative impact of the COVID 19 pandemic, while. While operating expenses relative to operating income of banking system ranged between 56.6% and 88.6%with an average of 68.1%.

Table 5:5 *Descriptive Statistics – Emerging Technology and Digitalisation as Measured by AI, IoT, Cloud Computing of Accounting and Finance, Big Data Analytics and Banking System's Governance, Stability, and Performance of G7 Banking System during 2020–2021*

Variable	Field	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Descriptive	Country	--	--	--	--	--	--	7	14
	Year	2020	2021	--	--	--	--	2	14
Dependent Variables: Banking Profitability, Operational Efficiency, and Banking Stability	Z-Score	11.83	31.06	17.618	6.065	15.76	--	--	14
	LL.GDP	9.38	144.58	43.121	42.67	33.42	--	--	14
	CAR	15.30	21.70	18.481	2.1	18.995	--	--	14
	ROE	-4.06	19.16	6.859	6.351	6.15	--	--	14
	CTI	56.63	88.62	68.149	10.803	64.265	--	--	14
Dependent Variables: Banking Corporate Governance	ESGDS	28.042	57.942	43.65	12.073	49.28	--	--	14
	BODS	11.00	20.00	13.865	3.147	13.00	13.00	--	14
	BODMF	8.779	21.125	13.223	3.744	12.25	11.00	--	14
	ACS	2.28	8.00	4.584	1.485	4.46	--	--	14
	ACMF	6.625	25.50	11.033	6.545	7.82	7.00	--	14
	BODCI	4.00	12.25	8.988	2.43	9.39	--	--	14
	CEOD	40.00	100.00	86.737	22.913	100.00	100.00	--	14
Independent Variables: Adoption of Emerging Digital Technology	IoT	9.58	55.00	29.01	12.722	28.3	--	--	14
	AI	3.00	14.30	6.164	3.023	5.3	--	--	14
	CC.F&A	11.028	35.725	26.569	10.307	32.078	--	--	12
	Big.D	3.172	6.61	4.968	1.164	4.582	--	--	14

- *Author's Own*
- *.GDP: Liquid Liabilities % of GDP; CAR: Capital Adequacy Ratio; ROE: Return On Equity; CTI: Cost TO Income Ratio; Board Size; ACS: Audit Committee Size; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; ESGDS: Environmental, Social, and Governance Disclosure; CEOD: CEO Duality; IoT: Internet of Things*

performed by businesses; AI: Artificial Intelligence performed by businesses; CC.F&A: Cloud Computing for Finance and Accounting performed by businesses; Big.D: Big Data Analytics performed by businesses.

Moreover, with reference to the dependent variables of corporate governance mechanisms, the transparency quality of ESG disclosures reached an average of 43.7%. G7 bankings'board of directors is characterised by with an average number of board members of around 13 directors composed of 9 independent directors (outsiders) that meet 13 times per year and with an audit committee composed of 4 members that meet 11 times each year. Also, Table 5:5 shows that 86.7% of theG7 banking industry practises separation of leadership roles while 13.3% practises duality of CEO/chairman roles.

In terms of the emerging disruptive technology measures, the utilisation of IoT services performed by G7 businesses across different industries reached 29.0%, while the AI technology utilisation ratio reached an average of 6.2%. In addition, cloud computing for financial and accounting along with big data analytics performed by businesses in G7 countries reached an average utilisation ratio of 26.6% and 4.97% respectively during the period COVID-19 pandemic period (2020-2021).

Table 5:5 above statistically describes the variables statistically, indicating that the G7 banking system's liquid liabilities as a percentage of its economic activity (GDP) registered an average of 124.42% during 2010–2021. The Z-score, which is a proxy of banking system stability that measures the distance to default at an aggregated level (the higher the ratio, the longer the distance from default), ranges between a minimum of 8.49 for the British banking system in 2010 and 2012 and a maximum of 35.17 with a mean of 17.95, generally indicating that the G7's banking system was stable during the study period. Management efficiency, which is measured by the cost to income ratio (CTI) show an average ratio of 67.34% (Canada registered the lowest in 2020). The regulatory capital of banks in relation their risk-weighted-assets (CAR) is consistent with regulation requirements, with a minimum value of 12.07% and an average of 16.54%. The profitability level highlights the good performance of the G7's banking system in relation to shareholders' equity, with an average ROE of 8.563% with a minimum of -12.18% (for the Italian banking system during 2011).

Also, the descriptive analysis in Table 5:6 shows that G7 countries' corporate governance mechanisms, whereby the banking BODs in G7 countries are composed on average of around 14 directors, with an average of 9 of those members

being independent directors, meet on average of 13 times each year, and have audit committees composed of 4 members. Also, the separation of leadership roles (CEO/chairperson) in the G7 banking system reached an average of 83.38%. Additionally, the G7 banking system achieved an average score for the ESG disclosure quality, as a proxy of transparency, of 40.19% during the 2010–2021 period with a minimum of 19.4% and a maximum of 58.8%.

In terms of innovative information technology and digitalisation measures, the IT capital expenditures of banks relative to their gross revenues (IGR) reached an average of 16.7% during the 12-year period; mobile cellular subscribers per 100,000 people ranged between 75.6% to 162.3% with an average of 115.7% (noting that the highest percentages were registered by Italy in 2012). Mobile broadband, data and voice subscriptions and the ICT infrastructure and connectivity reached an average of 75.76% and 4.25% respectively. Moreover, the usage percentage of automated online banking services enabled by network protocols reached an average of 48.57%, with a lowest usage rate of 8.59% in Japan during 2012 and a highest usage rate of 83.3% in the UK during 2021. Also, the percentage of businesses deploying cloud computing technology reached an average of 33.6% (noting that Japan scored the highest percentage at 70.4% in 2021 while Canada registered the second lowest at 4.6% during the same time period). The average investment percentage of enterprise resource planning solutions by businesses ranged between 8.8% for Canadian businesses in 2019 and 56.48% for Germany in 2015, reaching an average of 30.43% of businesses purchases in G7 countries.

As for the variables excluded from further analysis, digital skills and digital transformation in corporations reached an average of 7.29% and 5.66% respectively, while the percentage of Internet usage relative to population ranged between 53.68% and 96.5% with an average of 82.46%.

Table 5:6 Descriptive Statistics – Emerging Technology, Digitalisation, and Innovation and Growth Ratio and Banking System's Corporate Governance, Stability, and Performance of G7 Banking System during 2010–2021

Variable	Field	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Descriptive	Country	--	--	--	--	--		7	84
	Year	2010	2021	--	--	--		12	84
Dependent Variables: Banking Profitability, Operational Efficiency, and Banking Stability	Z-Score	8.49	35.17	17.95	6.92	16.18		--	84
	LL.GDP	70.51	287.85	124.422	55.35	96.99		--	72
	CAR	12.07	21.7	16.54	2.36	16.13		--	84
	ROE	-12.18	32.88	8.563	6.318	7.425		--	84
	CTI	56.63	97.17	67.344	9.422	64.4		--	84
Dependent Variables: Banking Corporate Governance	ESGDS	19.399	58.807	40.189	11.654	40.9	55	--	83
	BODMF	7	21.125	12.366	3.256	11.264	10	--	83
	ACMF	5.667	27.651	10.397	5.372	7.75	7	--	83
	BODS	10	20	14.289	3.21	14	11	--	83
	ACS	0.153	8	4.215	1.698	4.617	5	--	83
	BODCI	0.776	14.2	8.888	3.167	9.176	10	--	82
	CEOD	33.33	100	83.376	23.876	100	100	--	76
Independent Variables: Advanced Technology, Digital Channels, IT Infrastructure, and Cloud Computing	MPS	75.63	162.31	115.725	21.205	117.3		--	81
	MBDVS	16.815	168.175	75.758	30.17	75.854		--	84
	ICT.IC	3	7.94	4.247	1.35	3.97	3.97	--	77
	I.BANKING	8.59	83.33	48.57	20.162	52.14	11	--	84
	CC	4.601	70.4	33.632	15.954	33.994		--	68
	ERP	8.8	56.476	30.432	10.874	33.33		--	49
	IGR	0.177	47.779	16.716	14.295	14.877	47.779	--	84
Independent Variables Excluded Due to Multicollinearity Violation *Appendix D provides evidence to collinearity issues resulting from the below excluded variables.*	IUPP	53.68	96.5	82.457	10.581	85		--	83
	M2MS	1.993	54.81	17.727	12.995	12.221		--	80
	DTS	4.389	8.654	7.288	1.021	7.587		--	70
	DT	4.331	7.027	5.656	0.769	5.875		--	45

- *Author's Own*
- *LL.GDP: Liquid Liabilities % of GDP; CAR: Capital Adequacy Ratio; ROE: Return On Equity; CTI: Cost TO Income Ratio; Board Size; ACS: Audit Committee Size; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; ESGDS: Environmental, Social, and Governance Disclosure; CEOD: CEO Duality; MPS: Mobile Phone Subscriptions; MBDVS: Mobile Broadband, Data, and Voice Subscriptions; ICT.IC: Information and Communication Technology Infrastructure and Connectivity; I.BANKING: Internet Banking usage % of population; CC: Cloud Computing performed by businesses; ERP: Enterprise Resource Planning performed by businesses; IGR: Innovation and Growth Ratio; IUPP: Internet Users Per Population; M2MS: Machine to Machine Subscriptions; DTS: Digital Skills; DT: % of Digital Transformation performed by businesses.*

The Pearson Correlation Matrix presented in Tables 5:7 and 5:8 show the correlations of the independent variables and testing for multicollinearity violations that occur when independent variables are significantly associated to each other (above -/+80%) (Shrestha, 2020). Also, the results of the VIF in tables 5:9 and 5:10 were below 10 across all independent variables. Thereby, suggesting no collinearity issue (Mertens et al., 2016).

Table 5:7 Pearson Correlation Matrix - G7 Country-Specific Banking Sample 2020 – 2021

	CCFA	BigD	AI	IoT
IoT	0.212	0.784	-0.247	1.000
AI	-0.062	-0.533	1.000	
BigD	0.225	1.000		
CCFA	1.000			

- *Author's Own*
- *IoT: Internet of Things performed by businesses; AI: Artificial Intelligence performed by businesses; Big.D: Big Data Analytics performed by businesses; CCF&A: Cloud Computing for Finance and Accounting performed by businesses.*

Table 5:8 Pearson Correlation Matrix – G7 Country-Specific Banking Sample 2010–2021

	ERP	CC	I.BANKING	ICTIC	MBDVS	MPS	IGR
IGR	0.525	-0.559	0.283	0.601	-0.418	0.014	1.000
MPS	0.166	0.117	-0.544	0.251	-0.031	1.000	
MBDVS	-0.251	0.592	0.131	-0.092	1.000		
ICTIC	0.391	-0.249	0.028	1.000			
IBANKING	-0.354	-0.144	1.000				
CC	-0.283	1.000					
ERP	1.000						

- *Author's Own*
- *MPS: Mobile Phone Subscriptions; MBDVS: Mobile Broadband, Data, and Voice Subscriptions; ICT.IC: Information and Communication Technology Infrastructure and Connectivity; I. BANKING: Internet Banking usage % of population; CC: Cloud Computing performed by businesses; ERP: Enterprise Resource Planning performed by businesses; IGR: Innovation and Growth Ratio.*

Table 5:9 Variance Inflation Factor (VIF) – G7 Country-Specific Banking Sample 2020 – 2021

Independent Variables	VIF
IoT	2.909
AI	1.568
CC.F&A	1.06
Big.D	3.859

- *Author's Own*
- *IoT: Internet of Things performed by businesses; AI: Artificial Intelligence performed by businesses; Big.D: Big Data Analytics* ***performed by businesses; CCF&A: Cloud Computing for Finance and Accounting performed by businesses.***

Table 5:10 Variance Inflation Factor (VIF) – G7 Country-Specific Banking Sample 2010 – 2021

Independent Variables	VIF
MPS	3.677
MBDVS	1.599
ICT.IC	2.131
I.Banking	3.626
CC	2.791
ERP	1.629
IGR	3.404

- *Author's Own.*
- *MPS: Mobile Phone Subscriptions; MBDVS: Mobile Broadband, Data, and Voice Subscriptions; ICT.IC: Information and Communication Technology Infrastructure and Connectivity; I. BANKING: Internet Banking usage % of population; CC: Cloud Computing performed by businesses; ERP: Enterprise Resource Planning performed by businesses; IGR: Innovation and Growth Ratio.*

Tables 5:11 and 5:12 show the results of the remaining diagnostic tests of the OLS assumption, indicating that there is violation of estimates related to normality for BODS and ACS models only. Autocorrelation violation was detected in ESGDS, BODMF, ACMF, BODCI and CEOD. Noting that 'nan' shown in Table 5:11 below, standing for Not a Number, resulted from a numeric calculation with an undefined result, such as '0/0'. This exists only in vectors with numeric datatype. This, however, resulted in GRETL due to null observations in few models however in order to not lose

information by erasing rows which might affect the reliability of estimates. The issue has been resolved by the machine learning nodes that were utilised in SPSS Modeler without losing any single information.

As for heteroskedasticity, the results of White's test show that there is violation of the OLS assumptions in relation to endogeneity, as the p-value of BODS, BODMF, BODCI are below the 0.05 level, which indicates the presence of heteroskedasticity across three out of 12 models.

Given that the former issues cause the pooled OLS estimates to be biased and inadequate to conduct the analysis. Noting that endogeneity leads to subjective and invalid parameter estimates, which make inference almost impossible (Roberts & Whited, 2013).

Accordingly, the pooled OLS model as an estimation method for the panel data set is considered inadequate to conduct the analysis as it will generate biased results. Thus, the researcher went further to generate the most reliable estimates via conducting alternative panel data regression modelling of fixed and random effects. Thereby, the Joint Significance, Breusch-Pagan, and Hausman tests are explored to choose between the pooled OLS, fixed effects and random effects for their ability to capture specific heterogeneities in the cross-section

Table 5:11 OLS Assumption and Diagnosis - G7 Country-Specific Banking Sample 2020 – 2021

OLS Assumptions		ESGDS	BODS	BODMF	ACS	ACMF	CEOD
Autocorrelation	t	7.005	0.414	6.559	1.523	2.600	6.461
Wooldridge	*p-value*	*<0.0001***	*0.689*	*0.000104****	*0.162*	*0.0287***	*0.00012****
Normality	Chi-Square	4.362	10.580	0.652	13.628	1.006	0.329
Test Statistics	*p-value*	*0.113*	*0.00505****	*0.722*	*0.0011****	*0.605*	*0.848*
Heteroskedasticity	LM	15.228	34.255	27.237	22.899	20.630	24.175
White's	*p-value*	*0.508*	*0.00502****	*0.0389***	*0.116*	*0.193*	*0.08574**
Cross-Sectional Dependence	Z	4.379	0.373	1.716	-1.226	0.223	-0.686
Pearson CD Asymptotic	*p-value*	*<0.0001****	*0.709*	*0.0861**	*0.220*	*0.823*	*0.493*
OLS or Fixed Effects	F statistic	6.719	4.899	95.281	2.780	20.624	15.206
Joint Significance of Differing Group Means	*p-value*	*<0.0001****	*0.00077****	*<0.0001****	*0.020909***	*<0.0001****	*<0.0001****
OLS or Random Effects	LM	20.410	1.213	36.094	0.052	0.814	27.659
Breusch Pagan	*p-value*	*<0.0001****	*0.271*	*<0.0001****	*0.820*	*0.367*	*<0.0001****
Fixed Effects or Random Effects	H	2.520	19.190	7.249	21.622	49.585	9.723
Hausman	*p-value*	*0.961*	*0.0139***	*0.510*	*0.005667****	*<0.0001****	*0.285*
Time Dummies	Chi-Square	3.585	0.754	25.719	1.829	2.720	4.820
Wald Joint	*p-value*	*0.465*	*0.944*	*<0.0001****	*0.767*	*0.606*	*0.306*

- *Author's Own*

- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation.*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present.*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*
- *Board Size; ACS: Audit Committee Size; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; ESGDS: Environmental, Social, and Governance Disclosure; CEOD: CEO Duality.*

Table 5:12 *OLS Assumption and Diagnosis - G7 Country-Specific Banking Sample 2020 – 2021 – Banking System Stability and Performance Models*

OLS Assumptions		Z	LL.GDP	CAR	ROE	CTI
Autocorrelation *Wooldridge*	t	nan	nan	nan	nan	nan
	p-value	*nan*	*nan*	*nan*	*nan*	*nan*
Normality *Test Statistics for*	Chi-Square	3.52545	0.567666	0.271585	0.286912	0.930257
	p-value	*0.171576*	*0.752892*	*0.873024*	*0.866359*	*0.628054*
Heteroskedasticity *White's*	LM	11.4573	10.0564	11.0281	5.81152	6.29339
	p-value	*0.17711*	*0.261093*	*0.200112*	*0.668335*	*0.614405*
Cross-Sectional Dependence *Pearson CD Asymptotic*	Z	5.47723	-0.365148	1.82574	5.47723	1.82574
	p-value	*<0.0001***	*0.715*	*0.067889**	*<0.0001***	*0.0678892**
OLS or Fixed Effects *Joint Significance of Differing Group Means*	F statistic	1149.78	235.978	3.41627	82.0812	0.894324
	p-value	*0.0008692****	*0.004225****	*0.241802*	*0.0120799***	*0.603147*
OLS or Random Effects *Breusch Pagan*	LM	4.66295	5.21395	0.84605	0.343592	nan
	p-value	*0.0308202***	*0.022406***	*0.357672*	*0.557763*	*nan*
Fixed Effects or Random Effects *Hausman*	H	34.2438	10.2714	12.4367	251.51	15.4824
	p-value	*<0.0001****	*0.0360955***	*0.014383***	*<0.0001****	*0.0037985****
Time Dummies *Wald Joint*	Chi-Square	11.0783	4.64396	3.10461	0.838156	1.03832
	p-value	*0.0008734****	*0.031163***	*0.0780711**	*0.359925*	*0.308214*

- *Author's Own*
- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *nan: "not a number" resulted from a numeric calculation with an undefined result, such as '0/0'. This exists only in vectors with numeric datatype. Also, the sample consists of a short 2-year time period.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation.*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present.*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*

- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*
- *LL.GDP: Liquid Liabilities % of GDP; CAR: Capital Adequacy Ratio; ROE: Return On Equity; CTI: Cost TO Income Ratio.*

Tables 5:11 and 5:12 above show that the Joint Significance of differing group means are at level of below 5% across models except the CAR and CTI models. Accordingly, the fixed effects model is considered adequate in favour of the pooled OLS for all models except CAR and CTI whereby the pooled OLS is considered adequate, as the level of significance for both models reached above 5%.

Breusch-Pagan and Hausman tests are at a level of below 5.0% across all models except for the Hausman test of ESGDS, BODMF and CEOD, CAR, and CTI. Accordingly, the results of both aforementioned tests suggest the random effects and pooled OLS models are rejected and the fixed effects model is the appropriate estimation method for assessing banking BODS, ACS, ACMF, BODCI, Z-score, LL.GDP, and ROE models, while the Joint Significance, Breusch-Pagan, and Hausman test results suggest that random effects are appropriate for ESGDS, BODMF, and CEOD.

As for CAR and CTI models, the test results suggest that the pooled OLS is appropriate in favour of the fixed and random effects.

Table 5:13 *OLS Assumption and Diagnosis – G7 Country-Specific Banking Sample 2010 – 2021 – Corporate Governance Models*

OLS Assumptions		ESGDS	BODS	BODMF	ACS	ACMF	CEOD
Autocorrelation *Wooldridge*	t	2.20551	0.290789	5.10482	3.20636	16.5424	19.4167
	p-value	*0.07854**	*0.771213*	*0.00376****	*0.023825***	*<0.0001****	*<0.0001****
Normality *Test Statistics*	Chi-Square	2.60713	20.3029	5.41101	29.6945	3.42595	18.4511
	p-value	*0.271562*	*<0.0001****	*0.066836**	*<0.0001****	*0.180329*	*<0.0001****
Heteroskedasticity *Distribution Free Wald*	Chi-Square	274.671	2034.65	90.0522	149.841	180.03	210.071
	p-value	*<0.0001****	*0.0000****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
Cross-Sectional Dependence *Pearson CD Asymptotic*	Z	1.74138	0.290789	3.70269	-0.141699	5.9334	-1.80336
	p-value	*0.081617**	*0.771*	*0.00021****	*0.887318*	*<0.0001****	*0.07133**
OLS or Fixed Effects *Joint Significance of Differing Group Means*	F Statistic	4.43734	2.19632	12.4867	1.53914	72.7462	12.5807
	p-value	*0.00558****	*0.09095**	*<0.0001****	*0.213707*	*<0.0001****	*<0.0001****

- *Author's Own*

- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation.*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present.*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*
- *Board Size; ACS: Audit Committee Size; ACMF: Audit Committee Meeting Frequency; BODMF: Board Meeting Frequency; ESGDS: Environmental, Social, and Governance Disclosure; CEOD: CEO Duality.*

Table 5:14 *OLS Assumption and Diagnosis – G7 Country-Specific Banking Sample 2010 – 2021 – Banking System Stability and Performance Models*

OLS Assumptions		Z	LL.GDP	CAR	ROE	CTI
Autocorrelation Wooldridge	*t*	2.64528	5.56955	7.2159	-0.103891	0.517291
	p-value	*0.04568***	*0.00509****	*0.000796****	*0.921295*	*0.627015*
Normality *Test Statistics*	*Chi-Square*	1.26885	1.14387	2.46293	2.16507	3.9943
	p-value	*0.530241*	*0.564434*	*0.291864*	*0.338736*	*0.135721*
Heteroskedasticity *Distribution Free Wald*	*LM*	34.3061	140.132	14.0151	2.49555	238.235
	p-value	*<0.0001****	*<0.0001****	*0.029467***	*0.868965*	*<0.0001****
Cross-Sectional Dependence *Pearson CD Asymptotic*	*Z*	2.28183	-0.0606709	-0.318318	4.65766	0.459273
	p-value	*0.022499***	*0.95162*	*0.750244*	*<0.0001****	*0.646038*
OLS or Fixed Effects *Joint Significance of Differing Group Means*	*F Statistic*	23.5047	18.5618	13.203	3.85214	5.76796
	p-value	*<0.0001****	*<0.0001****	*<0.0001****	*0.011227***	*0.001238****

- *Author's Own*
- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation.*

- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present.*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*
- *LL.GDP: Liquid Liabilities % of GDP; CAR: Capital Adequacy Ratio; ROE: Return On Equity; CTI: Cost TO Income Ratio.*

On other hand, the G7 banking sample as shown in Tables 5:13 and 5:14 above show the presence of autocorrelation, normality, and heterogeneity across models, suggesting the pooled OLS model is inadequate to conduct the regression analysis, whereby BODMF, ACS, ACMF, BODCI, CEOD, Z- Score, LL.GDP and CAR suffer from autocorrelation issues, while all 12 models suffer from heteroskedasticity except for the ROE model. However, according to the results, the Joint Significance of differing group means test is at a level of below 5.0% across 8 out of 12 models. Thus, the pooled OLS models are rejected, and the fixed effects model is the appropriate estimation method for assessing models except BODS and ACS.

Additionally, despite the aforementioned test assumptions, and with the intention of generating reliable and valid estimates, the researcher went further into diagnosing the fixed effects model's reliability and validity to be utilised in this essay, considering that the fixed effects model, as mentioned previously and with support from previous literature, analyses the dataset, taking into consideration the cross-sectional effects while excluding time effects. The researcher, however, ran a fixed effects model with time dummies and concluded the existence of a statistically significant impact due to time across multiple models and in order to generate and compare multiple modelling techniques with the aim to choose the best fit

modelling technique and produce reliable estimates to investigate the research problem while testing the research hypotheses.

Accordingly, the data was exported into SPSS Modeler (data mining and text analytics software), where machine-learning nodes were used to conduct the analysis via the utilisation of a Generalised Linear Mixed Models (GLMM), which is built on a series of complex covariance tables that combine the analysis techniques of both the fixed effects and random effects models, thereby producing conservative, reliable, and valid outputs regarding the research problem. IBM defines the GLMM model as a complex multilevel model that is used for non-normal distributed longitudinal data and is considered an extension of the linear model, whereby it assumes that the dependent variable is linearly correlated to the independent variables and covariates through a specific link distribution function while having non-normal distribution (IBM). In order to reliably estimate the models, it is important to consider the problems of endogeneity in our estimates. Therefore, the summary results of several estimation methods including OLS, Fixed Effects, Random Effects, and Generalised Linear Mixed Models (GLMM), whereby GLMM produced models with more reliable estimates with the lowest Akaike Criterion Information (AIC) and Schwarz/ Bayesian Criterion Information (SIC/BIC), noting that both AIC and BIC are considered criteria for selecting models across finite set of several models' assessment (Claeskens & Hjort, 2008; Wasserman & Kass, 1995).

5.4.6.2. The Impact of Emerging Technologies and Digitalisation (AI, IoT, Big Data, and Cloud Computing) on G7 Countries' Banking System's Corporate Governance, Stability, and Performance during the Period 2020-2021.

The estimated results of the impact of innovative information and communication digital technology on banking governance mechanisms of boards and audit are presented in Table 5:15. Since the estimated models are three equation models (OLS, fixed effects, random effects), the below tables suggest the most reliable model according to the diagnostic and fit tests mentioned previously. (For full results tables, see Appendix B).

Noting that the period 2020–2021 was subject to exogenous disruptions as a result of the COVID-19 pandemic, which could have a significant impact on the regression estimates presented in Tables 5:15 and 5:16 below. However, this should be reconsidered by future researchers in order to provide empirical evidence based on data collected after the COVID-19 period in order to rule out any exogenous disruptions that could generate biased results. On the other hand,

Tables 5:15 and 5:16 provide empirical evidence on how AI, IoT, CC, and Big.D impacted the corporate governance, stability, and performance of the G7 banking system during a period that was impacted by unanticipated shocks, highlighting the relationship between adopting emerging technologies during economic downturns.

Table 5:15 *Summary of Statistically Important Relationships Between Emerging Digital Technology and Banking Corporate Governance – G7 Country-Specific Banking Sample 2020–2021*

	ESGDS	**BODS**	**BODMF**	**ACS**	**ACMF**
	Fixed Effects	***Fixed Effects***	***Random Effects***	***Fixed Effects***	***Fixed Effects***
IoT	-0.4402 0.0002***	Insignificant	-0.1032 <0.0001***	-0.0814 0.0027***	0.08533 0.017**
AI.	-0.0347 0.0026***	Insignificant	0.058253 <0.0001***	-0.047 0.0365**	0.04411 0.0868*
CC.FA	3.4272 0.0004***	1.0464 <0.0001***	0.267021 <0.0001***	0.9203 <0.0001***	-0.5669 0.0005***
Big. D	-8.8649 0.0033***	-7.7024 0.0001***	-0.2117 0.0027**	-4.7385 0.0001***	3.138 0.0186**
LVR R-squared	*0.9999*	*0.9939*		*0.9891*	*0.9992*
Within R-squared	*0.9886*	*0.9710*		*0.9781*	*0.9167*
S.E. of regression	*0.3480*	*0.6201*	*5.0352*	*0.3737*	*0.4448*
Log-likelihood	*9.1916*	*-0.5415*	*-33.9920*	*5.5340*	*3.4462*
Schwarz criterion	*5.5957*	*25.9321*	*80.4085*	*13.7810*	*17.9568*
Akaike criterion	*1.6168*	*21.0831*	*77.9839*	*8.9319*	*13.1077*

- *Author's Own*
- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *Board Size; ACS: Audit Committee Size; ACMF: Audit Committee Meeting Frequency; BODMF: Board Meeting Frequency; ESGDS: Environmental, Social, and Governance Disclosure; CEOD: CEO Duality; IoT: Internet of Things performed by businesses; AI: Artificial Intillegence performed by businesses; CC.F&A: Cloud Computing for Finance and Accounting performed by businesses; Big.D: Big Data Analytics performed by businesses*

Table 5:16 *Summary of Statistically Important Relationships Between Emerging Digital Technology and Banking Stability and Performance – G7 Country-Specific Banking Sample 2020–2021*

	Z	**LL.GDP**	**CAR**	**ROE**	**CTI**
	Fixed Effects	***Fixed Effects***	***Pooled OLS***	***Fixed Effects***	***Pooled OLS***
IoT	0.0810025 0.0001***	Insignificant	Insignificant	0.341318 0.0002***	Insignificant
AI	0.178011 <0.0001***	Insignificant	Insignificant	0.259719 0.0004***	Insignificant
CC.FA	Insignificant	Insignificant	Insignificant	1.6481 <0.0001***	-0.7557 0.0207**

Big.D	1.66258 0.0014***	Insignificant	Insignificant	6.41624 0.0047***	Insignificant
R-squared	*0.9999*	*0.9992*	*0.3057*	*0.9971*	*0.6530*
Adjusted R-squared	*0.9861*	*0.2808*	*-0.0911*	*0.9936*	*0.4547*
S.E. of regression	*0.1436*	*2.9877*	*2.1666*	*0.6593*	*7.7971*
Log-likelihood	*17.0087*	*-19.4107*	*-23.0711*	*-1.2769*	*-38.4383*
Schwarz criterion	*-9.1683*	*63.6704*	*58.5667*	*27.4029*	*89.3012*
Akaike criterion	*-14.0174*	*58.8213*	*56.1422*	*22.5539*	*86.8767*

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *LL.GDP: Liquid Liabilities % of GDP; CAR: Capital Adequacy Ratio; ROE: Return on Equity; CTI: Cost TO Income Ratio; IoT: Internet of Things performed by businesses; AI: Artificial Intillegence performed by businesses; CC.F&A: Cloud Computing for Finance and Accounting performed by businesses; Big.D: Big Data Analytics performed by businesses.*

According to the Pooled OLS model, the significance levels of F statistic for LL.GDP, CAR were both above 10% level. The findings suggest that higher adoption of IoT by businesses operating in G7 countries negatively affect the banking system's ESG disclosure quality by -44%, board activity by -10.3%, and number of audit committee members by -8.14%, all at a significance level of below 1%. On the other hand, IoT is found to increase audit committee activity by 8.5% and statistically significantly at level below 1%. Additionally, IoT is found to have a positive impact on banking system stability as the bankruptcy risk measured by the Z -score is found to be affected positively and statistically significantly by 8.1% at level below 1%, implying that the IoT increases banking solidity and stability in the economy. As for banking system profitability measured by ROE, the findings suggest that an increase in the adaptation rate of IoT by businesses enhances the banking system's net income relative to shareholders' equity by 34.1% at level of below 1%.

The adoption of AI technology by businesses in G7 countries is found to lower the ESG disclosure quality of banks by 3.47%, while also decreasing the number of audit committee members by 4.7%, at levels of below 1% and 5% respectively. On the other hand, the results suggest that an increase of 1% in adopting AI technology will increase the activity of board and audit committee members by 5.8% and 4.7% respectively at levels of below 1% and 10% respectively.

As for banking system stability and profitability measures, it is found that AI reduces bankruptcy risk by positively impacting Z-score by 17.8%, and improves banking ROE by 25.97%, both at level of below 1%.

As for the adoption of cloud computing in accounting and finance (CC. FA), the findings imply that cloud computing technology in accounting improves the level of banking transparency as measured by the ESG disclosures by 3.4 multiples, increases the number of BOD and audit committee members by 104.6% and 92% respectively, along with increasing the BOD activity by 26.7%, as measured by the number of meetings held during the year (all at level of below 1%). Contrary results indicate that an increase in the adoption of cloud computing technology lowers audit committee activity by 56.69% at a level of below 1%. Moreover, cloud computing is found to increase banking system profitability and operational efficiency by positively impacting ROE by 164.8% at a level of below 1% while also reducing the operating expenses relative to operating income by -75.57% and statistically significantly at a level of below 5%.

Lastly, big data analytics are found to impact ESG disclosure quality negatively and statistically significantly by -8.865 multiples at a level of below 1%, the number of board and audit committee members by -7.7 multiples and -4.74 multiples respectively, both at a level of below 1%. In addition to decreasing BOD activity by -21.17% at a level below 1%. Moreover, the findings suggest that big data analytics improve banking system stability and profitability as the results suggest a positive and statistically significant relationship between big data and both Z-score and ROE measures, by 1.66 and 6.42 multiples respectively, both at a level of below 1%.

Previous literature has revealed how technologies are able to support most audit assignments (Pedrosa & Costa, 2012) and studied the impact and significance of such emerging technologies on the efficiency and productivity of auditors' performance when auditing financial statements (Banker et al., 2002). Our findings, which revealed a negative relationship between AI and audit committee size, provided additional support to previous literature, which state that the rise and advancements of AI-enabled tools, specifically focusing on automating repetitive labour-intensive tasks (Rapport, 2016), have significantly transformed the audit function (Raphael & Mtebe, 2017). The automation of the otherwise mundane and routine audit functions allows auditors to complete tasks in a timely manner, and save their efforts towards more complex tasks and judgment-dependent areas (Tiberius & Hirth, 2019).

An example of AI-based automation in audit tasks includes the automation of the payment transaction testing process, whereby the technology locates and processes relevant information on behalf of the human, thus allowing the auditor to focus on more complex areas (Kokina & Davenport, 2017). Auditors may also utilize deep learning, natural language processing, and machine learning AI technologies (SAS, 2019) whereby deep learning can be used to notify auditors of possible threats within clients' controls (Sun & Vasarhelyi, 2018), natural-language processing can be used to extract relevant knowledge at high speeds (Yordanov, 2020), and machine learning can be applied to tasks such as ratio analysis (Hoogduin, 2019).

IT advancements within accounting functions are leading to significant time and cost savings, thereby proving that digitisation/automation efforts increase audit quality and creates higher value for clients due to information availability, according to Ghasemi et al. (2011) and Raphael and Mtebe (2017).

Our findings regarding the AI, IoT, and big data analytics in relation to ACS are consistent with the results of Mazza and Azzali (2016), who stated that the quality of IT controls and their impact on audit functions revealed the presence of a negative relationship between adopting technologies and ACS with their activities. According to Muda and Landau (2019), the variable of 'technology use' has a significantly favourable impact on auditing and accounting practises, as they improve the speed and accuracy of tasks. Scholars also believe that 'traditional' accounting can no longer keep pace with and may not be competent enough to handle current technology-enabled advancements; thus, companies are encouraged to adopt tech-enabled auditing tools to enhance accuracy and quality levels. The impact of technological advancements in cloud computing on the transparency and profitability of the banking system in G7 countries and the improvement of operational efficiencies based on our findings provides empirical evidence to previous researchers who hypothesised that technology adoption led to improved auditing and accounting performance among practising professional auditors (Thottoli & Thomas, 2020).

In the field of blockchain technology, Abreu et al. (2018) demonstrated how its implementation improves auditing by increasing efficiencies. Other technologies, such as big data analytics and the cloud, are also becoming more prevalent in auditing environments and substantially altering accounting and auditing firms' practises (Soni et al., 2018). Auditors

are also employing computer-assisted auditing techniques (CAATs), which facilitate improved audit quality and efficacy, resulting in more trustworthy data analysis (Correia et al., 2019). Our findings regarding the impact of big data analytics also support previous research, such as that by Earley (2015), who explained that big data allows auditors to resolve issues beyond utilising external data, and outlined how it significantly and favourably impacts audit quality, as it allows auditors to test a much larger sample, provides more accurate insights to client processes and enhances the ability to detect fraud. In his research, he also stated that the steady increase in computerised data throughout the years facilitated easier data access and the ability to store large data sets, and the use of analysis software enhanced big data's ability to further add value to organisations. Big data basically allows companies to better understand data and the story it is trying to portray (Capriotti, 2014; Whitehouse, 2014) and acts as a tool for auditors in areas such as trend analysis, scoping, and risk assessment (Meuldijk, 2017). Alles (2015) stated that auditors were encouraged to adopt big data analytics within their practises following multiple accounting scandals such as Enron and WorldCom. Big data allows auditors to verify their actions and confirm their decisions in a computational manner (Holsapple et al., 2014).

Additionally, our results regarding IoT, CC, AI and big data support previous views such as that of Appelbaum and Smith (2018), who believe that blockchain technologies and their underlying transactions will become the 'single point of truth' due to their storing and recording nature. Blockchain technology will fundamentally change the audit process due to its ability to present a detailed track record (Liu et al., 2019) as well detect irregularities within the whole data set (Kokina & Davenport, 2017). This allows auditors to conduct their tasks on trusted data, thereby alleviating the need for routine tasks such as reconciliations (Bonyuet, 2020) and freeing up their focus for more complex responsibilities.

Generally, the literature review confirms that pre-designed technology (Berg, 1998) allows for the implementation of various audit tools that can support tasks ranging from data mining to data examination. Additionally, prior research has demonstrated that the use of tech-enabled auditing tools aids in the overall design and sequencing of objectives (Kacanski, 2016) by facilitating auditors' perspectives and decisions (Thottoli & Thomas, 2020). For instance, these tools can mimic the duties of junior auditors, allowing the lead auditor to focus on more complex tasks (Abdolmohammadi & Usoff, 2001). These tools' ability to add value and enhance efficiencies is also coupled with their ability to lower auditors' responsibilities (Pedrosa & Costa, 2012). Considering that these disruptive technologies facilitate automation, it is believed

that employment of audit and accounting graduates will decline in the future (Kokina & Davenport, 2017). Wheeler (2020) revealed that the banking sector as a whole is expected to limit job opportunities as a result of such technologies, and believes that front-office employees such as tellers, loan officers, customer service representatives, credit processors, and compliance personnel will be the most impacted.

Davenport and Kirby (2016), however, believe that the auditing field will be augmented by technology as opposed to being fully automated, thus confirming the view of large audit firms, that believe that human auditors will remain in demand (Agnew, 2016). Mehrotra (2019) emphasizes that people are the core component of banks and human intervention is required for interactions. Nonetheless, there is some evidence regarding auditors' concerns of the impact of technological advancements on their careers. For example, while studying 85 auditors' perceptions on AI's impact on the audit field in Bangladesh, Afroze and Aulad (2020) revealed that the sample believed that AI poses a direct threat on their jobs, and are intimidated by the extent of automation provided by AI.

From a financial sustainability point of view, our findings indicate that IoT, AI, and big data analytics improve banking stability as measured by Z-score, and enhance profitability as measured by ROE statistically significantly at a level of below 1%. These findings lend empirical support to previous literature suggesting that the technology will become growingly present within different sectors, and that utilising AI in financial services specifically yields multiple benefits, as it enhances analytics, automates business processes, and improves decision-making (Nobanee & Al-Blooshi, 2020). Buchanan (2019) states that efficiency and productivity is enhanced as a result of implementing AI and believes that it is highly impacting the financial industry in three core areas: fraud detection, algorithmic trades, and Robo-advisory.

Other researchers have examined the profound impact of digitisation and AI specifically on the financial services industry. Ryll et al. (2020) surveyed 151 firms in 33 countries and revealed the perceived significance of AI in financial services, arguing that lending, borrowing, and deposit operations are anticipated to increase over time due to AI's use in the industry. Another study by Medetoğlu & Saldanli, (2022) surveyed 215 individuals to investigate the use of AI in the banking industry and found that its application significantly reduces costs and may significantly alter business practises in

the near future. It is estimated that the banking industry will save 1 trillion USD by 2030 as a result of branch closures and increased use of AI and other technologies (Mehrotra, 2019; Wheeler, 2020).

On the other hand, a number of researchers have revealed the potential dangers that may result from the digitisation of financial services, such as Yuan and Jing (2018). Mehrotra (2019) gave an example of an AI tool that displayed discrimination and bias against certain ethnicities. Saraswat (2017) cited the ongoing challenges posed by implementing AI, which include privacy violations and a lack of appropriately trained personnel.

Furthermore, our findings of the improved banking ROE attributed by the adoption of IoT, AI, Cloud computing in accounting and finance, as well as big data analytics activities are consistent with recent studies of Cho and Chen (2021), Kou et al. (2021), and Wang et al., (2021), who pointed out a positive effect of investing in financial technology on profitability. Le and Ngo (2020) provided evidence that adopting innovative technologies significantly contributes to enhancing financial performance. The positive impact may be explained by the fact that the adoption of new software and online banking improves the management of credit risk (Campanella et al., 2017), reduces the information cost access (Liberti & Petersen, 2019) and operating costs (Dong et al., 2020).

Financial reporting quality is defined as the extent to which a company’s financial statements provide truthful information about the company's underlying financial health, position, performance, and position (Arthur et al., 2019), and our findings suggest that cloud computing enhances G7 banks’ transparency via improving the ESG disclosure quality, and thereby provide empirical evidence which is consistent with previous scholars. The quality of financial reporting is a key result of digital accounting and influences the effectiveness of decision-making for a company. Thus, it is suggested that the success of strategic decision-making in digital accounting be communicated through the quality of financial reporting.

5.4.6.3. The Impact of Emerging Technologies and Digital Transformation on G7 Countries’ Banking System’s Corporate Governance, Stability, and Performance (2010-2021)

This section presents the summary of results and discussion in relation to the effect of advanced technologies, digital channels, and technological infrastructure and connectivity on banking corporate governance, stability and performance. (For full results tables, see Appendix B).

Generally, the below summary of results of Tables 5:17 and 5:18 provides empirical evidence that the adoption advanced technologies and digitalisation are important metrics in the G7 banking system corporate governance and financial sustainability, whereby information and communication infrastructure and connectivity and cloud computing are considered the most effective technological measures that affect banking corporate governance models statistically significantly (respectively, 4 models out of 6), in addition to their statistically significant impact across banking stability and performance measures. Also, three digital technology measures, MBDVS, I. Banking, and IGR, were found to have a statistically significant impact on at least 5 out of 11 models followed by ERP and MPS models.

Table 5:17 *Summary of Results of Banking Corporate Governance, Models – G7 Country-Specific Banking Sample 2010–2021*

	ESGDS	**BODS**	**BODMF**	**ACS**	**ACMF**	**CEOD**
	GLMM	**GLMM**	**GLMM**	**GLMM**	**GLMM**	**GLMM**
MPS	Insignificant	Insignificant	Insignificant	Insignificant	-0.0070 <0.0001***	-0.0060 0.030**
MBDVS	0.0070 0.092*	Insignificant	0.0050 0.051*	Insignificant	-0.0090 <0.0001***	Insignificant
ICT.IC	-0.7100 <0.0001***	0.3260 <0.0001***	0.5410 0.072*	-0.6330 <0.0001***	Insignificant	Insignificant
I. Banking	Insignificant	Insignificant	Insignificant	Insignificant	0.0220 <0.0001***	-0.0180 0.068*
CC	-0.0010 <0.0001***	-0.0010 0.001***	-0.0020 0.001***	-0.0020 0.074*	Insignificant	Insignificant
ERP	Insignificant	Insignificant	-0.0040 <0.0001***	0.0010 0.050**	Insignificant	Insignificant
IGR	Insignificant	Insignificant	-0.0040 0.034**	Insignificant	0.0050 <0.0001***	-0.0030 0.098*
Distribution	*Gamma*	*Normal*	*Normal*	*Normal*	*Normal*	*Normal*
Link Function	*Log*	*Log*	*Log*	*Log*	*Log*	*Log*
F (5, 37)	*60.4070*	*615.6780*	*1051.1270*	*486.5620*	*141.6910*	*8.1900*
P-value(F)	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
Schwarz/ Bayesian Criterion	*20.5030*	*24.4230*	*55.1280*	*51.1960*	*18.7930*	*-9.7810*
Akaike criterion	*12.8560*	*38.5210*	*47.4800*	*43.5480*	*11.1450*	*-2.6210*

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *Board Size; ACS: Audit Committee Size; ACMF: Audit Committee Meeting Frequency; BODC: Board Composition of Independents; BODMF: Board Meeting Frequency; ESGDS: Environmental, Social, and Governance Disclosure;*

CEOD: CEO Duality; MPS: Mobile Phone Subscriptions; MBDVS: Mobile Broadband, Data, and Voice Subscriptions; ICT.IC: Information and Communication Technology Infrastructure and Connectivity; I.BANKING: Internet Banking usage % of population; CC: Cloud Computing performed by businesses; ERP: Enterprise Resource Planning performed by businesses; IGR: Innovation and Growth Ratio.

The transparency level as measured by the ESG disclosure quality is found to be affected positively and statistically significantly by the increase in mobile broadband, data, and voice subscriptions. This implies that increased adoption of digital technologies such as blockchain and smart contract increases G7 banks transparency towards stakeholders. In contrast, IT infrastructure and cloud computing were found to affect ESG disclosure quality negatively by -71.0% and -0.1% respectively and statistically significantly at level of below 1%.

Table 5:18 *Summary of Results of Banking Stability and Performance Models – G7 Country-Specific Banking Sample 2010–2021*

	Z-score	**LL.GDP**	**CAR**	**ROE**	**CTI**
	GLMM	**GLMM**	**GLMM**	**GLMM**	**GLMM**
MPS	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
MBDVS	0.0060 <0.0001***	-0.2450 <0.0001***	Insignificant	Insignificant	Insignificant
ICT.IC	0.0370 0.082*	-8.0170 <0.0001***	0.8560 0.002***	1.3950 0.007***	-0.1830 0.006***
I. Banking	-0.0060 0.014**	1.5830 <0.0001***	0.0800 0.001***	-0.0880 0.010***	Insignificant
CC	-0.0050 <0.0001***	0.3270 <0.0001***	0.0530 0.004***	0.0560 0.100*	Insignificant
ERP	Insignificant	Insignificant	Insignificant	0.0130 0.031**	-0.0020 0.012**
IGR	Insignificant	Insignificant	Insignificant	-0.0120 0.001***	-0.0050 0.014**
Distribution	*Normal*	*Normal*	*Normal*	*Normal*	*Normal*
Link Function	*Log*	*Identity*	*Identity*	*Log*	*Log*
F (5, 37)	*195.5230*	*176.5200*	*46.7640*	*70.2350*	*110.9190*
P-value(F)	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
Schwarz (Bayesian) criterion	*35.9240*	*288.6920*	*176.7220*	*164.5320*	*77.9540*
Akaike criterion	*28.2760*	*285.3530*	*169.0740*	*178.6310*	*92.0530*

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*

- *LL.GDP: Liquid Liabilities % of GDP; CAR: Capital Adequacy Ratio; ROE: Return On Equity; CTI: Cost TO Income Ratio; MPS: Mobile Phone Subscriptions; MBDVS: Mobile Broadband, Data, and Voice Subscriptions; ICT.IC: Information and Communication Technology Infrastructure and Connectivity; I. BANKING: Internet Banking usage % of population; CC: Cloud Computing performed by businesses; ERP: Enterprise Resource Planning performed by businesses; IGR: Innovation and Growth Ratio.*

Z-Score: The findings show that an increase in mobile broadband, data, and voice subscriptions, and IT infrastructure and connectivity in G7 countries improves the banking system's stability. whereby MBDVS and ICT.IC measures impact positively and statistically significantly the Z-score of the banking system by 0.6% and 3.7% respectively at level of below 1% and 10%, while an increase in Internet banking, and cloud computing are found to worsen the banking stability due to its negative and statistically significant impact by 0.6% and -0.5% respectively at levels of below 10% and 1% respectively.

Liquid Liabilities as a Percentage of Gross Domestic Product (LLGDP): Banking liquidity is found to be affected positively and statistically significantly by two digitalisation metrics, measured by Internet banking and cloud computing, by 158.3% and 32.7% respectively, both at levels of below 1%. This implies that innovative digital technologies increase the liquidity of the financial market, allow surplus units to draw on new sources of funds and permit stakeholders to circumvent capital constraints imposed by regulations (BIS, 2021). Also, according to the financial stability board and previous literature, innovative financial technologies accelerate financial inclusion and thereby improve generating liquidity by reaching untapped individuals and SMEs and their funds. Liquidity-generating innovations increase the liquidity of the financial market, allowing for new sources of funds and allowing stakeholders to circumvent regulatory body restrictions. Price-risk-transfer innovations enable consumers to limit their exposure to market volatilities such as exchange and inflation rates, and credit-risk-transferring instruments provide methods that allow banks and other financial institutions to transfer their default risks (Abor et al., 2018; Financial Stability Board (FSB), 2017).

On the other hand, LL.GDP was found to be affected statistically significantly negatively by MBDVS and ICT.IC by -24.5% and -8.02 multiples respectively both at levels of below 1%. The negative findings are consistent with the

empirical work and views of Dong et al. (2020), who stated that the development of Internet financial services in Chinese commercial banks prompt diversification and profitability in parallel with decreasing banks' liquidity.

Capital Adequacy Ratio (CAR): The technological advancements, adaptation and digitalisation as measured by the infrastructure and connectivity of information and communication technologies, Internet banking, and cloud computing are the only measures affecting capital adequacy ratio of the G7 banking system statistically significantly; the three measures are found to improve banking capital relative to the risk weighted assets as an increase in ICT.IC, I.Banking and CC measures will both improve CAR by 85.6%, 8.0%, and 5.3% the three are statistically significant at level of below 1%. These results provide empirical evidence of the positive impact of digital technology in boosting equity capital by investors. Our findings support the views that equity-generating instruments tend to boost the capital base of financial companies (Abor et al., 2018).

Return On Equity (ROE): ICT infrastructure, cloud computing, and resource planning solutions (ERP) are found to be statistically important and enhancement measures in relation to ROE. The results indicate that an increase in ICT.IC, CC, and ERP increase net income relative to shareholders' equity by 139.5% (sig. at below 1%), 5.6% (sig. at 10%), and 1.3% (sig. at below 5%). Controversially, an increase in Internet banking usage and banks' technological investments relative to gross revenues are found to decrease ROE by -8.8% and -1.2% respectively both at a level of 1%.

When studying the impact of IT on banks' profitability, Campanella et al. (2017) examined 3,692 banks across 28 European countries in 2013, revealing a positive relationship between IT investments (in retail Internet, home banking and business Internet) and profitability. Dong et al., (2020) provided evidence of the benefits gained by Chinese commercial banks from the development of Internet finance, which although it led to decreased liquidity also led to enhanced profitability, and improved security, while Wang et al. (2021) stated that fintech's ability to reduce operating costs and enhance efficiencies boosts the productivity of commercial banks.

However, the negative effects of I. Banking and IGR may be a result of the increased competition between banking institutions and fintech companies, which reduces the fees and commission income of banking institutions. The results are validated by prior research, and empirical studies by other researchers have provided opposing viewpoints. Sathye (2005)

and Solow (1987) provide evidence that the adoption of Internet banking in Australian credit unions does not increase bank performance.

Management Efficiency (CTI): ICT infrastructure, Internet banking, ERP solutions, and innovation and growth ratio are found to improve banking management efficiency by decreasing operating expenses relative to operating income by -18.3%, -0.2% and -0.5% respectively (all at a significance level of below 1%).

The negative effects in our findings which imply improvements in management efficiency are consistent with the views in which the digital revolution is driving new business models (Stiglitz, 2017) and allowing access to new markets, while diversifying financial products, services, and cost reduction (Financial Stability Board (FSB), 2019). Smart contracts can be used to automate transactions and business processes, thus reducing transaction costs by lowering processing costs in the mortgage origination process, as discussed previously.

Several applications of big data aim to enhance credit risk evaluations, investment returns, and contract pricing by capitalising on the value of information. Robo-advice and e-aggregators aim to improve financial advice services and overview of financial products available to users by leveraging the availability of information. Across the entire spectrum of financial services, internal auditors, regulators, and administrators utilise technologies such as regulatory technology (RegTech) to reduce the costs of regulatory reporting or to detect risks early. Moreover, current experiments with DLT applications in securities settlement seek to expedite settlement, reduce back-office expenses, and increase the transparency of transactions and holdings (FSB, 2017).

In addition, the increased use of the Internet, mobile broadband and data and greater machine-to-machine activity and connectivity have been found to reduce the number of bank branch locations. Traditional branches and human interaction to conduct financial business (such as brick-and-mortar banking) are no longer the primary method of conducting business, as digital financial entrants use online communication channels such as mobile applications and direct marketing tools to increase efficiencies, improve customer experiences, and keep costs low. Neobanks such as Monzo and Revolut are also making strides in the communications industry by offering user-friendly interfaces on their channels, thereby enhancing consumer convenience.

Digital financial entrants are not only limited to banking and credit lending. A growing number of digital companies are invading different financial arenas such as payments, and stock trading with apps such as RobinHood, with clear disruptions to the market and generating high competition (D'Acunto et al., 2019). Other financial entrants such as peer-to-peer (P2P) platforms allow for informed decision-making utilising advanced information and communication technologies which enable collecting and sharing information, thus complementing traditional banks (De Roure et al., 2019; Tang, 2019; Vallée & Zeng, 2019). The nature of these digital platforms allows for network externalities, which limits contestability (Rochet & Triole, 2003). Most of these companies have already gained significant market share within their areas, suggesting high competition towards the future.

Overall, our findings regarding the impact of innovative digital technology on G7 banking systems' stability indicate that the adoption of advanced technologies improve financial inclusion by providing the tools necessary to enhance risk detection, conduct proper analytics, and increase managerial effectiveness, all with the aim of ensuring that vulnerable populations are included within the financial system (Alameda, 2020; Fülöp et al., 2022; Mhlanga, 2020; Mor & Gupta, 2021). The results are consistent with those obtained in research by Bansal (2014) and Beck et al. (2007) as well as Lyons et al. (2017). Moreover, these results support the views of the Bank for International Settlement (BIS); financial innovations are categorised into products, processes and financial system/institutions (Tufano, 2003), and are grouped into five main pillars; credit granting instruments, equity generating instruments, liquidity enhancement innovations, price-risk innovations, and credit-risk instruments, which ultimately 1) offer borrowers a greater depth of credit allocation, thus increasing borrowings; 2) tend to boost the capital base of financial companies (Abor et al., 2018); 3) increase the liquidity of the financial market by allowing for new sources of funds and permitting stakeholders to bypass constraints imposed by regulatory bodies; 4) enable consumers to limit their exposure to market volatilities such as exchange and inflation rates; while 5) provide methods that allow banks and other financial institutions to transfer their default risks.

Financial inclusion is first and foremost facilitated by a strong telecommunications infrastructure through initiatives such as upgrading equipment and boosting Internet speed, which enables rapid information transmission, reduced costs, limited information asymmetry, and an overall smooth network, thus allowing reach to low-income populations within a market. Also, the results of this essay related to the positive impact shown and discussed above are supported by (Bank

for International Settlements (BIS) Committee on Payments and Market Infrastructures, 2017) suggesting that DLT and fintech within an interconnected system is that data shared across key entities may lead to greater market transparency and more effective risk management across systems.

G20 countries have amended and clarified existing rules pertaining to equity crowdfunding and online marketplace lending, which have also been a significant focus of IOSCO (2015). In Canada, for example, new crowdfunding rules were introduced in May 2015, which were subsequently amended twice by January 2016. Mexico proposed that the banking and securities regulator should also mandate crowdfunding platforms, while the UK is conducting a review of the market post-implementation of crowdfunding regulations. China, on the other hand, opted to conduct research based on international best practises prior to developing a regulatory framework. When it comes to online marketplace lending, China and Canada issued rules and regulations to ensure that proper activity is captured.

In contrast, the negative and statistically significant impact of a few digital technologies' metrics in relation to various banking stability models, such as mobile broadband subscriptions in relation to Z-score, may suggest that the adoption of digital financial technology is still in its infancy. Cyber-attacks and systemic risks may arise when systemically important institutions or markets are dependent on third parties; higher leverage implies less equity available to absorb any losses materialising from the realisation of market, credit, or other risks due to financial inclusion and increased liquidity and maturity mismatch. Business may be susceptible to external factors that could negatively impact its balance sheet, and consequently lead to a leaner capital structure (FSB, 2017).

Digital financial technology (including artificial intelligence, distributed ledger technologies, cloud computing, the Internet of things and big data) offer solutions to markets and monetary/supervisory authorities and are expected to play a supportive and enabling role to enhance risk mitigation practises and achieve sustainability. The latter results are consistent with G20 Think Tank the Task Force 9 for Global Cooperation for Sustainable Development Goal (SDG) (Dikau et al., 2022).

In this essay, the positive and statistically significant impact of innovative digital technology on the stability of banking systems in G7 nations supports the Financial Stability Board's (FSB) perspective on the potential financial risks

that could be mitigated by digital technology innovations. The findings lend empirical support to the FSB report, 'Financial Stability Implications from FinTech – Supervisory and Regulatory Issues that Merit Authorities' Attention' (FSB, 2017), which states that innovations in financial services yield benefits for economic development and financial stability through multiple transmission channels, whereby reducing some of the financial frictions, decentralisation and diversification in the financial system can mitigate the effects of financial instability; with the existence of other providers of financial services, the failure of a single institution is less likely to cause a market to close.

Efficiency in operations, including incentives created by contestability, supports stable business models of financial institutions, and contributes to overall increases in financial-system and real-economy efficiency. Transparency reduces information asymmetry and enables risks to be appraised and priced with greater precision. It can encourage the development of financial instruments with exposure to risks, thereby completing markets and increasing market participants' risk-management skills. Access to and convenience of financial services have an impact on the financial inclusion of households and enterprises. This is essential for sustaining economic growth and diversifying exposure to investment risk.

5.4.7. G7 Bank-Specific Sample - Findings and Discussion - The Impact of Innovation and Growth on Transparency and Financial Sustainability in the Presence of Leadership Duality vs. Separation of Leadership Roles

This section analyses and investigates the relationship between innovation and growth indicators, corporate governance mechanisms, and financial sustainability of G7 banks. Firstly, the researcher identifies the impact of technological innovation on the ESG disclosures' quality of banks, as measured by the EDS, SDS, and GDS, which are considered proxies of transparency, which is regarded as the foundation of corporate governance. Secondly, the researcher investigates the impact of innovation and growth ratio on banking financial sustainability measures in the presence of duality of chairperson/CEO roles versus the impact of a separation of roles in the banking environment. The analysis is conducted using Gretl statistical software and IBM SPSS Modeler. The sample comprises 371 local banks in the G7 nations listed by the Global Industrial Classification Standards (GICS) for the period 2010–2021. To answer the research questions posed in the first section in this essay, this section is divided into four subsections. Section 5.4.7.1 presents the descriptive statistics for the sample banks, Section 5.4.7.2. shows the results of diagnostic

tests, and Section 5.4.7.3 presents and discusses the findings of the analysis of innovation and growth ratio in relation EDS, SDS, and GDS. Section 5.4.7.4 presents a summary of results and a discussion of the relationship between innovation and growth ratio and financial sustainability measures (ROE, CTI, NIM, AQ, CAR, and ESGDS) in a duality banking environment compared to a separation banking environment.

Additionally, due to the unintentional sampling bias towards the US, as our bank-specific sample investigated in this section includes 371 banks operating across the G7 countries, of which US banks constitute around 65% of the sample, the researcher included additional investigations in Appendix C by expanding the banking sample to cover 39 countries across G20 countries, validating the conclusions of the G7 countries about the influence of technical innovation and growth on the financial sustainability of banks in the presence of duality versus the separation of CEO/chairperson responsibilities, this lessens the bias of the US banking sample.

5.4.7.1. Descriptive Statistics

To provide a better representation of the variables and their distribution, descriptive statistics are conducted on the data. The minimum, maximum, mean, median, standard deviation, and number of observations are included in the analysis. This essay uses data collected between 2010 and 2021, which includes large numbers of diversified and regional banks in G7 nations. In this analysis, three transparency metrics were examined: the EDS, SDS, and GDS. Table 5:19 below describes the dependent and independent variables, which indicates that those banks operating in the G7 nations have an average score of EDS, SDS, and GDS of 29.67%, 12.44%, and 76.86% respectively with an average and a minimum value of around 1% for each of the ESG aspects, with a maximum value of 99.67%, 65.57% and 100.0% respectively.

Regarding the innovation and growth indicator, as can be seen from Table 5:19 below, the average bank operating in G7 registered 4.6% information and technology capital expenditures relative to operating income with a maximum of 15.6%.

Table 5:19 *Summary Statistics for Bank-Specific Sample of G7 Banks (2010–2021)*

Variable Type	Field	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Descriptive Variables	Ticker	--	--	--	--	--	--	371	4366
	Year	2010	2021	--	--	--	--	12	4366
	Country	--	--	--	--	--	USA	7	4366
Dependent Variables: Banking Corporate Governance related to Transparency and Accountability towards Stakeholders	GDS	1.000	100	76.87	14.31	83.02	83.02	--	4205
	SDS	1.028	69.11	12.44	9.37	9.34	7.92	--	2925
	EDS	1.087	99.67	29.67	20.99	33.22	33.22	--	1102
	ESGDS	3.259	75.16	30.00	8.53	29.29	27.74	--	4199
Dependent Variables: Banking Profitability, Operational Efficiency, and Stability Indicators	ROE	-11.79	15.53	1.83	4.18	0.096	--	--	4172
	CAR	8.00	22.22	15.00	2.57	14.53	--	--	3365
	CTI	28.93	102.25	65.24	12.06	64.877	--	--	4226
	AQ	0.009	7.84	1.48	1.57	0.949	--	--	2959
	NIM	-0.94	7.44	3.199	1.34	3.39	--	--	4168
Independent Variables: Innovation and Growth Indicator	IGR	-8.36	15.61	4.61	4.26	3.82	--	--	3338
Split Variables: Corporate Governance Mechanisms	CEOD	0	1	--	--	--	1	2	4366

- *Author's Own*

- *CAR: Capital Adequacy Ratio; ROE: Return on Equity; CTI: Cost TO Income Ratio; AQ: Asset Quality; NIM: Net Interest Margin ESGDS: Environmental, Social, and Governance Disclosure; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality IGR: Innovation and Growth Ratio.*

5.4.7.2. OLS Assumptions and Diagnosis

In order to illustrate the impact of implementing inappropriate econometric techniques when modelling the innovation and corporate governance relationship, a baseline approach must be selected against which to compare alternative methodologies. More specifically, given its widespread use in the early literature, the pooled OLS method of estimation was employed as our baseline analysis despite its strict exogeneity assumptions. The results of the panel assumptions pooled the OLS estimation for each model are reported in the following tables in this section and suggest violations of estimates for all models. Therefore, panel modelling techniques were applied, in the context of deciding the appropriate type of modelling technique to deploy between fixed effects and random effects alternative panel regression models.

Accordingly, after running the pooled OLS regression analysis, diagnostic tests were conducted to predict the validity of the dataset and the appropriateness of the pooled OLS as a multiple linear regression analysis technique, which included linearity, normality, multicollinearity, autocorrelation, and endogeneity. According to the test results shown in Table 5:21 below, the panel assumption of the pooled OLS model was violated across all models. Normality, autocorrelation, and heteroskedasticity were detected according to the t statistic, Wooldridge, and White's test results respectively. In regard to multicollinearity, the nature of the simple linear regression does not include collinearity issues that occur between independent variables as only one independent variable (IGR) is used in the analysis.

Table 5:20 *Pearson Correlation Matrix – G7 Bank-Specific Sample*

	NIM	AQ	CTI	CAR	ROE	IGR	ESGDS	EDS	SDS	GDS
GDS	-0.010	-0.275	-0.166	-0.025	0.120	0.277	0.496	0.041	0.130	1.000
SDS	0.004	0.319	-0.028	0.131	0.046	0.293	0.864	0.191	1.000	
EDS	-0.112	0.082	-0.042	0.055	0.057	0.107	0.233	1.000		
ESGDS	0.031	0.056	-0.112	0.050	0.080	0.308	1.000			
IGR	0.223	0.028	-0.014	0.037	0.039	1.000				
ROE	0.057	-0.408	-0.312	0.051	1.000					
CAR	0.049	0.146	-0.016	1.000						
CTI	0.041	0.169	1.000							
AQ	-0.388	1.000								
NIM	1.000									

- *Author's Own*
- *CAR: Capital Adequacy Ratio; ROE: Return on Equity; CTI: Cost TO Income Ratio; AQ: Asset Quality; NIM: Net Interest Margin ESGDS: Environmental, Social, and Governance Disclosure; EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score; CEOD: CEO Duality IGR: Innovation and Growth Ratio.*

As can be seen in Table 5:20, The Pearson Correlation Matrix, the results of the independent variable IGR ranged between a minimum of -1.4% in relation to ROE as a dependent variable, and a maximum of 30.8% in relation to the overall ESG disclosure score. It is noteworthy that in a simple linear regression the multicollinearity violations do not exist as there is one independent variable. However, the correlation coefficients show that the three dependent variables (EDS, SDS, and GDS) were highly intercorrelated, with ESGDS, more specifically SDS, as the coefficient reached 86.4% due to

the fact that the three disclosures score are the core component of ESGDS, noting that both highly correlated measures will be used as dependent variables in separate models.

Table 5:21 *Diagnostic Tests for Linear Regression Assumptions of G7 Panel Data Sample*

OLS Assumptions		GDS	SDS	EDS
Autocorrelation	t	62.5532	74.8607	13.2561
Wooldridge	p-value	*<0.0001****	*<0.0001****	*<0.0001****
Normality	Chi-Square	3498.55	2514.62	45.8762
Test Statistics	p-value	*0.0000****	*0.0000****	*<0.0001****
Heteroskedasticity	LM	1.29522	104.462	18.5645
White's	p-value	*0.523295*	*<0.0001****	*<0.0001****
OLS or Fixed Effects	F statistic	20.1355	25.2233	375.865
Joint Significance	p-value	*0.0000****	*0.0000****	*<0.0001****
OLS or Random Effects	LM	5422.34	5886.99	5.59883
Breusch Pagan	p-value	*0.0000****	*0.0000****	*<0.0001****
Fixed or Random Effects	H	70.9018	52.9313	0.223256
Hausman	p-value	*<0.0001****	*<0.0001****	*0.63657*
Time Dummies	Chi-Square	63.271	181.956	13.2337
Wald Joint	p-value	*<0.0001****	*<0.0001****	*0.104058*

- *Author's Own*
- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*

- *EDS: Environmental Disclosure Score; SDS: Social Disclosure Score; GDS: Governance Disclosure Score.*

Table 5:21 above show that EDS, SDS, and GDS models for G7 banking samples suffer from autocorrelation, normality, and heteroskedasticity as the p-value is below the significance level of 5% for the Wooldridge t statistics for normality of residuals, and White's test (except the GDS model is found to be homoscedastic as White's test's p-value is above 5%). Accordingly, the diagnostics results of assumptions suggest that the pooled OLS modelling technique is inadequate to estimate the relationship. Therefore, panel specification tests were conducted to determine the suitable modelling technique between the alternative panel models of fixed effects and random effects. According to the results of the joint significance test between OLS and fixed effects along with the Breusch-Pagan test between OLS or random effects confirmed that pooled OLS is inadequate when compared to both alternative panel data modelling. However, the Hausman test to choose between fixed and random effects suggests that the fixed effect model is adequate to conduct the regression analysis for GDS and SDS, while the random effects model is adequate to estimate the EDS model as p-value are above 5%.

Moreover, based on the Wald Joint test for time dummies, which suggests that GDS, SDS, and EDS models are affected by time, and since the fixed effects model does not take into consideration time effects, and in order to produce the most reliable estimates, the GLMM model was utilised via SPSS Data and Text Analytics Modeler due to its power in handling complex regression modelling, taking into considerations both the random effects and fixed effects in a single modelling run while establishing covariance tables to generate reliable estimates.

Table 5:22 *Diagnostic Tests for Linear Regression Assumptions of G7 Panel Data Sample*

OLS Assumptions and Diagnosis		CTI		ROE		NIM	
		IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation
Autocorrelation *Wooldridge*	*t*	7.4201	7.84804	10.6321	12.394	34.5472	36.9029
	p-value	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
Normality *Test Statistics*	*Chi-Square*	166.849	455.563	187.742	321.605	51.7994	222.886
	p-value	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
Heteroskedasticity *White's*	*LM*	1.89618	68.0191	3.67342	52.1814	22.5488	41.6706
	p-value	*0.38748*	*<0.0001***	*0.159341*	*<0.0001***	*<0.0001***	*<0.0001***
Cross-Sectional Dependence *Pearson CD Asymptotic*	*Z*	6.77499	NAN	6.19893	NAN	30.4185	47.4217
	p-value	*<0.0001***	*NAN*	*<0.0001***	*NAN*	*<0.0001***	*0.0000****
OLS or Fixed Effects *Joint Significance*	*F Statistic*	8.90992	6.05221	7.85513	8.74036	47.5888	38.2347
	p-value	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***	*0.0000****	*0.0000****
OLS or Random Effects *Breusch Pagan*	*LM*	1160.21	1204.59	953.022	1853.54	2310.1	4969.87
	p-value	*<0.0001***	*<0.0001***	*<0.0001***	*0.0000****	*0.0000****	*0.0000****
Fixed Effects or Random Effects *Hausman*	*H*	7.43572	1.28917	13.4196	0.925543	69.4552	8.14305
	p-value	*0.00639****	*0.256201*	*0.000249****	*0.336024*	*<0.0001***	*0.00432****
Time Dummies *Wald Joint*	*Chi-Square*	29.6775	28.4882	17.5545	106.449	93.4416	62.9481
	p-value	*0.00024****	*0.000389****	*0.02482***	*<0.0001***	*<0.0001***	*<0.0001****

- *Author's Own*
- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*
- *ROE: Return on Equity; CTI: Cost TO Income Ratio; NIM: Net Interest Margin.*

Table 5:23 *Diagnostic Tests for Linear Regression Assumptions of G7 Panel Data Sample*

OLS Assumptions and Diagnosis		AQ		CAR		ESGDS	
		IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation
Autocorrelation *Wooldridge*	*t*	27.767	33.009	16.606	25.3291	78.383	69.550
	p-value	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
Normality *Test Statistics*	*Chi-Square*	829.677	3233.38	734.987	579.939	367.057	531.271
	p-value	<0.0001***	0.0000***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
Heteroskedasticity *White's*	*LM*	15.637	116.338	2.29692	12.8682	1.51157	81.1235
	p-value	<0.0001***	<0.0001***	0.317124	0.00161***	0.469642	<0.0001***
Cross-Sectional Dependence *Pearson CD Asymptotic*	*Z*	75.7613	NAN	9.11827	NAN	NAN	NAN
	p-value	<0.0001***	NAN	<0.0001***	NAN	NAN	NAN
OLS or Fixed Effects *Joint Significance*	*F Staistic*	8.734	16.730	10.869	9.453	35.263	27.033
	p-value	<0.0001***	0.0000***	<0.0001***	<0.0001***	0.0000***	0.0000***
OLS or Random Effects *Breusch Pagan*	*LM*	860.465	3543.42	821.477	1482.52	2242.98	4123.71
	p-value	<0.0001***	0.0000***	<0.0001***	0.0000***	0.0000***	0.0000***
Fixed Effects or Random Effects *Hausman*	*H*	25.152	17.255	2.1037	0.14703	46.794	39.052
	p-value	<0.0001***	<0.0001***	0.146945	0.701389	<0.0001***	<0.0001***
Time Dummies *Wald Joint*	*Chi-Square*	130.989	236.041	27.246	32.257	252.016	191.873
	p-value	<0.0001***	<0.0001***	0.00064***	<0.0001***	<0.0001***	<0.0001***

- *Author's Own*
- *Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*
- *CAR: Capital Adequacy Ratio; AQ: Asset Quality ESGDS: Environmental, Social, and Governance Disclosure.*

Tables 5:22 and 5:23 show the regression assumptions and diagnosis of financial sustainability models in relation to innovation and growth ratio in the presence of CEO duality vs. the absence of duality, whereby all models were found to suffer from autocorrelation and normality. As for endogeneity violations, the results show that CTI, ROE, CAR, and ESGDS models in the presence of duality are homoscedastic while all other models suffer from heteroskedasticity issues.

On the other hand, Joint significance and Hausman tests suggest that the pooled OLS and random effects models are considered inadequate in favor of the fixed effects model except for CTI, ROE, and CAR models in the absence of CEO duality as well as CAR model in the presence of duality.

Additionally, Wald Joint test for time dummies suggests that all models suffer from time effects suggesting that the fixed effects model may generate unreliable estimates due to its nature in excluding time effects. Accordingly, the researcher utilised the Generalised Linear Mixed Model (GLMM) in SPSS Modeler due to its power in integrating both random and fixed effects modelling techniques via complex covariance tables whereby cross-sectional and time effects are taken into consideration in a single modelling run.

5.4.7.3. Findings and Discussion – The Impact of Innovation and Growth Ratio on G7 Banking ESG Disclosures' Quality (Transparency)

The below tables present multiple modelling techniques conducted including the GLMM model as considered a best fit to investigate the relationship between IGR and each of the ESG disclosure scores as proxy of transparency of banks in G7 countries.

Table 5:24 *IGR vs. EDS Regression Results – G7 Banking Sample*

EDS				
	OLS	**FE**	**RE**	**GLMM**
Constant	28.2041	28.5199	30.0017	3.4140
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.4257	0.3562	0.2610	0.0120
	*0.0888**	*0.1014*	*0.1731*	*0.050***
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Log*
R-squared	*0.0114*	*0.5689*		*0.0110*
Adjusted R-squared	*0.0101*	*0.0024*		*0.0100*
F (1, 143)	*2.9353*			*3.8390*
P-value(F)	*0.08883**			*0.050***
S.E. of regression	*19.9235*	*14.5967*	*19.9552*	*11.6581*
Schwarz criterion	*6751.0*	*7066.2*	*6754.5*	*1097.0*
Akaike criterion	*6741.8*	*6393.6*	*6745.2*	*1078.5*
Durbin-Watson	*0.4794*	*1.0951*	*1.0951*	*0.8941*

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *EDS: Environmental Disclosure Score; IGR: Innovation and Growth Ratio.*

Table 5:25 *IGR vs. SDS Regression Results – G20 Banking Sample*

SDS				
	OLS	**FE**	**RE**	**GLMM**
Constant	9.1799	12.2522	11.0235	2.4010
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.6529	-0.0037	0.0803	0.0030
	*<0.0001***	*0.9240*	*0.067**	*0.097**
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Log*
R-squared	*0.0858*	*0.8484*		*0.0900*
Adjusted R-squared	*0.0854*	*0.0000*		*0.0900*
F (1, 367)	*22.5700*			*2.7530*
P-value(F)	*<0.0001****			*0.097**
S.E. of regression	*9.4127*	*4.1977*	*9.7800*	*8.0715*
Schwarz criterion	*16187.7*	*15044.3*	*16357.8*	*561.4*
Akaike criterion	*16176.3*	*12940.9*	*16346.4*	*538.6*
Durbin-Watson	*0.1384*	*0.5851*	*0.5851*	*0.4430*

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *SDS: Social Disclosure Score; Innovation and Growth Ratio.*

Table 5:26 *IGR vs. GDS Regression Results – G7 Banking Sample*

GDS				
	OLS	**FE**	**RE**	**GLMM**
Constant	71.8763	76.5068	75.9097	71.8030
	*<0.0001***	*0.0000***	*0.0000***	*<0.0001***
IGR	0.9693	-0.0431	0.0871	1.0110
	*<0.0001***	*0.3733*	*0.0598**	*<0.0001***
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Log*
R-squared	*0.0766*	*0.7395*		*0.1210*
Adjusted R-squared	*0.0763*	*0.0002*		*0.1210*
F (1, 370)	*49.0494*			*202.4820*
P-value(F)	*<0.0001****			*<0.0001****
S.E. of regression	*14.2704*	*8.0437*	*14.7501*	*12.1872*
Schwarz criterion	*26915.1*	*25737.3*	*27134.2*	*14723.2*
Akaike criterion	*26902.9*	*23467.6*	*27122.0*	*14705.3*
Durbin-Watson	*0.2125*	*0.5974*	*0.5974*	*0.3440*

- *Author's Own*

- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*

- *GDS: Governance Disclosure Score; IGR: Innovation and Growth Ratio.*

The findings of the impact of innovation and growth as a proxy of IT investments cost-benefit measure of banks in G7 countries, based on a micro-level sample data of 371 banks during the period 2010–2021, suggest a strong direct positive effect on each of the ESG disclosures quality as proxy of banking transparency and statistically significantly across all models. An increase in banking technological investments relative to their gross revenues improves the environmental disclosure quality by 1.2% statistically significantly at level 5%, improves the quality of social disclosures by 0.3% at level of below 10%, and improves disclosures quality related to the governance aspect of banking institutions by 101.1% at a level of below 1%.

These results provide empirical evidence to previous research that interpreted the vital role of digital technology in ESG disclosures as discussed in depth in the thematic analysis and interpretation of previous research conducted by the researcher.

Our findings support the view of previous researchers Wang et al. (2023), who posit that financial digital technology will reduce information asymmetry and moral hazard, and who categorise transparency as information transparency, system design transparency, data privacy transparency, online advertising transparency, potential risks

transparency, informed decision-making transparency, information visualisation transparency, and personalisation transparency.

The nature of blockchain technology is considered to promote transparency due to its openness and shared characteristics, which allow participants to form an open credit data record (Casino et al., 2019). Further elements which induce authenticity and credibility include the presence of an identical mathematical algorithm and the fact that the data of each are exchanged and integrated on an automatic basis (Niranjanamurthy et al., 2019). On the other hand, each Survey of Consumer Finances (SCF) data has symmetrical credit data information, thus allowing members within the supply chain to validate the credit data through the blockchain ledger. Under this model, there is no longer a monopoly on credit data information; this openness nature improves the credit coefficient and strengthens the performance of enterprises (Saberi et al., 2019).

The conventional SCF structure for financial services separates commodity trading and corporate finance into separate connections. Credit transmission and credit blind spots are problematic among suppliers, primary businesses, and financial institutions. With the advent of blockchain technology, the credit information of vendors, core businesses, and financial institutions is recorded within the blockchain, reducing time, labour, and transactional costs while effectively limiting credit risks (Morkunas et al., 2019). Over time, the ‘blockchain plus supervision’ pattern is anticipated to be adequately supervised to control credit risk (Wong et al., 2020).

Financial transparency, whose main principles include lowering opportunistic behaviour and reducing information asymmetry, is among the core reasons to consider digital financial technology (Ben Ali, 2020). Our findings are consistent with previous empirical works which argued that technology is considered to be a key element in lowering corruption (Ben Ali & Gasmi, 2017; Mistry & Jalal, 2012; Shim & Eom, 2008).

The legal framework that applies to publicly traded firms includes both state corporate law, which establishes fiduciary duties, and federal securities legislation, which mandates information disclosure. The board of directors of an institution is expected to operate in good faith and monitor operations properly to ensure compliance. Auditors hold a responsibility in the eyes of stakeholders; Roger O’Donnell, an audit partner at KPMG, affirmed this during a conference in 2017 that discussed financial reporting issues.

In response to a query about the use of financial technology in auditing, O'Donnell stated that a substantial portion of auditing is dependent on the clients' systems, demonstrating the importance of customising technological solutions. When implementing blockchain technology, costs must be outweighed by value-added. Due to their auditability, blockchains have numerous accounting and auditing applications. For example, Liu et al. (2019) discussed how blockchains have impacted auditing practises, as well as the potential and issues that permissioned and permissionless blockchains present for auditors. Moreover, according to Dai and Vasarhelyi (2017), blockchains have the potential to transform current auditing practises, resulting in a more accurate and timely automated assurance system, and could facilitate a real-time, verifiable, and transparent accounting ecosystem. According to the findings of Wang and Chen (2021), the implementation of blockchain technology can reduce bank confirmation from two weeks to three days.

There are some literature reviews that provide an overview of the blockchain concept and ideas in the accounting and auditing fields, such as Schmitz and Leoni (2019), and Secinaro et al. (2021). The authors present the frameworks and methodologies that have been suggested, and new research areas from a variety of angles in those evaluations.

Although blockchain's nature promotes openness and sharing of information, a bank is required to safeguard both client data and information regarding money transfers and flow of funds and is held liable for complying with Know Your Customer (KYC) and Anti-Money-Laundering (AML) regulations, which causes some misalignment with blockchain.

According to The Wall Street Journal, using digital technology to validate global payments, which can take up to two weeks when using legacy systems, could be completed in as little as a few hours.

Some academics believe that smart contracts may be used and incorporated into financial statement audits in the future. Rozario and Vasarhelyi (2018), for instance, proposed that smart audit procedures (a new type of audit data analytics) could be implemented autonomously to resolve various audit risks and have the potential to realise near-real-time audit reporting. Smart auditing is facilitated by smart contracts and carried out in blockchain environments. Moreover, Rozario and Thomas (2019) introduced the concept of interconnected blockchain ecosystems consisting of business private/permissioned ecosystems for smart audits and external audit ecosystems.

Transparency and effectiveness are the most evident benefits of DLT solutions. The use of smart contracts expedites the execution of financial transactions without requiring any additional reconciliation between the parties involved. The

information is readily accessible and replicated among all participants, creating high levels of transparency, and in the majority of cases, multiple participants must concur with the data on record prior to its entry into the ledger, thereby promoting trust and credibility. Another important advantage is the robustness and durability of DLT solutions (such as the case with wholesale payments). Their design and random distribution enable multiple data storage options and reduces the risk of failure due to the distress of a single node, thereby ensuring sustainability and longevity. While academics and proponents of DLT tout numerous benefits, it is important to note that central banks have yet to completely implement DLT solutions. Globally, central banks have conducted proofs of concept and multiple experiments with DLT solutions, but no central bank has adopted this technology.

In this regard, Changpeng 'CZ' Zhao, CEO of Binance, the blockchain foundation, explains that since blockchain's greatest benefit is its transparency, it offers the possibility of having an immutable public record of transactions and tracking them from their origin to their destination. In addition, Nowiński and Kozma (2017) argue that blockchain technology creates value for businesses in a variety of ways: first, through transaction authentication mechanisms; second, by reducing costs because it eliminates intermediaries that were previously required for operations and transactions; and third, by increasing operational efficiency, thereby reducing waiting time. These four elements summarise the allure of blockchain: technological simplicity, decentralisation, and transactional transparency.

5.4.7.4. Findings and Discussion: The Impact of Innovation and Growth Ratio on G7 Banking Financial Sustainability: Leadership Duality vs. Separation

This section will investigate the impact of IT investments relative to gross revenues on banking stability and performance in the presence of dual control (CEO/chairperson duality) vs. the separation of roles, with the aim of lending empirical evidence to the possibility that leveraging digital technology in banking institutions may mitigate and to an extent eliminate the core agency problem related to information asymmetry, transparency, and accountability between principals and agents. Based on the researcher's discussion, interpretation, and analysis presented in this essay, it is evident that emerging technologies have led to the reconsideration of the traditional role of audit activities as a supervisory function in the digital era (See Appendix B for the full results tables).

Table 5:27 *Summary of Results: The Impact of Innovation and Growth on Return on Equity in Relation to CEO Duality vs. Separation*

Dependent: ROE / Split: CEOD				
	OLS	**FE** ***For duality model***	**RE** ***For separation model***	**Linear Predictive Model**
Duality of Roles				
IGR	0.0025	0.000121887	0.0007	0.0030
	*<0.0001***	*0.7180*	*0.0209***	*<0.0001****
Separation of Roles				
IGR	-0.0008	0.000065	-0.000047	-0.0010
	0.2008	*0.8484*	*0.8810*	*0.002****

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *ROE: Return on Equity; CEOD: CEO Duality; IGR: Innovation and Growth Ratio.*

Table 5:28 *Summary of Results – The Impact of Innovation and Growth on Net Interest Margin in Relation to CEO Duality vs. Separation*

Dependent: NIM / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
IGR	0.1435	0.00312362	0.0116	0.1430
	*<0.0001****	*0.6999*	*0.1167*	*<0.0001****
Separation of Roles				
IGR	0.0167	-0.00121768	0.0014	0.0170
	0.3542	*0.8096*	*0.7839*	*0.007****

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *NIM: Net Interest Margin; CEOD: CEO Duality; IGR: Innovation and Growth Ratio.*

Table 5:29 *Summary of Results – The Impact of Innovation and Growth on Management Efficiency in Relation to CEO Duality vs. Separation*

Dependent: CTI / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	67.5076	65.361	65.5377	67.7320
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	-0.3154	0.234068	0.1125	-0.3240
	*<0.0001***	*0.0589**	*0.2917*	*<0.0001***
Separation of Roles				
Constant	63.5562	63.0634	63.4396	63.4150
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.1545	0.251766	0.2075	0.2660
	0.2622	*0.0067***	*0.0045***	*<0.0001***

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *CTI: Cost TO Income Ratio; CEOD: CEO Duality; IGR: Innovation and Growth Ratio.*

The findings presented in Table 5:27 above suggest that more G7 banking technological investments relative to gross revenues in the presence of CEO/chairperson duality improves profitability measured by the net income relative to shareholders' equity by 0.3% and statistically significantly at level below 1%. This is in comparison to a negative impact of IGR on ROE by 0.1%, at a significance level below 1% when G7 banks practise a separation of roles (absence of leadership duality).

Based on the results presented in Table 5:28, innovation and growth measures are found to impact positively and statistically significantly on net interest margins at a level below 1% in both banking corporate governance modality of leadership duality and separation, noting that IGR in the presence of CEO/chairperson roles impact NIM by 14.3%, which is considered stronger when compared to 1.7% for G7 banks with separated leadership roles.

As for management efficiency model results in Table 5:29, G7 banks' operating expenses relative to operating income was found to be reduced (improved) by information and technology capital expenditures (IT CAPEX/or/ IT investments) relative to gross revenues by 32.4% at a significance level of below 1% in the presence of CEO duality, while CTI is found to increase (worsen) when duality is absent by 26.6% at level of below 1%.

Table 5:30 *Summary of Results: The Impact of Innovation and Growth on Asset Quality in Relation to CEO Duality vs. Separation*

Dependent: AQ / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	1.7259	1.38178	1.5240	1.7260
	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
IGR	-0.0761	0.0048737	-0.0175	-0.0760
	*0.0005****	*0.7002*	*0.1454*	*<0.0001****
Separation of Roles				
Constant	1.2405	1.69401	1.6049	1.2410
	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
IGR	0.0536	-0.0341989	-0.0236	0.0540
	*0.0590**	*0.0024****	*0.0289***	*<0.0001****

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%*
- *AQ: Asset Quality; CEOD: CEO Duality; IGR: Innovation and Growth Ratio.*

Table 5:31 *Summary of Results: The Impact of Innovation and Growth on Capital Adequacy Ratio in Relation to CEO Duality vs. Separation*

Dependent: CAR / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	15.2353	15.1466	15.2006	15.1040
	*<0.0001****	*<0.0001****	*0.0000****	*<0.0001****
IGR	-0.0180	-0.000843	-0.0123	-0.0170
	0.7078	*0.9780*	*0.6735*	*0.4640*
Separation of Roles				
Constant	14.7780	14.8809	14.9267	14.7350
	*<0.0001****	*<0.0001****	*0.0000****	*<0.0001****
IGR	0.0443	0.0259	0.0279	0.0400
	0.1370	*0.2509*	*0.1804*	*0.005****

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *CAR: Capital Adequacy Ratio; CEOD: CEO Duality; IGR: Innovation and Growth Ratio.*

On the other hand, G7 banks' credit risk indicator, measured by the percentage of non-performing loans of the total loan portfolio, as shown in Table 5:30, is also found to be improved by more technological investments in the presence of CEO duality as opposed to the absence of duality, whereby IGR reduces impaired loans relative to total loan portfolio by 7.6% (significant below 1% level) in the existence of leadership duality practises. Controversially, more IT CAPEX in relation to gross revenues, NPLs is found to be increased relative to the total loan portfolio by 5.4% (significant at level below 1%) in the absence of dual control.

When it comes to capital adequacy ratio (Table 5:31), G7 banks' IGR in the presence of dual control practises is found to impact CAR negatively insignificantly by -1.7%, while IGR improves equity capital in relation to risk weighted assets by 4.0% in a separated leadership-role environment, and statistically significantly at a level below 1%.

Table 5:32 *Summary of Results: The Impact of Innovation and Growth on Environmental, Social, and Governance Disclosures' Quality in Relation to CEO Duality vs. Separation*

Dependent: ESGDS / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	25.8136	28.534	28.4977	25.8140
	*<0.0001****	*<0.0001****	*0.0000****	*<0.0001****
IGR	0.5727	-0.13088	-0.0700	0.5730
	*<0.0001****	*0.0068****	*0.1165*	*<0.0001****
Separation of Roles				
Constant	27.7204	30.6678	30.3290	27.7200
	*<0.0001****	*<0.0001****	*0.0000****	*<0.0001****
IGR	0.6283	0.0397993	0.0926	0.6280
	*<0.0001****	*0.3569*	*0.0331***	*<0.0001****

- *Author's Own*
- **: Significant at 10%; **: significant at 5%; ***: significant at 1%.*
- *ESGDS: Environmental, Social, and Governance Disclosure; CEOD: CEO Duality IGR: Innovation and Growth Ratio.*

The ESG transparency level of banks in countries as measured by the ESG disclosure quality is found to be improved by the innovation and growth ratio and statistically significantly at level below 1% in both corporate governance

models of duality and separation of CEO/chairperson roles, whereby IGR in presence of duality affects ESGDS by 57.3%, while ESGDS is affected by 62.8% in the absence of duality.

In contrast to the results of separation of leadership roles, the positive impact of CEO/chairperson roles on G7 banks' stability and performance indicates that the applications of emerging technologies such as digital banking channels, blockchain, smart contracts enabled by AI, and big data analytics can all work towards verifying IT protocols, monitoring and enforcing negotiations and executing business contracts. This will increase transparency, eliminate infortune, and promote accountability. Our empirical findings corroborate Jensen and Meckling's view that a business is a 'node of contracts and relationships'; the objective is to distribute contracts equitably between principal and agent.

In contrast to the current model of disciplinary governance, which is characterised by opportunistic behaviour, the emerging technology, and blockchain in particular, responds appropriately to this agency theory and its central issue. According to Williamson (1979), opportunism is eradicated due to the fact that the blockchain is a transparent, verifiable ledger. Effective blockchain governance results from the automation of governance mechanisms via smart contracts, the eradication of opportunism, and the reduction of transaction costs. The blockchain is not a novel technology in its own right, but rather a disruptive technology that challenges all conventional forms of government.

In addition, our empirical findings are supported by prior literature and scholars who assert that emerging technologies in the context of auditing have modified the auditing process and streamlined the auditing profession (Kuruppu & Oyelere, 2017). Banker et al. (2002) state that information technology (IT) facilitated streamlining by automating components of the auditing process. By automating portions of the auditing process that were previously performed manually (Sjoberg & Johansson, 2016), audits can be completed with less time and effort while maintaining data integrity. By outsourcing the analysis of accounting entries, AI can transform the audit (Baldwin et al., 2006), which is advantageous because it reduces the risk of human error and effectively detects fraudulent behaviour (Moffitt et al., 2018). KPMG (2017) identifies data analytics, robotics, artificial intelligence, and blockchain as the top four digital trends. These emerging technologies are altering the responsibilities and duties of audit professionals, thereby having a significant impact on the auditing profession (Institute of Chartered Accountants in England and Wales (ICAEW), 2017). According to the Institute for the Accountancy Profession in Sweden, this continuous transformation could potentially reshape the

entire auditing environment. Therefore, digitisation is believed to play an ongoing role in the development of the auditing profession, making it an intriguing research topic (Fotoh & Lorentzon, 2021; Stensjö, 2020; Törnqvist & Forss, 2018).

5.5. Conclusion

This empirical essay and its conclusions are consistent with the theoretical study, which asserts that digitalisation and the adoption of emerging technologies transform and improve banking corporate governance modality and characteristics, transparency, accountability, stability, and performance, which are regarded as the overarching objectives of corporate governance. The attainment of these objectives facilitates the transformation and decentralisation of internal and external supervisory authorities and permissions, thereby enabling the management of diverse aspects of business affairs with the aim of institutional sustainability towards socioeconomic development and a healthy investment climate. Emerging digital technology is paving the way for substantial changes in the preparation and auditing of financial statements, but legislative, legal, and regulatory aspects still pose some of its risks.

Establishing a suitable governance framework is predicated to improve economic performance, primarily in developing nations, with fraud and mismanagement prevention playing a crucial role. Corporate governance is a cutting-edge instrument for public enterprise management, emphasising transparency and directing administrators towards a new dimension of risk management that the enterprise itself exposes.

Our results are consistent with the findings of Loum and Biçer (2021), who found that the presence of an effective internal audit department increases organisational efficiency and effectiveness and ensures the credibility of reports. The conclusions are also supported by those of Radwan et al. (2021) which stated that 1) digital transformation has a significant impact on internal audit; 2) digital transformation results in cost reduction; and 3) new regulations and laws are required to govern digital transformation within financial services to ensure the security and protection of users.

Continuous innovations coupled with increased competition should promote managers and other key stakeholders within financial organisations to align their strategic goals with the adoption of technologies, with the aim of enhancing customer experience while reducing costs, as expectations are continually changing and high-cost structures will have to be properly justified in today’s ‘cost-saving’ operations as enabled by technology.

Our essay differs from its contemporaries in that it empirically examines the impact of emerging technologies and digitalisation on the corporate governance and sustainability of the G7 banking system. Digital transformation and various forms of innovative technologies have the potential to provide efficient solutions to a variety of problems that are negatively impacting current systems in corporate governance; however, a number of obstacles remain, including raising the necessary capital, the possibility of hacking, and a lack of in-depth research and comprehension, to name a few.

Regulators and central banks should create a new corporate governance system that is based on digital technologies that provide flexibility and dynamism. Also, they should reconsider the dual role of leadership in the digital age in order to avoid conflicts and agency issues as a result of technology's monitoring and supervision.

Good telecommunications infrastructure enables a streamlined communication network, rapid information transmission within the banking system, and a reduction in information asymmetries and costs; this promotes sectoral dynamism and reduces the cost of financial banking services, making them more accessible to low-income populations. Improving the quality of telecommunication infrastructure requires increasing the sophistication of network equipment and Internet speeds.

Digital technology now covers the entire value chain and all banking activities. As a result, banks are forced to adapt by being more agile and flexible and interacting differently with all their stakeholders. This digital transformation is certainly a source of opportunities that must be seized, but also a source of new risks that must be controlled. It is a new challenge for the banks, their management and their boards of directors to seize these opportunities and manage these risks with a view to creating value. Thus, digital transformation, which brings with it challenges in terms of performance, organisation, cultural evolution and risks, is a strategic issue. It must therefore be dealt with at the highest level in the banks, discussed and debated in their boards of directors, which must therefore take up this subject and put it on the agenda.

The digital transition currently at work in the economic and social ecosystem seems to mark a paradigm shift. Administrators must therefore become aware of the importance of what is at stake in this transition. Boards of directors, being the main governance mechanism, are directly concerned. First, the board must understand how this major transformation affects the bank itself. It is a question of understanding its business model, without which the board cannot exercise its primary function of determining strategy. The board's other function is to assess the risks associated with cyber-attacks, the protection of the bank's data, and the risks associated with the adaptation of employees. Even the nature of the information that is given to the board to

feed into its decisions is changing, and it is necessary to know how to interpret and sort it, especially with the use of big data. This leads to a reconsideration of the composition of the board, since the appointments committees must recruit new directors with digital skills.

A second impact of the digital transformation on cognitive governance relates to the board's own operation. Artificial intelligence will be invited to join the board of directors – not to make decisions on its behalf, but to carry out all the repetitive and formalistic responsibilities associated with its operation.

The spread of digital culture is required for the establishment of a common and shared strategic vision for the digital environment. Pedagogy is essential for helping individuals comprehend the benefits of digital technology and increasing corporate interest. The board of directors must guarantee that the bank has a shared 'digital vision' that is consistent with its worldwide strategy and is supported by enough financial and organisational resources. The CEO, CIO, or CDO must submit this vision and its implementation to the board of directors once a year. This vision must include an environmental study as well as projections of competition trends and the identification of new entrants. In this environment, bank executives must be educated about the digital shift, and business lines must develop new services supported by new technology. To accomplish this, the perspective of the IS (Information System) by the Business Units and the CEO must shift from an 'IS = cost unit' vision to an 'IS = source of value and savings' vision. In this scenario, contacts between the CEO, the business, and the CIO are more important than ever. It is thus up to the board to guarantee that the triptych of CEO/CIO/business lines functions properly in the bank and that the tasks of each are clearly defined by the various stakeholders.

5.5.1. Findings

Scholars, auditors, regulators, and consumers of financial statements are presently very interested in the topic of digitalisation and emerging technologies within the context of auditing. In the current era of digitalisation, this study contributes to the extant literature by supplementing some previous studies and providing empirical insights into how digitalisation and trending technologies are transforming the auditing profession. Numerous studies have investigated auditors' perceptions of the effects of emerging technologies on auditing, but none have empirically examined the topic using a quantitative data collection method. Therefore, this research covers a gap in the existing literature.

5.5.2. Recommendations

To meet stakeholders', including shareholders', expectations, banks must adapt their IT systems to systematically collect, aggregate, and report on a broad range of knowledge and information.

Moving toward this goal will require significant changes to the organisational structure and technological infostructure, from applications to data integration, architecture, and governance. Also, ESG data must be woven into existing processes, such as credit approvals and decision-making. And banks will need to adjust their data architecture, define a data collection strategy, and reorganise their data governance model to successfully manage and report information to related stakeholders, including ESG data.

Other potential use cases include regulatory and internal stress tests, analytical risk-weighted asset calculations, provisioning, risk-appetite frameworks, credit policies, capital allocation, pricing, portfolio emissions alignment, external disclosures, and internal reporting.

Additionally, some banks may default to building in-house technical solutions, for which some software-as-a-service (SaaS) solutions may provide a more cost-effective and feasible alternative. Banking leaders should implement a clear build-versus-buy framework, with proper market screening mechanisms and early-warning capabilities to ensure resources are deployed as efficiently as possible.

Resistance to upgrading legacy IT interfaces can hamper the integration of data. While it may seem like an adequate short-term solution, adding new components to a complex architecture creates operational risk in the mid- to long term. Indeed, new ESG regulatory and business imperatives present an opportunity for banks to revise their existing enterprise architecture framework to be more closely aligned with best practises. Banks should aim to design modular, decoupled architecture components, linked by a well-managed and standardised API-based integration architecture to revise and amend corporate governance frameworks and practises in order for their technological investment to be effective and beneficial.

The key recommendations below are addressed by the researcher to financial legislative and regulatory authorities, central banks, banking institutions, investors, and fintech firms, among other related parties across economic sectors:

- To foster research and development (R&D) investments in order to adopt and deploy blockchain/DLT and other financial innovation technologies thematic sandboxes to support the development and amendments of rules, regulations, and policies concerning blockchain.
- To build digital skills and capacity to utilize blockchain and distributed ledgers, among other emerging technology.
- Since emerging technologies are based on data and information, the core element of the creation of any technology, banking institutions and related regulatory bodies should guarantee the flow of accurate and valid data. This can be achieved by the enforcement of data governance frameworks and practises.
- To establish technical standards pertaining to the compatibility of blockchains and other emerging technologies in order to facilitate the deployment of the technology with the capacity to communicate with other similar DLTs on a local, national, and international scale, both now and in the future.
- To set regulations, standards, and protocols to itemize data and information that will be shared on micro and macro levels at local, regional and international scales relative to banking activities, that will be stored, safeguarded, transferred, exchanged, and executed through DLTs.
- To have unified data terminologies and structures which enable the communication, connection, and execution across DLTs.
- Banks are recommended to maintain their autonomy of deploying their operational and business activities on their own blockchain/DLT platform, with the ability to share data and engage with their various stakeholder groups. In order to achieve the independence of banking blockchain/DLT, banks are recommended, in the short and medium terms, to adapt multi-governance models of establishing consortiums, joint ventures, and in some cases statutory organisations in partnership with corporations across different industries, including fintech firms and regulatory authorities, to deploy different banking operations external intermediation governance mechanisms, such as market discipline and system regulation, supervised by securities and exchange agencies, depository commissions, and companies control departments, can be implemented on blockchain technology. This can include activities such as financial instruments trading, ownership registries and transfers, shareholder activism, and shareholders' voting rights. The adoption governance model involves the creation of a statutory organisation funded, managed, and operated by the government.

Also, banks with common governance, control, and risk appetite characteristics and business objectives related to banking activities or functionalities that may be advantageous to deploy on blockchain/DLT are advised to establish consortiums and separate entities (joint ventures) and fund them with all relevant stakeholders from various sectors, such as trade finance activities, KYC, digital identity verifications, and credit sharing information.

- Due to the nature and norms of banking secrecy, it is recommended that, in the long run, banking institutions utilise private permissioned blockchains and distributed ledgers among other emerging technologies, particularly for essential internal banking processes. However, in the short- to medium term, banking institutions should increase their investments in R&D and strengthen their partnerships with fintechs and other associated parties in order to develop the digital capacity and skills necessary to operate their future technologies.

On the other hand, as executive management codifies the principles of the systems they administer, maintain, and automate in parallel with managing and instigating innovation and creativity, the following recommendation should be into consideration:

- Auditing should transition from a conventional audit model to IT audit and data controllers. With the implementation of technology, the risk and compliance roles are automated. As well, the auditor's role will shift from detecting misinformation or data obfuscation to monitoring automation, as there will not be any information asymmetry and opportunistic behaviour, since technology enhances the level of transparency with real-time accounting and reporting and monitoring, whereby data cannot be manipulated.
- Since emerging technologies eliminate information asymmetry, opportunistic behaviour, and the possibility of collusion and corruption, along with real-time accounting and monitoring as stated above, regulators and banking institutions should reconsider CEO duality, as technology is a utility that provides real-time information to all, which is a prerequisite for the new corporate governance concept. The implementation of CEO duality will improve return on technological investments as the systems will be fully utilised and optimised to reap all its benefits. This in alignment with the IT governance standards, as the Control Objectives for Information and Technology (COBIT) encompasses a main core process of data management that consists of a core process related to data management that state which in turn state for data stewardship. Furthermore, since technology is centred around data and information, and since managers are more informed and knowledgeable than outsiders, in accordance with the stewardship theory, CEO duality in the era of digitalisation is a must.

- It is recommended that central banks and banking institutions invest in R&D and establish a separate R&D organisational unit that is regarded as the source of truth and the central hub of knowledge, with the responsibility of enterprise data management, for the purposes of conducting experimental research, accelerating innovation, big data analytics, knowledge management, data science, strategic and tactical planning, ESEG (environmental social economic governance) performance monitoring, support, and auditability.
- Regulators and banking institutions should consider the appointment of board members with fintech and digital expertise.
- The findings of this research along with the above stated recommendations provide, to some extent, answers to questions stated by the Institut Français des Administrateurs (IFA), who set up a think tank in association with the Club Informatique des Grandes Enterprises Françaises (CIGREF) on the monitoring of digital risks on the role of the Board of Directors in this area, investigating how the board should organise itself to deal with digitisation, and if digital expertise should be introduced to the board (IFA, 2017).
- Additionally, in order to maximise and regulate the flow of data and structure for optimal alignment, there are requirements for the use and implementation of these technologies:
  - Organisational, cultural, and structural shifts are a must.
  - As a result of the adoption of technology, all stakeholders will have access to data and information; therefore, rules and regulations should be imposed to protect the data to prevent conflicts of interest and biased governance practises.
  - Central bank and financial authorities should impose standard rules and regulations on banking institutions to adopt blockchain and smart contract technologies, as they are the best way to protect stakeholders and reduce corruption and collusion in management and environments where power and ownership are concentrated.
  - In addition, central banks should reconsider their position on the acceptance of digital currencies into their banking systems, as this will increase and facilitate the flow of funds, thereby resolving issues such as the problem of money laundering and positively affecting the financial inclusion of unbanked individuals in societies. This acceptance will serve as the catalyst that accelerates innovation and sustainable development.
  - The imposition of advanced technologies will inevitably result in the proliferation and vulnerability of data, which will necessitate the use of cloud storage; therefore, national and sovereign laws should be enacted to protect such data.

- As big data analysis has become commonplace and its use can be exploited to compromise the privacy of individuals, alter cultural norms, and influence the outcomes of events, the outsourcing of the use of such data should be prohibited.
- In order for banks to ensure effectiveness, the adoption of corporate governance practises must be dynamic and extracted from a flexible framework, with the aim of contributing to economic growth and development at both micro and macro levels. This allows for a healthy investment climate, which is considered one of the most important factors for achieving sustainability, thus producing a cyclical environment which directly and indirectly benefits the interests of the institutions practising these frameworks, even if these practises show a negative impact on organisational performance in the short term.
- All relevant stakeholders must adopt best-fit practises based on an organisational strategy and architecture that aim for growth and financial sustainability from a holistic ESG point of view while effectively monitoring corporate performance towards the achievement the desired goals. The organisational strategy must focus on two main pillars to enable flexibility within the bank to create a dynamic governance structure, research, and development, with a focus on intellectual property, in order to build and continuously develop machine learning and artificial intelligence modelling to optimise governance practises towards sustainability goals. This can be done by being adaptable to change and utilising the latest and most advanced information technology systems to improve transparency levels through information flow, as higher transparency levels and the use of technology go hand in hand and lower the need for human intervention.
- Banks must therefore implement well-regulated and highly governed data, as data governance is the backbone and the main nerve to activate and enable machine learning and AI, with the aim of adopting the modern Dynamic and Systemised Capabilities Governance Model.

5.5.3. Limitations

No research is flawless, in the light of limitations and restrictions. Therefore, in this section the limitations, restrictions, and threats to validity and reliability are discussed consecutively.

The first major limitation concerns the number of cross-sections and time series included. The essay consists of two data samples with different time periods in which the first sample consists of 7 countries over a period of 12 years, while the second sample consists of 7 countries over a period of 2 years, which together could make the within-variation a little low. Also, the short

time period in the second sample, the two years 2020 and 2021, is a result of data gap on a global scale; this has been resolved within the past few years through the initiatives outlined by international institutions such as the World Bank, World Economic Forum, and G20 Summit. In a few years, when more data points can be included, stronger conclusions may be drawn.

Secondly, the study measures a time period during which a lot has happened in the world. These exogenous events may have an indirect effect on the model. A simple example can make this abundantly clear: At the beginning of 2020 we saw the the COVID pandemic and its economic consequences, unlike anything we have seen before. This is in parallel with the worldwide cultural changes involving technological advancements.

Also, more specifically, governments and financial services clearly could not and cannot cope with the changed economic environment, resulting in mass layoffs in recent years. This study, however, provides a general insight related to the specific impact at that period showing the statistical significance effect of emerging technologies and digital transformation on G7 banking governance and stability. If more data points become available, along with newly developed measures regarding ICT and DLT, the significance of these exogenous events might be revealed in depth. On the other hand, experience values might be problematic, mainly due to reporting bias. Lastly, due to time constraints, and because of a too wide scope of research, there are various restrictions on this particular research, which might be most interesting to follow up on in further studies.

5.5.4. Avenues for Future Research

Given the limitations of this study, there are several avenues for future research. Foremost, future research should further explore the effects of digitalisation and emerging technologies on managerial incentives, voting rights, reputation, ownership structure, legal and regulatory mechanisms. Moreover, it would be interesting to include control variables of banks' main characteristics such as total assets, market capitalisation and leverage ratio. Further investigation is also needed regarding the impact of such emerging technologies in emerging markets and in comparison, with advanced markets.

Our empirical findings suggest that legislative and regulatory authorities, investors, managers, and other marke practitioners should reconsider the duality of leadership role (CEO duality) as digitalisation is transforming the corporate governance model towards a more agile and autonomous organisation while eliminating the core agency issue between principals and agents by enhancing the productivity and efficiency of the internal audit and eliminating to an extent the manual tasks and

activities of auditing practises in parallel with enhancing the reporting quality in a real time manner and thus higher transparency and effective governance.

Additionally, future research shall provide empirical evidence related to the topic via utilising machine learning and artificial intelligence nodes. Lastly, more research is required on developing complex and dynamic emerging digital technology-enabled corporate governance practises that are the best fit for each corporate culture, ecology and time in relation to a sound investment climate, economic stability, and sustainability, thereby enabling international organisations, regulatory bodies, and banking institutions to have an agile and flexible corporate governance frameworks aiming towards sustainability and economic prosperity, since banking institutions specifically are considered the neural network of global economic development.

Based on the results and recommendations of this study, the researcher suggests the following future studies:

1) The Impact of Emerging Financial Digital Technologies and Digitisation on The Agency Problem of Banking Institutions.
2) The Future of Banking Board of Directors and Internal Audit in the Era of Digitalisation: Advanced vs. Emerging Markets.
3) Duality of Leadership Roles (CEO-Chairperson) in a Decentralised Autonomous Banking Institution (DAO).
4) Designing a New Hybrid Dynamical Banking Corporate Governance System via Experimental Research Utilising Machine-Learning (ML) and Artificial-Intelligence (AI) Modelling Techniques.
5) The Future of Banking Network Supervision in the Era of Digital Finance.
6) The Role of Strategic Planning, Data Science and Knowledge Management (as Intermediate Contractors Between the Environmental, Social, Governance, and Economic (ESGE) Neural Networks of Stakeholders) in Shaping the Future of Banking Corporate Governance.

Chapter 6

6. Postlude

Based on my views, in accordance with the overall thesis, and in my capacity as a CEO of a bank and a board member in several institutions, I see corporate governance of banking institutions as important and significant in relation to sustainable growth at both macro and micro levels.

The leveraged nature of banking institutions is made up of best practises with the aim of increasing transparency, not only between the principals and agents but also to include employees, depositors, borrowers, suppliers, and socio-economic aspects. That said, their degree of importance and impact varies based on time, space, and culture.

In order for banks to survive ever-escalating changes, international regulators, financial authorities, central banks, financial and banking institutions, and investors should consider the adoption of a dynamic corporate governance practises adapted from a flexible framework in order to be effective and in alignment with the digital finance era, aiming to contribute to economic growth and development. This allows for a healthy investment climate, which is considered one of the most important factors towards achieving sustainability, thus producing a cyclical environment which directly and indirectly fairly benefits the interests of all.

Accordingly, and to facilitate the adoption of dynamic and flexible governance frameworks among regulators and underlying institutions, all relevant stakeholders must adopt best-fit practises based on an organisational strategy and architecture that revolve around growth and financial sustainability from a holistic ESG point of view while effectively monitoring corporate performance towards the achievement of the desired goals.

The best practises of corporate governance should be revisited in order to reconsider the duality of CEO/Chairperson roles in the era of digitalisation, along with the reconsideration of both external and internal supervisory functions due to the perceived benefits of the technology, which can be seen to eliminate information asymmetry, opportunistic behaviour, and transactional costs (agency problem).

The organisational strategy must focus on two main pillars to enable flexibility within the bank to create a dynamic governance structure: 1) research and development, with a focus on intellectual property, in order to build and continuously develop machine learning; and 2) artificial intelligence modelling, to optimise governance practises towards sustainability goals. This can be done by being adaptable to change and experimenting with the latest and most advanced information technology systems to improve transparency levels through information flow, as higher transparency levels and the use of technology go hand in hand and enhance integrity via lowering the need

for human intervention. Banks must therefore implement well-regulated and highly governed data management framework, as data governance is the backbone and the main nerve to activate and enable machine learning and AI towards the adoption of the modern Dynamic & Systemised Capabilities Governance Model.

On the other hand, risks associated with technological advancements and cognitive intelligence cannot be fully avoided since they are invented and managed by humans.

This research, by providing empirical evidences, bridges the gap and contribute to the existing body of literature in relation to banking corporate governance via concluding that, with the increased adoption of technological advancements in banking institutions, both the risk and compliance roles are more automated, as well as the auditor's role shifting from manually detecting misinformation or data obfuscation to monitoring automated results and alerts, as the probability of having any information asymmetry and opportunistic behaviour is significantly mitigated via enhanced transparency. Thus, auditors will no longer perform certain responsibilities and their profession’s emphasis will shift from data analysis to emotional intelligence, since technology enhances the level of transparency with real-time accounting, reporting and monitoring.

Furthermore, since technology is centered around data and information, and since managers are more informed and knowledgeable than outsiders (i.e., independent directors) in accordance with the stewardship theory, CEO duality in the era of digitalisation is essential. Therefore, regulators and banking institutions should reinforce the practises of CEO duality, as technology is a utility that provides real-time automated information to all, which is a prerequisite for the new corporate governance concept.

The implementation of CEO duality has the potential to improve the return on technological investments, as technology and related information systems are intended to be fully utilised and optimised to reap all of their benefits. The adoption of technological advancements with CEO duality practices go hand in hand in preventing any exacerbation in agency problems, thereby enabling rapid and smooth digital transformation, as there will be no resistant from agents (executive management) to automate their authority and power, since technology, from internal governance perspective, eliminate the doubt with certainty which in turn mitigate the conflicts between principals and agents. Also, from external perspective, technology will expose banking institutions to external cyber threats, and real-time monitoring and supervision by external authoritative parties, which may necessitate the modernization and reinforcement of integrated and optimised three lines of defense model.

Accordingly, emerging technology is transforming the corporate governance model of banking institutions in the direction of a more agile and autonomous organisation, as the increased and well-regulated adoption of emerging technologies in banking institutions will give the ability to distribute smart contracts equitably between all stakeholders and specifically shareholders and management, thereby eliminating the core agency issue between principals and agents by enhancing the productivity and efficiency of the internal audit and control activities in parallel with enabling a real-time quality reporting promoting higher transparency and effective governance, in contrast to the current model of disciplinary governance, which is characterised by opportunistic behaviour, and information asymmetry.

“Above all those who know is the One who truly knows.”

Quran Surah Yusuf, 76

7. Appendices

7.1. Appendix B: Emerging Technologies, Digitalisation and Banking Corporate Governance, Stability, and Performance – Regression Results

7.1.1. Country-Specific Banking System Sample: Regression Results (2020–2021)

Table 7:1 *US Banking Sample Descriptive Statistics*

Fi*eld*	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Name	--	--	--	--	--		285	2565
Country	--	--	--	--	--	USA	1	2565
Year	0	8	--	--	--		9	2565
Corporate Governance Variables (Independent)								
BODS	4	33	11.35	3.06	11	11	--	2565
ACS	2	14	4.52	1.3	4	4	--	2565
BODGD	0	0.56	0.13	0.1	0.11	0	--	2565
ACMF	0	28	8	3.7	7	5	--	2565
BODCI	2	21	9.21	2.7	9	9	--	2565
BODMF	2	57	11	4.36	11	12	--	2565
GDS	1.00	0.88	0.48	0.14	0.52	0.52	--	2565
CEOD	--	--	--	--	--	1	2	2565
Financial Performance Measures (Dependent Variables of Essay One)								
ROA	-0.001	0.02	0.009	0.004	0.01		--	2565
ROE	-0.013	0.191	0.089	0.037	0.09		--	2565
NIM	0.02	0.053	0.037	0.006	0.036		--	2565
Market Performance Measures (Dependent Variables of Essay Two)								
P/E	0.000	34.362	14.511	6.453	14		--	2565
P/BV	0.000	2.664	1.249	0.505	1.231		--	2565
DIV.Y	0.000	0.06	0.021	0.014	0.022		--	2565
PR	0.000	0.072	0.018	0.017	0.013		--	2565

- *Author's Own*

Table 7:2 *US Banking Sample – Pearson Correlation Matrix*

	CEOD	GDS	BODMF	BODCI	ACMF	BODGD	ACS	BODS
BODS	0.051	0.051	-0.060	0.873	0.087	0.160	0.386	1.000
ACS	0.063	0.121	0.103	0.454	-0.006	0.157	1.000	
BODGD	-0.006	0.311	-0.033	0.269	0.093	1.000		
ACMF	-0.064	0.085	0.150	0.086	1.000			
BODCI	0.087	0.144	0.009	1.000				
BODMF	0.161	0.042	1.000					
GDS	-0.011	1.000						
CEOD	1.000							

- *Author's Own*

Table 7:3 *US Banking Sample – Variance Inflation Factor (VIF)*

Variables	VIF
BODS	4.495
ACS	1.288
BODGD	1.205
ACMF	1.059
BODCI	4.966
BODMF	1.097
GDS	1.136
CEODY	1.046

- *Author's Own*

Table 7:4 *US Banking Sample – OLS Assumptions and Diagnosis*

Assumptions	Result	P/E	P/BV	DIV.Y	PR
Autocorrelation	t-statistic	2.30935	3.37467	28.0066	29.2564
Wooldridge	P-value	0.02164**	0.00084***	<0.0001***	<0.0001***
Normality	Chi-square	765145.06	56098.389	960.497	339253
Test Statistic	P-value	0.0000***	0.0000***	0.0000***	0.0000***
Heteroskedasticity	LM	36.88326	43.484798	84.331786	368.023
White's	P-value	0.73266	0.450665	0.000169***	<0.0001***
Cross Sectional Dependence	Z	165.193	240.834	83.69294	215.172
Asymptotic Test	P-value	0.0000***	0.0000***	0.0000***	0.0000***
Time Dummies	Chi-square	110.376	661.065	154.696	233.263
Wald Joint Asymptotic Test	P-value	<0.0001***	<0.0001***	<0.0001***	<0.0001***
OLS Or Fixed Effects	F	1.1872	4.44484	15.2104	66.4403
Joint Asymptotic	P-value	0.02309**	<0.0001***	0.0000***	0.0000***
OLS or Random Effects	LM	3.14613	774.05	3534.5	7734.34
Breusch-Pagan	P-value	0.076107*	<0.0001***	0.0000***	0.0000***
Random or Fixed Effects	H	8.62	4.97684	42.2633	15.5744
Hausman	P-value	0.37554	0.760048	<0.0001***	0.048893**
Analysis of Variance	F	0.23203	2.03226	1.6589	1.0845
ANOVA	P-value	0.9847	0.0427**	0.1082	0.3739

- *Author's Own*

Table 7:5 *US Sample – Empirical Findings – Dependent: ROA*

ROA	OLS	FE	RE	GLMM
Constant	0.0094	0.0092	0.0091	-4.654
	<0.0001***	<0.0001***	<0.0001***	0.000***
BODS	0.0001	-0.0004	-0.0001	-0.009
	0.1142	0.0079***	0.4289	0.261
ACS	-0.0001	0.0001	0.0000	-0.016
	0.1505	0.5723	0.8001	0.086*
BODGD	0.0031	0.0083	0.0057	0.421
	0.0058***	<0.0001***	<0.0001***	0.0000***
ACMF	0.0000	0.0000	0.0000	0.001
	0.5655	0.6226	0.5537	0.797
BODCI	-0.0001	0.0003	0.0001	0.012
	0.4026	0.0123**	0.3625	0.153
BODMF	-0.0002	-0.0002	-0.0002	-0.018
	<0.0001***	<0.0001***	0.0015***	0.0000***
GDS	0.0031	0.0042	0.0039	0.318
	<0.0001***	<0.0001***	0.0337**	0.007***
CEODY	-0.0004	0.0000	-0.0002	-0.002
	0.0906*	0.9055	0.5814	0.943
R-squared	*0.036513*	*0.415401*		
F (8, 284)	*12.10793*	*5.528863*		
Log-likelihood	*9827.659*	*10468.44*	*9815.127*	
S.E. of regression	*0.005255*	*0.004341*		
Adjusted R-squared	*0.033497*	*0.0478*	*0.005345*	
P-value(F)	*<0.0001***	*8.40E-126*	*0.005279*	
Akaike criterion	*−19637.32*	*−20350.88*	*−19612.25*	*1904.01*
Durbin-Watson	*0.898*	*1.482*	*1.482*	

- *Author's Own*

Table 7:6 *US Sample – Empirical Findings – Dependent: ROE*

ROE	OLS	FE	RE	GLMM
Constant	0.0896	0.11	0.094	-2.3
	<0.0001***	<0.0001***	<0.0001***	0.0000***
BODS	0.001	-0.0035	-0.0003	-0.012
	0.223	0.0393**	0.7846	0.125
ACS	-0.0002	0.0014	0.0003	-0.008
	0.8641	0.4402	0.7918	0.373
BODGD	0.0392	0.0422	0.039	0.393
	0.0027***	0.0644*	0.0083***	0.0000***
ACMF	-0.0004	0.0001	-0.0002	-0.003
	0.2498	0.8289	0.6671	0.374
BODCI	-0.0013	0.0023	-0.0002	0.006
	0.1813	0.182	0.8913	0.527
BODMF	-0.0011	-0.0025	-0.0016	-0.014
	<0.0001***	<0.0001***	0.0084***	0.0000***
GDS	0.023	0.0258	0.025	0.223
	0.0093***	0.0218**	0.1331	0.057*
CEODY	-0.001	-0.0020	-0.0012	-0.014
	0.699	0.6863	0.7229	0.617
R-squared	*0.016881*	*0.273586*		
F (8, 284)	*5.486238*	*2.930459*		
Log-likelihood	*3577.148*	*3965.245*	*3574.717*	
S.E. of regression	*0.060098*	*0.054793*		
Adjusted R-squared	*0.013804*	*0.018558*	*0.060517*	
P-value(F)	*<0.0001****	*<0.0001****	*0.060143**	
Akaike criterion	*−7136.296*	*−7344.490*	*−7131.434*	*1903.02*
Durbin-Watson	*1.201*	*1.623*	*1.623*	

- *Author's Own*

Table 7:7 *US Sample – Empirical Findings – Dependent: NIM*

NIM	OLS	FE	RE	GLMM
Constant	0.0377	0.0355	0.0368	-3.271
	<0.0001***	<0.0001***	<0.0001***	0.0000***
BODS	-0.0004	0.0002	-0.0003	0.001
	0.2357	0.786	0.4484	0.87
ACS	0.0003	0	0.0002	-0.002
	0.4975	0.9454	0.6251	0.549
BODGD	-0.0086	-0.0132	-0.0095	-0.228
	0.0723*	0.1144	0.0843*	0.0000***
ACMF	-0.0001	-0.0001	-0.0001	0
	0.4811	0.6067	0.5203	0.775
BODCI	0.0003	-0.0004	0.0002	-0.001
	0.3376	0.4421	0.5962	0.803
BODMF	-0.0002	-0.0002	-0.0002	-0.002
	0.0188**	0.1624	0.0473**	0.049**
GDS	0.0068	0.0181	0.0098	-0.047
	0.0359**	0.0614*	0.0051***	0.314
CEODY	0.0014	-0.0003	0.0012	0
	0.1323	0.6455	0.2559	0.972
R-squared	*0.005856*	*0.178901*		
F (8, 284)	*1.881958*			
Log-likelihood	*6145.931*	*6391.195*	*6145.45*	
S.E. of regression	*0.022076*	*0.02128*	*0.022076*	
Adjusted R-squared	*0.002744*	*0.008391*		
P-value(F)	*<0.0001****			
Akaike criterion	*−12273.86*	*−12196.39*	*−12272.90*	*-3709.04*
Durbin-Watson	*1.368*	*1.653*	*1.653*	

- *Author's Own*

Table 7:8 *US Sample – Empirical Findings – Dependent: P/E*

PE	OLS	FE	RE	GLMM
Constant	11.4754	13.5203	11.6564	2.115
	0.0075***	0.1664	0.0079***	0.0000***
BODS	-0.0907	-1.6619	-0.1683	0.001
	0.9151	0.1034	0.839	0.866
ACS	0.6422	-0.438	0.5882	0.002
	0.2944	0.844	0.3838	0.892
BODGD	-13.9094	-5.6693	-13.6052	-0.263
	0.0249**	0.54	0.0245**	0.077*
ACMF	0.0854	0.3109	0.0987	-0.001
	0.8062	0.4985	0.7773	0.763
BODCI	-0.3637	2.0424	-0.2502	0.003
	0.6947	0.1137	0.7827	0.743
BODMF	0.0413	-0.4018	0.0197	0.001
	0.832	0.1731	0.9164	0.739
GDS	19.4862	16.1435	19.2781	1.068
	<0.0001***	<0.0001***	<0.0001***	0.0000***
CEODY	-2.7625	0.4038	−2.62805	0.029
	0.2158	0.6383	0.2199	0.22
R-squared	*0.006494*	*0.134878*		
F (8, 284)	*5.1681*			
P-value(F)	*<0.0001****			
Log-likelihood	*−13152.72*	*−12975.26*	*−13152.75*	
S.E. of regression	*40.878*	*40.459*	*40.870*	
Adjusted R-squared	*0.003384*	*0.00388*		
Akaike criterion	*26323.44*	*26536.52*	*26323.49*	*2697.065*
Durbin-Watson	*1.849894*	*2.121869*	*2.121869*	

- *Author's Own*

Table 7:9 *US Sample – Empirical Findings – Dependent: P/BV*

PBV	OLS	FE	RE	GLMM
Constant	0.8359	0.9155	0.8652	0.718
	<0.0001***	<0.0001***	<0.0001***	0.0000***
BODS	0.0213	-0.0107	0.0096	0.004
	0.0253**	0.504	0.4374	0.754
ACS	0.0073	-0.0149	-0.0055	-0.004
	0.5404	0.3287	0.6706	0.714
BODGD	0.4456	0.5266	0.4809	0.243
	0.0031***	0.0046**	0.0019***	0.116
ACMF	-0.0079	-0.0116	-0.0094	-0.009
	0.0377**	0.059*	0.042**	0.066*
BODCI	-0.0195	0.0127	-0.0056	-0.000001
	0.0852*	0.4863	0.701	0.977
BODMF	-0.0104	-0.003	-0.0075	-0.005
	0.0016***	0.5607	0.0512*	0.109
GDS	0.9712	0.9836	0.9785	1.223
	<0.0001***	0.0078***	0.0045***	0.0000***
CEODY	-0.0146	0.0135	-0.0074	0.02
	0.6209	0.7163	0.8293	0.488
R-squared	*0.054147*	*0.391971*		
F (8, 284)	*18.2903*			
P-value(F)	*<0.0001****			
Log-likelihood	*−2701.588*	*−2134.897*	*−2703.621*	
S.E. of regression	*0.695*	*0.591*	*0.695*	
Adjusted R-squared	*0.051187*	*0.039167*		
Akaike criterion	*5421.176*	*4855.794*	*5425.242*	*2011.453*
Durbin-Watson	*1.007405*	*1.566662*	*1.566662*	

- *Author's Own*

Table 7:10 *US Sample – Empirical Findings – Dependent: DIV.Y*

DIVY	OLS	FE	RE	GLMM
Constant	0.01298	0.02606	0.02353	-3.737
	<0.0001***	<0.0001***	<0.0001***	0.0000***
BODS	0.00048	0.0003	0.00026	0.011
	0.0161**	0.2855	0.4711	0.351
ACS	0.00077	-0.00008	0.00014	0.003
	0.0021***	0.7998	0.6413	0.823
BODGD	0.01382	-0.00069	0.00263	-0.074
	<0.0001***	0.8558	0.569	0.714
ACMF	-0.00042	-0.00005	-0.00014	-0.02
	<0.0001***	0.6403	0.1755	0.002***
BODCI	-0.00076	-0.00045	-0.00041	-0.028
	0.0013***	0.1206	0.3244	0.036**
BODMF	0.0001	-0.00006	0	-0.003
	0.1386	0.5126	0.9798	0.433
GDS	0.01371	-0.00248	-0.00051	-0.068
	<0.0001***	0.1831	0.8223	0.657
CEODY	0.0008	-0.00173	-0.00105	0.024
	0.1972	0.0351**	0.3176	0.506
R-squared	*0.044643*	*0.670714*		
F (8, 284)	*14.9301*	*15.84852*		
P-value(F)	*<0.0001****	*0*		
Log-likelihood	*7209.361*	*8575.425*	*7155.778*	
S.E. of regression	*0.015*	*0.009*	*0.015*	
Adjusted R-squared	*0.041653*	*0.004967*		
Akaike criterion	*-14400.72*	*-16564.85*	*-14293.56*	*3894.569*
Durbin-Watson	*0.379701*	*1.080229*	*1.080229*	

- *Author's Own*

Table 7:11 *US Sample – Empirical Findings – Dependent: PR*

PR	OLS	FE	RE	GLMM
Constant	0.0642	0.0073	0.0108	-5.177
	<0.0001***	0.2298	0.3314	0.0000***
BODS	-0.0008	-0.001	-0.0009	0.022
	0.5889	0.1588	0.2067	0.265
ACS	-0.0022	0.0007	0.0005	-0.027
	0.247	0.6536	0.7175	0.272
BODGD	-0.0196	0.0456	0.0417	1.652
	0.4017	<0.0001***	<0.0001***	0.0000***
ACMF	0.0032	0.0007	0.0008	0.006
	<0.0001***	0.1161	0.0844*	0.507
BODCI	-0.0013	0.001	0.0007	0.008
	0.4695	0.1241	0.2547	0.69
BODMF	0.0004	-0.000021	0	-0.003
	0.4391	0.9115	0.9209	0.69
GDS	-0.0439	0.0176	0.0158	1.023
	0.0058***	0.0072***	0.0456**	0.004***
CEODY	-0.0205	-0.0022	-0.0035	0.011
	<0.0001***	0.5835	0.3982	0.837
R-squared	*0.029644*	*0.895717*		
F (8, 284)	*9.7605*			
P-value(F)	*<0.0001****			
Log-likelihood	*2075.768*	*4936.457*	*2035.682*	
S.E. of regression	*0.108*	*0.038*	*0.110*	
Adjusted R-squared	*0.026606*	*0.012036*		
Akaike criterion	*-4133.536*	*-9286.914*	*-4053.365*	*6165.614*
Durbin-Watson	*0.159654*	*1.421944*	*1.421944*	

- *Author's Own*

7.1.2. G6 Banking Sample Descriptive Statistics

Table 7:12 *G6 Banking Sample – Descriptive Statistics*

Variable Type	Field	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Descriptive Variables	Name	--	--	--	--	--		112	1008
	Country	--	--	--	--	--	Japan	6	1008
	Year	0	8	--	--	--		9	1008
Corporate Governance Variables (Independent)	BODS	4	24	11.954	3.623	12	10	--	1008
	ACS	0	9	1.913	2.532	0	0	--	1008
	BODGD	0	0.538	0.107	0.137	0.061	0	--	1008
	ACMF	0	51	12.442	6.115	13	14	--	1008
	BODCI	0	18	4.549	4.416	3	2	--	1008
	BODMF	3	39	14.388	4.897	13	12	--	1008
	GDS	1.000	0.821	0.462	0.151	0.464	0.464	--	1008
	CEOD	--	--	--	--	--	1	2	1008
Financial Performance Measures (Dependent Variables of Essay One)	ROA	-0.007	0.012	0.003	0.003	0.002		--	1008
	ROE	-0.081	0.193	0.053	0.053	0.047		--	1008
	NIM	0.003	0.024	0.014	0.004	0.013		--	1008
Market Performance Measures (Dependent Variables of Essay)	P/E	0	27.475	10.962	6.215	10.43		--	1008
	P/BV	0	1.807	0.64	0.421	0.507		--	1008
	DIV.Y	0	0.062	0.025	0.015	0.022		--	1008
	PR	0.001	4.571	1.175	1.231	0.748		--	1008

- *Author's Own*

Table 7:13 *G6 Banking Sample – Pearson Correlation Matrix*

	CEOD	GDS	BODMF	BODCI	ACMF	BODGD	ACS	BODS
BODS	0.331	0.298	-0.094	0.587	-0.168	0.399	0.442	1.000
ACS	0.342	0.333	-0.286	0.691	-0.166	0.573	1.000	
BODGD	0.411	0.459	-0.128	0.737	-0.296	1.000		
ACMF	-0.276	0.083	0.425	-0.331	1.000			
BODCI	0.502	0.364	-0.201	1.000				
BODMF	-0.179	-0.048	1.000					
GDS	0.145	1.000						
CEOD	1.000							

- *Author's Own*

Table 7:14 *G6 Banking Sample – Variance Inflation Factor (VIF)*

CG Variables	VIF
BODS	1.578
ACS	2.146
BODGD	2.605
ACMF	1.518
BODCI	3.734
BODMF	1.352
GDS	1.414
CEOD	1.379

- *Author's Own*

Table 7:15 *G6 Banking Sample – OLS Test Assumptions and Diagnosis – Market Performance Models*

Assumptions	Result	ROA	ROE	NIM
Autocorrelation Wooldridge	t-statistic	4.96635	7.58918	24.0874
	P-value	*<0.0001****	*<0.0001****	*<0.0001****
Normality Test Statistic	Chi-square	848.544	513.211	1990.863
	P-value	*0.0000****	*0.0000****	*0.0000****
Heteroskedasticity White's	LM	130.3283	124.1216	493.92972
	P-value	*0.0000****	*0.0000****	*0.0000****
Cross Sectional Dependence Asymptotic Test	Z	12.2887	28.4451	66.1464
	P-value	*<0.0001****	*<0.0001****	*0.0000****
Time Dummies Wald Joint Asymptotic Test	Chi-square	22.3496	30.0578	91.712
	P-value	*0.00431****	*0.000206****	*<0.0001****
OLS Or Fixed Effects Joint Asymptotic	F	3.77443	10.4183	34.8363
	P-value	*<0.0001****	*<0.0001****	*<0.0001****
OLS or Random Effects Breusch-Pagan	LM	206.638	970.754	2057.29
	P-value	*<0.0001****	*<0.0001****	*0.0000****
Random or Fixed Effects Hausman	H	8.61506	16.5452	75.0115
	P-value	*0.375801*	*0.03521***	*<0.0001****
Analysis of Variance ANOVA	F	0.786652	1.36812	4.10665
	P-value	*0.6154*	*0.2183*	*0.0003****

- *Author's Own*

Table 7:16 *G6 Banking Sample – OLS Test Assumptions and Diagnosis – Financial Performance Models*

Assumptions	Result	P/E	P/BV	DIV.Y	PR
Autocorrelation Wooldridge	t-statistic	1.92811	47.0956	18.7316	21.1535
	P-value	*0.056396**	*<0.0001***	*<0.0001***	*<0.0001***
Normality Test Statistic	Chi-square	49406.705	29120.396	207.552	619.842
	P-value	*0.0000***	*0.0000***	*0.0000***	*0.0000***
Heteroskedasticity White's	LM	60.218774	55.363396	180.49452	88.852641
	P-value	*0.042332***	*0.097884**	*0.0000***	*<0.0001***
Cross Sectional Dependence Asymptotic Test	Z	15.696778	58.3707	49.9612	35.3968
	P-value	*<0.0001***	*0.0000***	*0.0000***	*<0.0001***
Time Dummies Wald Joint Asymptotic Test	Chi-square	23.6305	115.519	68.7997	80.5642
	P-value	*0.00264***	*<0.0001***	*<0.0001***	*<0.0001***
OLS Or Fixed Effects Joint Asymptotic	F	1.73069	368.308	5.14508	14.8792
	P-value	*<0.0001***	*0.0000***	*<0.0001***	*<0.0001***
OLS or Random Effects Breusch-Pagan	LM	16.5158	3666.98	187.643	1289.62
	P-value	*<0.0001***	*0.0000***	*<0.0001***	*<0.0001***
Random or Fixed Effects Hausman	H	11.82	13.6942	111.35	44.7552
	P-value	*0.15953*	*0.09009**	*<0.0001***	*<0.0001***
Analysis of Variance ANOVA	F	2388.54	0.776371	1.71898	4.26283
	P-value	*0.471087*	*0.6243*	*0.1017*	*0.0002****

- *Author's Own*

Table 7:17 *G6 Banking Sample – Empirical Findings – Dependent: ROA*

ROA	OLS	FE	RE	GLMM
Constant	0.0058	0.0009	0.0040	-6.1320
	0.0001***	0.8276	0.0508*	0.0000***
BODS	-0.0001	0.0003	0.0000	0.0020
	0.1112	0.0579*	0.8337	0.9120
ACS	-0.00020	0.0000	0.0000	0.0540
	0.2881	0.9871	0.8036	0.061*
BODGD	0.0087	0.0080	0.0077	0.7160
	0.0058***	0.0538*	0.0279**	0.1190
ACMF	0.0000	-0.0001	-0.0001	0.0050
	0.7648	0.4582	0.3198	0.6000
BODCI	-0.0002	-0.0004	-0.0003	-0.0660
	0.1368	0.0202**	0.0371**	0.015**
BODMF	-0.0003	-0.0002	-0.0003	-0.0150
	<0.0001***	0.0683*	0.0015***	0.5190
GDS	0.0074	0.0093	0.0081	0.3180
	0.0004***	0.1911	0.0008***	0.3770
CEODY	-0.0010	-0.00040	-0.00080	0.0320
	0.1194	0.2832	0.3167	0.9360
Mean dependent var	0.002515	0.002515	0.002515	
Sum squared resid	0.071125	0.048325	0.071526	
R-squared	0.053654	0.357016		
F (8, 111)	7.079867			
Log-likelihood	3387.464	3582.254	3384.636	
S.D. dependent var	0.008639	0.008639	0.008639	
S.E. of regression	0.008438	0.007377	0.008457	
Adjusted R-squared	0.046075	0.032283		
P-value(F)	<0.0001***			
Akaike criterion	-6756.928	-6924.508	-6751.271	3606.72
Durbin-Watson	0.768459	1.121204	1.121204	

- *Author's Own*

Table 7:18 *G6 Banking Sample – Empirical Findings – Dependent: ROE*

ROE	OLS	FE	RE	GLMM
Constant	0.1052	0.0107	0.0485	-2.762
	<0.0001***	0.6484	0.0448**	0.0000***
BODS	-0.0037	0.0029	0.0005	0.003
	<0.0001***	0.0373**	0.726	0.844
ACS	-0.0001	-0.0001	0.0006	0.004
	0.9559	0.9333	0.8224	0.866
BODGD	0.0943	0.0835	0.0867	-0.268
	0.0016***	0.0089***	0.068*	0.535
ACMF	0.0008	0.0017	0.0011	-0.007
	0.1114	0.0221**	0.3641	0.435
BODCI	0	-0.003	-0.002	-0.023
	0.9912	0.0682*	0.3809	0.314
BODMF	-0.0038	-0.0014	-0.0022	-0.026
	<0.0001***	0.0782*	0.1758	0.01***
GDS	0.062	0.0266	0.033	0.332
	0.0019***	0.2191	0.1891	0.073*
CEODY	-0.0116	-0.0089	-0.0086	0.06
	0.0534*	0.2404	0.2605	0.411
Mean dependent var	0.0485	0.0485	0.0485	
Sum squared resid	6.411077	2.784655	6.65143	
R-squared	0.089753	0.604634		
F (8, 111)	12.3131	11.41193		
Log-likelihood	1118.789	1539.076	1100.239	
S.D. dependent var	0.083632	0.083632	0.083632	
S.E. of regression	0.080109	0.055999	0.081556	
Adjusted R-squared	0.082464	0.027133		
P-value(F)	<0.0001***	<0.0001***		
Akaike criterion	-2219.578	-2838.152	-2182.479	2585.758
Durbin-Watson	0.841235	1.921713	1.921713	

- *Author's Own*

Table 7:19 *G6 Banking Sample – Empirical Findings – Dependent: NIM*

NIM	OLS	FE	RE	GLMM
Constant	0.0282	0.0167	0.0181	-4.193
	<0.0001***	<0.0001***	<0.0001***	0.0000***
BODS	-0.0007	0.0001	0	-0.001
	<0.0001***	0.1779	0.8033	0.797
ACS	0.0004	-0.0001	-0.0001	0.01
	0.0006***	0.3077	0.6406	0.0107**
BODGD	0.0049	-0.0046	-0.0024	-0.28
	0.0613*	0.0127**	0.4577	0.001***
ACMF	-0.0001	0	-0.0001	-0.003
	0.0014***	0.6532	0.4379	0.15
BODCI	0.0004	-0.0004	-0.0001	-0.036
	<0.0001***	0.0001***	0.1365	0.0000***
BODMF	-0.0002	0	-0.0001	-0.003
	<0.0001***	0.5177	0.5128	0.188
GDS	-0.0093	-0.0022	-0.0026	-0.146
	<0.0001***	0.081	0.0515*	0.056*
CEODY	0.0015	-0.0002	0.0002	0.016
	0.0053***	0.6773	0.5091	0.225
Mean dependent var	*0.014383*	*0.014383*	*0.014383*	
Sum squared residuals	*0.049112*	*0.009172*	*0.065486*	
R-squared	*0.22838*	*0.855894*		
F (8, 111)	*36.95982*	*44.32045*		
Log-likelihood	*3574.12*	*4419.803*	*3429.094*	
S.D. dependent var	*0.00795*	*0.00795*	*0.00795*	
S.E. of regression	*0.007011*	*0.003214*	*0.008092*	
Adjusted R-squared	*0.222201*	*0.051967*		
P-value(F)	*<0.0001****	*5.70E-301*		
Akaike criterion	*-7130.24*	*-8599.607*	*-6840.188*	
Durbin-Watson	*0.107115*	*0.393561*	*0.393561*	*-953.145*

- *Author's Own*

Table 7:20 *G6 Banking Sample – Empirical Findings – Dependent: P/E*

PE	OLS	FE	RE
Constant	8.7744	16.6167	8.7659
	0.0349**	0.0719*	0.0746*
BODS	0.9979	1.1494	1.0294
	0.0001***	0.1022	0.0008***
ACS	-0.3562	-0.7546	-0.2687
	0.4106	0.0363**	0.5774
BODGD	16.9319	0.4829	13.5411
	0.0558*	0.5235	0.1601
ACMF	-0.3143	-0.3145	-0.3260
	0.0373**	0.1496	0.0609*
BODCI	-0.5243	-1.9866	-0.6221
	0.1095	0.0743*	0.0951*
BODMF	-0.2216	-6.2722	-0.2795
	0.2124	0.5696	0.1681
GDS	3.3553	14.4754	5.6828
	0.5685	0.3351	0.3839
CEODY	-1.0230	-0.2912	-0.7128
	0.5635	0.8187	0.7247
R-squared	0.032837	0.204856	
F (8, 111)	4.239787		
Log-likelihood	−4618.067	−4519.362	−4618.406
S.E. of regression	23.73525	22.82671	23.73135
Adjusted R-squared	0.025092	0.020941	
P-value(F)	<0.0001***		
Akaike criterion	9254.134	9278.724	9254.811
Durbin-Watson	1.7366	2.089794	2.089794

- *Author's Own*

Table 7:21 *G6 Banking Sample – Empirical Findings – Dependent: P/BV*

PBV	OLS	FE	RE
Constant	1.2589	0.6720	0.6770
	<0.0001***	<0.0001***	0.0005***
BODS	-0.0489	0.0199	0.0190
	0.0013***	0.0002***	0.0008***
ACS	-0.0391	-0.0038	-0.0040
	0.1232	0.5677	0.4426
BODGD	1.4858	-0.4772	-0.4538
	0.0042***	0.0001***	0.0171**
ACMF	0.0033	-0.0057	-0.0061
	0.7065	0.0424**	0.0458**
BODCI	0.0045	-0.0291	-0.0274
	0.8141	<0.0001***	<0.0001***
BODMF	-0.0236	-0.0023	-0.0025
	0.0237**	0.4358	0.5423
GDS	0.1746	0.4270	0.4257
	0.6125	<0.0001***	0.1149
CEODY	0.4230	-0.0187	-0.0129
	<0.0001***	0.5207	0.6066
R-squared	0.05299	0.979867	
F (8, 111)	6.987337	363.1888	
Log-likelihood	−1758.270	182.6179	−1801.071
S.E. of regression	1.390775	0.215083	
Adjusted R-squared	0.045406	0.078	1.423467
P-value(F)	<0.0001***	0	1.450375
Akaike criterion	3534.539	-125.2358	3620.141
Durbin-Watson	0.040456	1.30097	1.30097

- *Author's Own*

Table 7:22 *G6 Banking Sample – Empirical Findings – Dependent: DIV.Y*

DIVY	OLS	FE	RE
Constant	0.0127	0.0493	0.0229
	<0.0001***	<0.0001***	0.0002***
BODS	0.0003	-0.0007	0.0001
	0.0935*	0.0375**	0.7676
ACS	0.0002	0.0016	0.0006
	0.5579	<0.0001***	0.1595
BODGD	0.0099	-0.0340	-0.0090
	0.1003	<0.0001***	0.5201
ACMF	-0.0001	-0.0007	-0.0003
	0.4133	<0.0001***	0.0498**
BODCI	0.0005	-0.0004	0.0005
	0.0359**	0.3261	0.1932
BODMF	0.0000	0.0001	0.0001
	0.8361	0.7819	0.5454
GDS	0.0126	-0.0155	-0.0010
	0.0016***	0.0027***	0.8916
CEODY	0.0009	0.0034	0.0023
	0.4406	0.0623*	0.0935*
R-squared	0.110234	0.458495	
F (8, 111)	15.47083	6.318265	
Log-likelihood	2734.85	2985.139	2709.785
S.E. of regression	0.016122	0.01334	0.016519
Adjusted R-squared	0.103108	0.073853	
P-value(F)	<0.0001***	<0.0001***	
Akaike criterion	-5451.7	-5730.279	-5401.571
Durbin-Watson	0.666682	1.067609	1.067609

- *Author's Own*

Table 7:23 *G6 Banking Sample – Empirical Findings – Dependent: PR*

PR	OLS	FE	RE
Constant	1.1052	1.1091	1.2513
	<0.0001***	0.0004***	0.0001***
BODS	0.0405	-0.0002	0.0111
	0.0019***	0.9930	0.6248
ACS	0.0439	0.0511	0.0600
	0.043**	0.0258**	0.0425**
BODGD	-2.7748	-0.5138	-1.3052
	<0.0001***	0.2263	0.0007***
ACMF	-0.0044	-0.0182	-0.0062
	0.5576	0.0614*	0.4556
BODCI	-0.1096	0.0147	-0.0486
	<0.0001***	0.4971	0.0229**
BODMF	-0.0021	0.0093	0.0045
	0.8123	0.3717	0.7588
GDS	1.1406	0.2367	0.3476
	0.0001***	0.4120	0.0312**
CEODY	-0.1917	-0.0398	-0.1332
	0.0309**	0.6944	0.3419
R-squared	*0.235024*	*0.732517*	
F (8, 111)	*38.36551*	*20.4356*	
Log-likelihood	*-1600.122*	*-1070.525*	*-1654.207*
S.E. of regression	*1.188828*	*0.745624*	*1.253731*
Adjusted R-squared	*0.228898*	*0.014866*	
P-value(F)	*<0.0001****	*<0.0001****	
Akaike criterion	*3218.244*	*2381.05*	*3326.414*
Durbin-Watson	*0.574299*	*1.59569*	*1.59569*

- *Author's Own*

7.2. Appendix B: Emerging Technologies, Digitalisation and Banking Corporate Governance, Stability, and Performance – Regression Results

7.2.1. Country-Specific Banking System Sample: Regression Results (2020–2021)

Table 7:24 *ESG Disclosures and Emerging Technologies Regression Results*

ESGDS	OLS		FE		RE	
Constant	31.4796	0.4803	4.7809	0.1648	9.3242	0.5012
IoT	-0.7663	0.2489	-0.4402	0.0002***	-0.2844	0.0143**
AI	-0.8013	0.3994	-0.0347	0.0026***	-0.0092	0.6868
CC.F&A	-0.0075	0.9881	3.4272	0.0004***	2.1700	0.0221**
Big.D	8.2431	0.4474	-8.8649	0.0033***	-3.2450	0.4791
R-squared	*0.2479*		*0.9999*			
Adjusted R-squared	*-0.2534*		*0.9886*			
F (4, 14)	*3.5464*					
P-value(F)	*0.098763**					
S.E. of regression	*14.1758*		*0.3480*		*31.7054*	
Log-likelihood	*-41.4415*		*9.1916*		*−51.14376*	
Schwarz criterion	*94.8724*		*5.5957*		*114.2770*	
Akaike criterion	*92.8830*		*1.6168*		*112.2875*	
Hannan-Quinn	*91.6289*		*−0.891415*		*111.0334*	

- *Author's Own*

Table 7:25 *Audit Committee Size and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	3.3102	*0.3190*	5.0712	*0.1174*	3.3102	*0.2686*
IoT	0.0369	*0.2230*	-0.0814	*0.0027***	0.0369	*0.1643*
AI	0.1077	*0.6577*	-0.0470	*0.0365***	0.1077	*0.6378*
CC.F&A	-0.0873	*0.0235***	0.9203	*<0.0001****	-0.0873	*0.0013****
Big.D	0.3416	*0.3844*	-4.7385	*0.0001****	0.3416	*0.3407*
R-squared	*0.4639*		*0.9891*			
Adjusted R-squared	*0.1576*		*0.9781*			
F (4, 14)	*34.1395*					
P-value(F)	*0.0008****					
S.E. of regression	*1.4041*		*0.3737*		*1.3134*	
Log-likelihood	*-17.8661*		*5.5340*		*−17.86610*	
Schwarz criterion	*48.1567*		*13.7810*		*48.1567*	
Akaike criterion	*45.7322*		*8.9319*		*45.7322*	
Hannan-Quinn	*44.8346*		*7.1366*		*44.8346*	

- *Author's Own*

Table 7:26 *Audit Committee Meeting Frequency and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	29.0842	0.1555	9.1021	0.1841	9.2057	0.0455**
IoT	0.1723	0.4061	0.0853	0.017**	0.0570	0.0565*
AI	-0.4158	0.5033	0.0441	0.0868*	0.0206	0.1243
CC.F&A	0.2724	0.2179	-0.5669	0.0005***	-0.4359	0.0007***
Big.D	-5.7090	0.2336	3.1384	0.0186**	2.5905	0.0206**
R-squared	*0.3949*		*0.9992*			
Adjusted R-squared	*0.0492*		*0.9167*			
F (4, 14)	*12.9943*					
P-value(F)	*0.007484****					
S.E. of regression	*6.7029*		*0.4448*		*12.2296*	
Log-likelihood	*-36.6238*		*3.4462*		*-44.6407*	
Schwarz criterion	*85.6722*		*17.9568*		*101.7060*	
Akaike criterion	*83.2476*		*13.1077*		*99.2815*	
Hannan-Quinn	*82.3500*		*11.3124*		*98.3838*	

- *Author's Own*

Table 7:27 *Board Size and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	19.8100	*0.014***	23.6655	*0.0024****	22.1415	*<0.0001****
IoT	0.0182	*0.6894*	-0.0270	*0.3137*	0.1333	*0.059**
AI	0.1457	*0.6726*	-0.0359	*0.2462*	0.1677	*0.5496*
CC.F&A	-0.2736	*0.0102***	1.0464	*<0.0001****	-0.2249	*0.1662*
Big.D	-0.0051	*0.9940*	-7.7024	*0.0001****	-1.5217	*0.061**
R-squared	*0.6954*		*0.9939*			
Adjusted R-squared	*0.5214*		*0.9710*			
F (4, 14)	*418.6453*					
P-value(F)	*<0.0001****					
S.E. of regression	*2.3504*		*0.6201*		*2.6000*	
Log-likelihood	*-24.0483*		*-0.5415*		*-26.0604*	
Schwarz criterion	*60.5212*		*25.9321*		*64.5454*	
Akaike criterion	*58.0967*		*21.0831*		*62.1208*	
Hannan-Quinn	*57.1990*		*19.2878*		*61.2232*	

- *Author's Own*

Table 7:28 *Board Meeting Frequency and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	23.213	*0.0782**	9.8627	*<0.0001****	9.898	*<0.0001****
IoT	0.0474	*0.7464*	-0.1034	*<0.0001****	-0.1032	*<0.0001****
AI	-0.09577	*0.7182*	0.0583	*<0.0001****	0.0583	*<0.0001****
CC.F&A	0.06124	*0.6621*	0.2682	*<0.0001****	0.267	*<0.0001****
Big.D	-2.599	*0.3669*	-0.2091	*0.0295***	-0.2117	*0.0027***
R-squared	*0.280928*		*0.999963*			
Adjusted R-squared	*-0.129971*		*0.995654*			
F (4, 14)	*1.952103*					
P-value(F)	*0.094032**					
S.E. of regression	*4.252855*		*0.0568*		*5.035224*	
Log-likelihood	*-31.16437*		*28.14188*		*-33.99197*	
Schwarz criterion	*74.75327*		*-31.4347*		*80.40847*	
Akaike criterion	*72.32874*		*-36.28377*		*77.98394*	
Hannan-Quinn	*71.43109*		*-38.07906*		*77.08629*	

- *Author's Own*

Table 7:29 *CEO Duality and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	99.3293	*0.1924*	78.1858	*<0.0001***	79.1226	*<0.0001****
IoT	0.0665	*0.9102*	0.0173	*0.3098*	0.0357	*0.2121*
AI	-0.9952	*0.5321*	0.1391	*0.0002****	0.1473	*<0.0001****
CC.F&A	-1.4073	*0.1279*	-0.0757	*0.1463*	-0.1620	*0.1133*
Big.D	5.7385	*0.7157*	1.4650	*0.0507**	1.6256	*0.0384***
R-squared	*0.4078*		*1.0000*			
Adjusted R-squared	*0.0693*		*0.8362*			
F (4, 14)	*7.4242*					
P-value(F)	*0.024751***					
S.E. of regression	*23.2960*		*0.2954*		*26.9732*	
Log-likelihood	*-51.5727*		*8.3575*		*-54.1326*	
Schwarz criterion	*115.5699*		*8.1340*		*120.6897*	
Akaike criterion	*113.1453*		*3.2850*		*118.2651*	
Hannan-Quinn	*112.2477*		*1.4897*		*117.3675*	

- *Author's Own*

Table 7:30 *Z- Score and Emerging Technologies Regression Results*

	OLS		**FE**		**RE**	
Constant	-11.00	*0.4187*	6.9103	*0.0121***	6.1770	*0.0575**
IoT	-0.045	*0.7194*	0.0810	*0.0001****	0.0823	*<0.0001****
AI	0.4697	*0.1886*	0.1780	*<0.0001****	0.1839	*<0.0001****
CC.F&A	-0.058	*0.7084*	−0.00088	*0.9701*	−0.00707	*0.8256*
Big.D	6.1565	*0.0719**	1.6626	*0.0014****	1.8359	*<0.0001****
R-squared	*0.7289*		*0.9999*			
Adjusted R-squared	*0.5739*		*0.9861*			
F (4, 14)	*2.1727*					
P-value(F)	*0.2085*					
S.E. of regression	*4.1171*		*0.1436*		*5.1779*	
Log-likelihood	*-30.7751*		*17.0087*		*-34.3274*	
Schwarz criterion	*73.9747*		*-9.1683*		*81.0793*	
Akaike criterion	*71.5502*		*-14.0174*		*78.6547*	
Hannan-Quinn	*70.6525*		*-15.8127*		*77.7571*	

- *Author's Own*

Table 7:31 *Banking System Liquid Liabilities Share of GDP and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	-134.975	0.302	56.398	0.158	40.404	0.2454
IoT	0.0859	0.953	-0.166	0.312	-0.168	0.3714
AI	2.401	0.393	0.007	0.959	0.1036	0.5448
CC.F&A	1.006	0.477	0.478	0.299	0.535	0.0125**
Big.D	28.945	0.319	-3.667	0.528	-0.726	0.779
R-squared	*0.5304*		*0.9992*			
Adjusted R-squared	*0.2621*		*0.2808*			
F (4, 14)	*0.7266*					
P-value(F)	*0.6103*					
S.E. of regression	*38.8216*		*2.9877*		*53.2108*	
Log-likelihood	*-57.7010*		*-19.4107*		*-62.2856*	
Schwarz criterion	*127.8265*		*63.6704*		*136.9957*	
Akaike criterion	*125.4020*		*58.8213*		*134.5712*	
Hannan-Quinn	*124.5044*		*57.0260*		*133.6736*	

- *Author's Own*

Table 7:32 *Capital Adequacy Ratio and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	21.865	*0.0063***	54.6300	*0.0278***	26.7086	*<0.0001****
IoT	-0.078	*0.3925*	0.0420	*0.5892*	-0.0182	*0.8116*
AI	-0.239	*0.1328*	-0.3765	*0.0013****	-0.2415	*0.0007****
CC.F&A	-0.036	*0.5590*	-0.2894	*0.2414*	-0.0520	*0.5715*
Big.D	0.3805	*0.7773*	-5.6871	*0.0852**	-0.9275	*0.3060*
R-squared	*0.3057*		*0.9272*			
Adjusted R-squared	*-0.0911*		*0.7231*			
F (4, 14)	*2.7479*					
P-value(F)	*0.1486*					
S.E. of regression	*2.1666*		*1.3123*		*2.3148*	
Log-likelihood	*-23.0711*		*-9.5377*		*-24.6662*	
Schwarz criterion	*58.5667*		*43.9245*		*61.7568*	
Akaike criterion	*56.1422*		*39.0754*		*59.3323*	
Hannan-Quinn	*55.2445*		*37.2801*		*58.4347*	

- *Author's Own*

Table 7:33 *Return on Equity and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	-10.3865	*0.3151*	-80.624	*0.0002****	-35.817	*0.0699**
IoT	0.0046	*0.9793*	0.3413	*0.0002****	0.4927	*0.0001****
AI	0.0339	*0.9136*	0.2597	*0.0004****	0.1265	*0.1882*
CC.F&A	0.1833	*0.3440*	1.6481	*<0.0001****	0.7120	*0.0418***
Big.D	2.2122	*0.2947*	6.4162	*0.0047****	1.4387	*0.6867*
R-squared	*0.4090*		*0.9971*			
Adjusted R-squared	*0.0713*		*0.9936*			
F (4, 14)	*2.3291*					
P-value(F)	*0.1894*					
S.E. of regression	*5.0602*		*0.6593*		*11.4597*	
Log-likelihood	*-33.2501*		*-1.2769*		*-43.8605*	
Schwarz criterion	*78.9247*		*27.4029*		*100.1455*	
Akaike criterion	*76.5002*		*22.5539*		*97.7210*	
Hannan-Quinn	*75.6026*		*20.7586*		*96.8233*	

- *Author's Own*

Table 7:34 *Management Efficiency and Emerging Technologies Regression Results*

	OLS		FE		RE	
Constant	94.412	*0.0007****	146.178	*0.2481*	94.412	*<0.0001****
IoT	0.3378	*0.1883*	-0.5660	*0.2685*	0.3378	*0.1278*
AI	0.4249	*0.1542*	0.0444	*0.9087*	0.4249	*0.0933**
CC.F&A	-0.7557	*0.0207***	-0.5539	*0.7009*	-0.7557	*0.0009****
Big.D	-3.6156	*0.2334*	-9.5165	*0.5972*	-3.6156	*0.1754*
R-squared	*0.6530*		*0.8928*			
Adjusted R-squared	*0.4547*		*0.5125*			
F (4, 14)	*3.4453*					
P-value(F)	*0.10013**					
S.E. of regression	*7.7971*		*8.1092*		*7.2935*	
Log-likelihood	*-38.4383*		*-31.3927*		*-38.4383*	
Schwarz criterion	*89.3012*		*87.6344*		*89.3012*	
Akaike criterion	*86.8767*		*82.7853*		*86.8767*	
Hannan-Quinn	*85.9790*		*80.9900*		*85.9790*	

- *Author's Own*

7.2.2. Country-Specific Banking System Sample – Regression Results (2010–2021)

Table 7:35 *ESGDS and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	14.0547	42.4752	6.5490
	0.5999	0.2194	<0.0001***
MPS	0.185332	-0.201084	0.0070
	0.3194	0.5481	0.4790
MBDVS	-0.144136	0.106805	0.0070
	0.0038***	0.5451	0.092*
ICT.IC	-2.76867		-0.7100
	0.0006***		<0.0001***
I.Banking	0.421632	0.344962	-0.0180
	0.1053	0.3887	0.2400
CC	-0.0196134	-0.0394232	-0.0010
	0.923	0.6427	<0.0001***
ERP	0.29019	-0.0302289	0.0080
	0.0534*	0.8144	0.1080
IGR	0.120642	-0.000659253	-0.0010
	0.5559	0.9958	0.9260
Mean dependent var	*46.50087*	*46.50087*	*Gamma*
Sum squared resid	*1819.885*	*1183.388*	*Log*
R-squared	*0.518929*	*0.687182*	
Adjusted R-squared	*0.427916*	*0.290537*	
F(7, 37)	*1.60E+13*		*60.4070*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*9.272379*	*9.272379*	
S.E. of regression	*7.013279*	*5.988342*	
Log-likelihood	*-147.0992*	*-137.4154*	
Schwarz criterion	*324.6517*	*320.5108*	*20.5030*
Akaike criterion	*310.1984*	*298.8308*	*12.8560*
Hannan-Quinn	*315.5865*	*306.9129*	
Durbin-Watson	*0.749284*	*0.971889*	

- *Author's Own*

Table 7:36 *ACS and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	8.3642	6.70798	4.5320
	0.0189**	0.0716*	<0.0001***
MPS	-0.0480218	-0.0152618	0.0000
	0.0179**	0.6444	0.9730
MBDVS	0.00178135	0.0141723	0.0030
	0.6173	0.3494	0.6270
ICT.IC	0.3273		-0.6330
	0.0009***		<0.0001***
I.Banking	0.00905926	-0.0264385	-0.0070
	0.5418	0.5141	0.7500
CC	-0.00606991	-0.00391905	-0.0020
	0.5794	0.661	0.074*
ERP	-0.00573484	0.000573635	0.0010
	0.5805	0.9653	0.050**
IGR	0.00452273	0.0100456	-0.0040
	0.2901	0.3383	0.4990
Mean dependent var	*4.714148*	*4.714148*	*Normal*
Sum squared resid	*16.41078*	*13.83052*	*Log*
R-squared	*0.653791*	*0.708225*	
Adjusted R-squared	*0.588292*	*0.069736*	
F (7, 37)	*6.51E+14*		*486.5620*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*1.037932*	*1.037932*	
S.E. of regression	*0.665984*	*0.647385*	
Log-likelihood	*-41.15594*	*-37.30708*	
Schwarz criterion	*112.7652*	*120.2941*	*51.1960*
Akaike criterion	*98.31188*	*98.61417*	*43.5480*
Hannan-Quinn	*103.6999*	*106.6962*	
Durbin-Watson	*1.046361*	*1.139809*	

- *Author's Own*

Table 7:37 *ACMF and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	13.7773	20.6502	2.9800
	0.0967*	0.0018***	0.001***
MPS	0.102807	-0.103168	-0.0070
	0.0223**	0.0296**	<0.0001***
MBDVS	-0.0409166	-0.00311827	-0.0090
	0.0016***	0.901	<0.0001***
ICT.IC	-1.16397		-0.1610
	0.0066***		0.2920
I.Banking	-0.241291	0.029632	0.0220
	0.019**	0.7526	<0.0001***
CC	0.1479	0.0398777	0.0020
	0.0453**	0.0088***	0.6330
ERP	0.0587124	-0.0612334	0.0020
	0.4418	0.0019***	0.1810
IGR	0.00745339	-0.00857416	0.0050
	0.8716	0.6733	<0.0001***
Mean dependent var	*9.474116*	*9.474116*	*Normal*
Sum squared resid	*233.6015*	*23.79386*	*Log*
R-squared	*0.819449*	*0.98161*	
Adjusted R-squared	*0.785291*	*0.456833*	
F (7, 37)	*3.24E+00*		*141.6910*
P-value(F)	0.1007*		*<0.0001****
S.D. dependent var	*5.422649*	*5.422649*	
S.E. of regression	*2.512679*	*0.849133*	
Log-likelihood	*−100.9087*	*−49.51445*	
Schwarz criterion	*232.2707*	*144.7088*	*18.7930*
Akaike criterion	*217.8174*	*123.0289*	*11.1450*
Hannan-Quinn	*223.2055*	*131.111*	
Durbin-Watson	*0.398205*	*1.217422*	

- *Author's Own*

Table 7:38 *CEOD and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	−4.17036	20.7423	5.2950
	0.934	0.5375	<0.0001***
MPS	0.668373	0.44994	-0.0060
	0.0288**	0.0942*	0.030**
MBDVS	−0.390675	0.363085	0.0090
	0.0003***	0.269	0.1120
ICT.IC	−1.85784		0.0750
	0.0455**		0.1270
I.Banking	0.723992	−0.369861	-0.0180
	0.0265**	0.5523	0.068*
CC	0.231331	0.00823648	0.0010
	0.1309	0.9533	0.3180
ERP	0.346561	0.316211	-0.0010
	0.213	0.1427	0.2300
IGR	0.0261647	0.0383868	-0.0030
	0.8329	0.3482	0.098*
Mean dependent var	*92.43049*	*92.43049*	*Normal*
Sum squared resid	*3287.88*	*1302.162*	*Log*
R-squared	*0.637056*	*0.856256*	
Adjusted R-squared	*0.568391*	*0.449547*	
F (7, 37)	*1.25E+00*		*8.1900*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*14.34868*	*14.34868*	
S.E. of regression	*9.426644*	*6.281676*	
Log-likelihood	*−160.4073*	*−139.5674*	
Schwarz criterion	*351.2679*	*324.8148*	*-9.7810*
Akaike criterion	*336.8146*	*303.1348*	*-2.6210*
Hannan-Quinn	*342.2026*	*311.2169*	
Durbin-Watson	*0.60705*	*0.975647*	

- *Author's Own*

Table 7:39 *BODS and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	14.2311	11.0439	1.3690
	0.0116**	0.0385**	<0.0001***
MPS	−0.0208712	0.028346	0.0030
	0.4258	0.3676	0.5170
MBDVS	−0.0193312	−0.0109341	-0.0010
	0.0285**	0.7409	0.8600
ICT.IC	0.652548		0.3260
	0.0021***		<0.0001***
I.Banking	−0.00736408	0.00261557	-0.0080
	0.8067	0.9775	0.5030
CC	−0.0519278	−0.0347939	-0.0010
	0.0288**	0.1182	0.001***
ERP	0.116322	0.0740038	0.0020
	0.016**	<0.0001***	0.3670
IGR	0.00965349	0.00488199	-0.0020
	0.3293	0.4264	0.4830
Mean dependent var	*14.8*	*14.8*	*Normal*
Sum squared resid	*69.39454*	*54.80447*	*Log*
R-squared	*0.820779*	*0.85846*	
Adjusted R-squared	*0.786872*	*0.168655*	
F (7, 37)	*3.27E+00*		*615.6780*
P-value(F)	0.1005*		*<0.0001****
S.D. dependent var	*2.966479*	*2.966479*	
S.E. of regression	*1.369499*	*1.288698*	
Log-likelihood	*−73.59801*	*−68.28719*	
Schwarz criterion	*177.6493*	*182.2543*	*24.4230*
Akaike criterion	*163.196*	*160.5744*	*38.5210*
Hannan-Quinn	*168.5841*	*168.6565*	
Durbin-Watson	*1.228316*	*1.335284*	

- *Author's Own*

Table 7:40 *BODMF and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	14.5242	12.4973	1.4270
	0.2044	0.398	0.4730
MPS	0.0573446	−0.0265750	-0.0160
	0.3053	0.7851	0.2200
MBDVS	−0.0140989	0.0284417	0.0050
	0.2296	0.5722	0.051*
ICT.IC	−0.958363		0.5410
	0.0133**		0.072*
I.Banking	−0.130753	0.0221736	0.0030
	0.1166	0.884	0.6680
CC	0.0571251	−0.00395654	-0.0020
	0.1332	0.8466	0.001***
ERP	0.0717938	−0.0268170	-0.0040
	0.3082	0.6026	<0.0001***
IGR	−0.0103646	−0.0193278	-0.0040
	0.7268	0.3821	0.034**
Mean dependent var	*11.78769*	*11.78769*	*Normal*
Sum squared resid	*174.6041*	*69.46536*	*Log*
R-squared	*0.675228*	*0.870791*	
Adjusted R-squared	*0.613784*	*0.132656*	
F (7, 37)	*6.34E+13*		*1051.1270*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*3.495516*	*3.495516*	
S.E. of regression	*2.172333*	*1.450866*	
Log-likelihood	*−94.35906*	*−73.62096*	
Schwarz criterion	*219.1714*	*192.9219*	*55.1280*
Akaike criterion	*204.7181*	*171.2419*	*47.4800*
Hannan-Quinn	*210.1062*	*179.324*	
Durbin-Watson	*0.607548*	*1.131585*	

- *Author's Own*

Table 7:41 *Z-Score and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	25.334	1.31265	2.6440
	0.0141**	0.8174	<0.0001***
MPS	−0.148327	0.101472	0.0010
	0.0007***	0.0135**	0.5020
MBDVS	0.233834	−0.0158264	0.0060
	<0.0001***	0.7269	<0.0001***
ICT.IC	0.987678		0.0370
	0.0205**		0.082*
I.Banking	−0.123284	0.126435	-0.0060
	0.078*	0.319	0.014**
CC	−0.122090	−0.0378250	-0.0050
	0.0441**	0.2688	<0.0001***
ERP	−0.0575795	0.0317556	0.0030
	0.6187	0.4335	0.6540
IGR	−0.0230330	0.0130132	-0.0020
	0.5567	0.6214	0.3200
Mean dependent var	*19.10911*	*19.10911*	*Normal*
Sum squared resid	*390.6129*	*101.4828*	*Log*
R-squared	*0.798616*	*0.94768*	
Adjusted R-squared	*0.760516*	*0.152813*	
F (7, 37)	*4.05E+14*		*195.5230*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*6.639485*	*6.639485*	
S.E. of regression	*3.24917*	*1.753635*	
Log-likelihood	*−112.4760*	*−82.14984*	
Schwarz criterion	*255.4052*	*209.9796*	*35.9240*
Akaike criterion	*240.9519*	*188.2997*	*28.2760*
Hannan-Quinn	*246.34*	*196.3817*	
Durbin-Watson	*0.68757*	*1.849329*	

- *Author's Own*

Table 7:42 *Z -Score and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	−64.3930	30.8445	78.3230
	0.0692*	0.5692	0.061*
MPS	1.02031	0.0454945	-0.0710
	0.0031***	0.871	0.6000
MBDVS	−0.540544	0.0533205	-0.2450
	0.0007***	0.7645	<0.0001***
ICT.IC	−6.46173		-8.0170
	0.0016***		<0.0001***
I.Banking	1.83248	0.760142	1.5830
	0.0002***	0.3303	<0.0001***
CC	0.583984	0.383813	0.3270
	0.0134**	0.0107	<0.0001***
ERP	0.0726905	0.28027	0.1210
	0.8723	0.1235	0.3180
IGR	0.0932123	0.0368055	-0.3330
	0.4544	0.6402	0.2870
Mean dependent var	*105.5151*	*105.5151*	*Normal*
Sum squared resid	*3354.309*	*1122.305*	*Identity*
R-squared	*0.84868*	*0.94937*	
Adjusted R-squared	*0.814511*	*0.738233*	
F (7, 37)	*3.20E+00*		*176.5200*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*24.15247*	*24.15247*	
S.E. of regression	*10.40209*	*6.33106*	
Log-likelihood	*−142.2002*	*−120.8504*	
Schwarz criterion	*313.7088*	*281.9999*	*288.6920*
Akaike criterion	*300.4003*	*263.7008*	*285.3530*
Hannan-Quinn	*305.1753*	*270.2663*	
Durbin-Watson	*0.671088*	*1.258496*	

- *Author's Own*

Table 7:43 *CAR and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	−8.83828	9.26063	6.4260
	0.1192	0.1435	0.021**
MPS	0.133606	−0.0139724	-0.0160
	0.023**	0.7661	0.4900
MBDVS	−0.0110904	0.0240889	0.0090
	0.2651	0.4424	0.5170
ICT.IC	−0.373399		0.8560
	0.0222**		0.002***
I.Banking	0.177909	0.0956301	0.0800
	0.0058***	0.2457	0.001***
CC	0.0135787	0.028598	0.0530
	0.7731	0.3602	0.004***
ERP	0.0380734	0.0171844	0.0160
	0.3851	0.6745	0.4680
IGR	0.0638411	0.0273188	0.0550
	0.2562	0.0184**	0.2210
Mean dependent var	*17.366*	*17.366*	*Normal*
Sum squared resid	*59.18362*	*22.75976*	*Identity*
R-squared	*0.76934*	*0.911297*	
Adjusted R-squared	*0.725702*	*0.714789*	
F (7, 37)	*9.46E+13*		*46.7640*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*2.414841*	*2.414841*	
S.E. of regression	*1.264736*	*0.830476*	
Log-likelihood	*−70.01684*	*−48.51469*	
Schwarz criterion	*170.487*	*142.7093*	*176.7220*
Akaike criterion	*156.0337*	*121.0294*	*169.0740*
Hannan-Quinn	*161.4217*	*129.1114*	
Durbin-Watson	*0.896602*	*1.077051*	

- *Author's Own*

Table 7:44 *ROE and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	37.5312	11.2684	-1.4100
	0.0025***	0.3836	0.5580
MPS	−0.237370	0.00171761	-0.0050
	0.012**	0.979	0.3260
MBDVS	0.0485604	0.052362	0.0140
	0.0485**	0.3618	0.1510
ICT.IC	0.656034		1.3950
	0.0134**		0.007***
I.Banking	−0.0676871	−0.0751455	-0.0880
	0.2901	0.6892	0.010***
CC	−0.0203058	−0.0404308	0.0560
	0.8139	0.5695	0.1020
ERP	−0.0543317	−0.0138925	0.0130
	0.4786	0.8693	0.031**
IGR	−0.109262	−0.0529632	-0.0120
	0.173	0.1432	0.001***
Mean dependent var	*8.618889*	*8.618889*	*Normal*
Sum squared resid	*335.6139*	*228.7871*	*Log*
R-squared	*0.680083*	*0.781913*	
Adjusted R-squared	*0.619558*	*0.059496*	
F(7, 37)	*6.15E+14*		*70.2350*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*4.882868*	*4.882868*	
S.E. of regression	*3.011751*	*2.633048*	
Log-likelihood	*−109.0615*	*−100.4401*	
Schwarz criterion	*248.5762*	*246.5602*	*164.5320*
Akaike criterion	*234.1229*	*224.8803*	*178.6310*
Hannan-Quinn	*239.511*	*232.9624*	
Durbin-Watson	*1.650629*	*2.048525*	

- *Author's Own*

Table 7:45 *CTI and Technology – G7 Country-Specific Banking Sample 2010–2021*

	OLS	FE	GLMM
Constant	29.6105	93.9857	4.4740
	0.1676	0.0085***	<0.0001***
MPS	0.159979	−0.0711734	0.0010
	0.241	0.6048	0.7160
MBDVS	−0.0702567	0.216709	-0.0050
	0.0198**	0.0363**	0.1820
ICT.IC	4.28621		-0.1830
	0.0005***		0.006***
I.Banking	0.0707884	−0.539948	0.0190
	0.6499	0.1172	0.2180
CC	−0.0248514	0.229074	0.0000
	0.8699	0.0028***	0.9110
ERP	0.138546	−0.214843	-0.0020
	0.1219	0.0266**	0.012**
IGR	−0.00487843	−0.208937	-0.0050
	0.964	0.0022***	0.014**
Mean dependent var	*68.67111*	*68.67111*	*Normal*
Sum squared resid	*1105.381*	*650.5507*	*Log*
R-squared	*0.765805*	*0.862169*	
Adjusted R-squared	*0.721498*	*0.278543*	
F (7, 37)	*1.80E+14*		*110.9190*
P-value(F)	<0.0001***		*<0.0001****
S.D. dependent var	*10.35716*	*10.35716*	
S.E. of regression	*5.465817*	*4.440006*	
Log-likelihood	*−135.8811*	*−123.9533*	
Schwarz criterion	*302.2155*	*293.5865*	*77.9540*
Akaike criterion	*287.7622*	*271.9065*	*92.0530*
Hannan-Quinn	*293.1502*	*279.9886*	
Durbin-Watson	*1.456836*	*2.177027*	

- *Author's Own*

7.2.3. Bank-Specific Sample – G7 Regression Results (2010–2021)

Table 7:46 *Management Efficiency and Innovation and Growth Ratio – Duality vs Separation*

Dependent: CTI / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	67.5076	65.361	65.5377	67.7320
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	-0.3154	0.234068	0.1125	-0.3240
	*<0.0001***	*0.0589**	*0.2917*	*<0.0001***
Separation of Roles				
Constant	63.5562	63.0634	63.4396	63.4150
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.1545	0.251766	0.2075	0.2660
	0.2622	*0.0067***	*0.0045***	*<0.0001***
Duality Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***1224***			
Distribution				
Link Function				
R-squared	*0.0106*	*0.6209*		*0.0130*
Adjusted R-squared	*0.0098*	*0.0050*		*0.0120*
F (1, 187)	*4.2755*			*15.7170*
P-value(F)	*0.04004***			*<0.0001****
S.E. of regression	*12.7930*	*8.6047*	*12.9168*	*12.0045*
Schwarz criterion	*9725.5*	*9880.9*	*9750.1*	*6096.2*
Akaike criterion	*9715.3*	*8915.1*	*9739.8*	*6086.0*
Durbin-Watson	*0.6207*	*1.6031*	*1.6031*	*0.8230*
Separation Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***2010***			
R-squared	*0.0025*	*0.5005*		*0.0100*
Adjusted R-squared	*0.0020*	*0.0050*		*0.0090*
F (1, 284)	*1.2623*			*19.9100*
P-value(F)	*0.2622*			*<0.0001****
S.E. of regression	*13.3407*	*10.1884*	*13.3403*	*11.6364*
Schwarz criterion	*16132.5*	*16902.3*	*16133.3*	*9878.8*
Akaike criterion	*16121.2*	*15299.0*	*16122.1*	*9867.6*
Durbin-Watson	*0.8251*	*1.6403*	*1.6403*	*0.9600*

- *Author's Own*

Table 7:47 *Return on Equity and Innovation and Growth Ratio – Duality vs Separation*

Dependent: ROE / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	0.0697	0.0790723	0.0779	0.0700
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.0025	0.0001219	0.0007	0.0030
	*<0.0001***	*0.7180*	*0.0209**	*<0.0001***
Separation of Roles				
Constant	0.0874	0.082883	0.0835	0.0870
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	-0.0008	0.000065	-0.000047	-0.0010
	0.2008	*0.8484*	*0.8810*	*0.002****
Duality Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	*1205*			
Distribution				
Link Function				
R-squared	*0.0571*	*0.6145*		
Adjusted R-squared	*0.0563*	*0.0001*		
F (1, 187)	*25.8998*			*72.8900*
P-value(F)	*<0.0001****			*<0.0001****
S.E. of regression	*0.0432*	*0.0301*	*0.0439*	*0.0432*
Schwarz criterion	*-4138.2*	*-3889.3*	*-4100.5*	*-7557.8*
Akaike criterion	*-4148.4*	*-4852.1*	*-4106.9*	*-7568.0*
Durbin-Watson	*0.5980*	*1.3750*	*1.3750*	*1.1210*
Separation Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	*1981*			
R-squared	*0.0048*	*0.5962*		
Adjusted R-squared	*0.0043*	*0.0000*		
F (1, 284)	*1.6444*			*9.4610*
P-value(F)	*0.2008*			*0.002****
S.E. of regression	*0.0515*	*0.0354*	*0.0516*	*0.1*
Schwarz criterion	*-6118.8*	*-5749.7*	*-6110.4*	*-11740.7*
Akaike criterion	*-6130.0*	*-7348.8*	*-6121.6*	*-11751.8*
Durbin-Watson	*0.5913*	*1.4526*	*1.4526*	*0.9940*

- *Author's Own*

Table 7:48 *Net Interest Margin and Innovation and Growth Ratio – Duality vs Separation*

Dependent: NIM / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	2.3229	2.86822	2.8990	2.3220
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.1435	0.00312362	0.0116	0.1430
	*<0.0001***	*0.6999*	*0.1167*	*<0.0001***
Separation of Roles				
Constant	3.1376	3.22876	3.1926	3.1240
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.0167	-0.00121768	0.0014	0.0170
	0.3542	*0.8096*	*0.7839*	*0.007***
Duality Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***1979***			
Distribution				
Link Function				
R-squared	*0.2230*	*0.9205*		*0.0040*
Adjusted R-squared	*0.2223*	*0.0004*		*0.0030*
F(1, 284)	*73.5473*			*7.2090*
P-value(F)	*<0.0001****			*0.007****
S.E. of regression	*1.1248*	*0.3915*	*1.2548*	*1.2429*
Schwarz criterion	*3709.1*	*2292.7*	*3973.3*	*874.0*
Akaike criterion	*3699.0*	*1330.2*	*3963.1*	*862.8*
Durbin-Watson	*0.2343*	*1.0276*	*1.0276*	*0.5210*
Separation Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***1203***			
R-squared	*0.0032*	*0.8655*		*0.2250*
Adjusted R-squared	*0.0027*	*0.00005*		*0.2250*
F (1, 284)	*0.8613*			*349.3720*
P-value(F)	*0.3542*			*<0.0001****
S.E. of regression	*1.2868*	*0.5107*	*1.2885*	*1.1152*
Schwarz criterion	*6627.5*	*4818.5*	*6633.5*	*274.4*
Akaike criterion	*6616.3*	*3219.7*	*6626.4*	*264.2*
Durbin-Watson	*0.1954*	*1.3604*	*1.3604*	*0.6010*

- *Author's Own*

Table 7:49 *Capital Adequacy Ratio and Innovation and Growth Ratio – Duality vs Separation*

Dependent: CAR / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	15.2353	15.1466	15.2006	15.1040
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	-0.0180	-0.000843	-0.0123	-0.0170
	0.7078	*0.9780*	*0.6735*	*0.4640*
Separation of Roles				
Constant	14.7780	14.8809	14.9267	14.7350
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.0443	0.0259	0.0279	0.0400
	0.1370	*0.2509*	*0.1804*	*0.005***
Duality Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	*950*			
R-squared	*0.0005*	*0.6823*		
Adjusted R-squared	*-0.0007*	*0.000002*		
F (1, 137)	*0.1410*			*0.5360*
P-value(F)	*0.7078*			*0.4640*
S.E. of regression	*3.1192*	*1.9245*	*3.1174*	
Schwarz criterion	*4270.6*	*4237.3*	*4270.7*	*1677.2*
Akaike criterion	*4261.2*	*3580.5*	*4261.2*	*1667.8*
Durbin-Watson	*0.3207*	*0.9718*	*0.9718*	*0.7030*
Separation Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***1754***			
R-squared	*0.0047*	*0.6065*		
Adjusted R-squared	*0.0041*	*0.0017*		
F (1, 244)	*2.2264*			*8.0700*
P-value(F)	*0.1370*			*0.005****
S.E. of regression	*2.7597*	*1.8702*	*2.7604*	*2.5234*
Schwarz criterion	*8551.6*	*8746.4*	*8553.5*	*3260.0*
Akaike criterion	*8540.6*	*7400.8*	*8542.5*	*3249.1*
Durbin-Watson	*0.3690*	*0.9078*	*0.9078*	*0.6350*

- *Author's Own*

Table 7:50 *Asset Quality and Innovation and Growth Ratio – Duality vs Separation*

Dependent: AQ / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	1.7259	1.38178	1.5240	1.7260
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	-0.0761	0.0048737	-0.0175	-0.0760
	*0.0005***	*0.7002*	*0.1454*	*<0.0001***
Separation of Roles				
Constant	1.2405	1.69401	1.6049	1.2410
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.0536	-0.0341989	-0.0236	0.0540
	*0.0590**	*0.0024***	*0.0289***	*<0.0001***
Duality Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***1060***			
R-squared	*0.0615*	*0.6680*		*0.2480*
Adjusted R-squared	*0.0606*	*0.0003*		*0.0610*
F (1, 183)	*12.5982*			*69.2980*
P-value(F)	*0.00049****			*<0.0001****
S.E. of regression	*1.2511*	*0.8183*	*1.2754*	*1.2511*
Schwarz criterion	*3495.0*	*3668.4*	*3536.8*	*486.9*
Akaike criterion	*3485.1*	*2749.7*	*3526.9*	*476.9*
Durbin-Watson	*0.2565*	*0.5861*	*0.5861*	*0.8300*
Separation Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***1898***			
R-squared	*0.0186*	*0.7459*		*0.0190*
Adjusted R-squared	*0.0181*	*0.0112*		*0.0180*
F (1, 277)	*3.5953*			*35.9050*
P-value(F)	*0.05898**			*<0.0001****
S.E. of regression	*1.6906*	*0.9309*	*1.7234*	*1.6906*
Schwarz criterion	*7392.6*	*6918.8*	*7466.5*	*2006.3*
Akaike criterion	*7381.5*	*5370.8*	*7455.4*	*1995.2*
Durbin-Watson	*0.1372*	*0.4863*	*0.4863*	*0.5280*

- *Author's Own*

Table 7:51 *ESG Disclosures Score and Innovation and Growth Ratio – Duality vs Separation*

Dependent: ESGDS / Split: CEOD				
	OLS	**FE**	**RE**	**Linear Predictive Model**
Duality of Roles				
Constant	25.8136	28.534	28.4977	25.8140
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.5727	-0.13088	-0.0700	0.5730
	*<0.0001***	*0.0068***	*0.1165*	*<0.0001***
Separation of Roles				
Constant	27.7204	30.6678	30.3290	27.7200
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.6283	0.0397993	0.0926	0.6280
	*<0.0001***	*0.3569*	*0.0331***	*<0.0001***
Duality Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	*1250*			
R-squared	*0.0918*	*0.8741*		*0.0920*
Adjusted R-squared	*0.0911*	*0.0125*		*0.0910*
F (1, 187)	*35.4704*			*126.1530*
P-value(F)	*<0.0001****			*<0.0001****
S.E. of regression	*7.3787*	*2.9793*	*7.8337*	*7.3787*
Schwarz criterion	*8556.1*	*7419.4*	*8706.7*	*5008.7*
Akaike criterion	*8545.8*	*6449.6*	*8696.4*	*4998.5*
Durbin-Watson	*0.1126*	*0.4162*	*0.4162*	*0.4800*
Separation Model	***OLS***	***FE***	***RE***	***Linear Predictive Model***
Number of Observations	***2043***			
R-squared	*0.0845*	*0.8295*		*0.0840*
Adjusted R-squared	*0.0840*	*0.0008*		*0.0840*
F (1, 284)	*22.0169*			*188.3480*
P-value(F)	*<0.0001****			*<0.0001****
S.E. of regression	*8.8417*	*4.1125*	*9.1315*	*8.8417*
Schwarz criterion	*14716.4*	*13447.3*	*14849.2*	*8918.6*
Akaike criterion	*14705.1*	*11839.4*	*14837.9*	*8907.3*
Durbin-Watson	*0.1383*	*0.4659*	*0.4659*	*0.4650*

- *Author's Own*

7.3. The Impact of Technological Innovation and Growth on Transparency and Financial Sustainability Measures of Banks in the Presence vs. Separation of CEO Duality: Additional Empirical Evidence and Support Based on 552 Banks Operating in G20 Countries

Table 7:52 *Summary Statistics for Bank-Specific Sample of G20 Banks (2010–2021)*

Variable Type	Field	Min	Max	Mean	Standard Deviation	Median	Mode	Unique	Valid
Descriptive Variable	Ticker	--	--	--	--	--		552	6624
	Year	0	11	--	--	--		12	6624
	Country	--	--	--	--	--	USA	39	6624
	Islamic.B	0	1	--	--	--	1	2	6624
Dependent Variables: Banking Corporate Governance	GDS	1.000	100.00	70.79	22.34	80.52	83.02	--	6624
	SDS	1.028	69.11	12.42	13.07	8.95	0	--	6536
	EDS	1.087	99.67	11.09	18.19	0	0	--	6624
	ESGDS	1.378	75.16	30.71	12.29	29.87	27.74	--	6514
Dependent Variables: Banking Profitability, Operational Efficiency, and Stability Indicators	ROE	-15.07	19.22	2.08	4.861	0.107	--	--	6412
	CAR	7.51	24.996	15.33	3.09	14.725	--	--	5408
	CTI	8.5	113.35	60.45	15.205	61.427	--	--	6383
	AQ	0.009	7.84	2.12	2.168	1.291	--	--	4423
	NIM	-0.94	9.21	3.32	1.662	3.296	--	--	6247
Independent Variables: Innovation and Growth Indicator	IGR-NII	-8.36	15.61	4.07	4.31	2.95	--	--	4968
Split Variables: Corporate Governance Mechanisms	CEOD	0	1	--	--	--	1	2	6624

- *Author's Own*

The table above statistically describes the data sample of G20 countries. Whereby EDS, SDS, and GDS registered an average score of 11.1%, 12.4%, and 70.8% respectively. noting that maximum score for each of the disclosures are equal to the highest scores registered by G7 banks. implying that G7 banking institutions are more transparent regarding ESG data flows to the market this is also supported the average scores which are higher than the scores achieved by G20 banks.

As for duality of leadership roles, 39.6% of G7 banking institutions were found to practise duality during the sample period compared to 30% of banks operating in G20 countries.

When it comes to risk-performance measures, G20 banks registered on average better results when compared to G7 banks. whereby, the average bank in G20 countries registered ROE, CAR, CTI, and NIM of 2.08%, 15.33%, 60.45%, and 3.32% compared to 1.83%, 15.0%, 65.24%, and 3.2% registered by an average bank operating in G7 countries. Noting that the negative ROE in both G7 and G20 samples resulted in 2020 and onward which may be due COVID-19 pandemic. Moreover, the average bank operating in G7 registered 4.6% information and technology capital expenditures relative to operating income with a maximum of 15.6% compared to an average of 4.07% in G20.

Table 7:53 *Pearson Correlation Matrix – G20 Bank-Specific Sample*

	NIM	AQ	CTI	CAR	ROE	IGR NII	CEO D	ESG DS	EDS	SDS	GDS
GDS	-0.002	-0.337	-0.023	-0.037	0.065	0.231	0.080	0.532	0.096	0.112	1.000
SDS	-0.008	0.342	-0.137	0.199	0.067	0.104	0.251	0.845	0.194	1.000	
EDS	-0.058	0.065	0.055	-0.010	0.025	0.125	0.010	0.296	1.000		
ESGDS	0.021	0.056	-0.124	0.092	0.087	0.207	0.204	1.000			
CEOD	-0.042	0.147	-0.172	0.059	-0.007	0.061	1.000				
IGRNII	-0.008	0.068	0.120	0.007	-0.145	1.000					
ROE	0.064	-0.306	-0.250	0.090	1.000						
CAR	0.083	0.095	-0.012	1.000							
CTI	0.159	-0.123	1.000								
AQ	-0.100	1.000									
NIM	1.000										

- *Author's Own*

Table 7:54 *Diagnostic Tests for Linear Regression Assumptions of G20 Panel Data Sample – ESG Disclosures (Transparency) Models in Relation to Innovation Growth of Banks*

OLS Assumptions		GDS	SDS	EDS
Autocorrelation	t	85.9284	157.686	21.4829
Wooldridge	p-value	*0.0000****	*0.0000****	*<0.0001****
Normality	Chi-Square	2662.09	2060.78	188.817
Test Statistics	p-value	*0.0000****	*0.0000****	*0.0000****
Heteroskedasticity	LM	0.889061	24.5369	17.3362
White's	p-value	*0.641125*	*<0.0001****	*0.000172****
OLS or Fixed Effects	F Statistic	21.3631	24.5797	6.43184
Joint Significance	p-value	*0.0000****	*0.0000****	*0.0000****
OLS or Random Effects	LM	8850.81	8233.43	939.084
Breusch Pagan	p-value	*0.0000****	*0.0000****	*0.0000****
Fixed or Random Effects	H	62.9909	8.20143	3.16428
Hausman	p-value	*<0.0001****	*0.00419****	*0.07526**
Time Dummies	Chi-Square	157.606	372.53	11.003
Wald Joint	p-value	*<0.0001****	*<0.0001****	*0.20153*

- *Author's Own*

- ** Significant at 10%; ** significant at 5%; *** significant at 1%.*

- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*

Table 7:55 *Diagnostic Tests for Linear Regression Assumptions of G20 Panel Data Sample – Financial Performance Models in Relation to Innovation and Growth Ratio: Evidence Duality vs. Separation of CEO /Chairperson Roles*

OLS Assumptions and Diagnosis		CTI		ROE		NIM	
		IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation
Autocorrelation *Wooldridge*	*t*	8.91335	15.7832	12.865	30.3708	27.52	79.1403
	p-value	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
Normality *Test Statistics*	*Chi-Square*	130.55	352.208	191.002	101.527	231.603	718.022
	p-value	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
Heteroskedasticity *White's*	*LM*	8.848	58.4153	10.1348	57.3537	19.7197	153.754
	p-value	*0.01198***	*<0.0001****	*0.006299****	*<0.0001****	*<0.0001****	*<0.0001****
Cross-Sectional Dependence *Pearson CD Asymptotic*	*Z*	3.21307	NAN	NAN	NAN	37.7609	47.3591
	p-value	*0.001313****	*NAN*	*NAN*	*NAN*	*0.0000****	*0.0000****
OLS or Fixed Effects *Joint Significance*	*F Statistic*	10.1651	11.0964	6.9059	13.0508	44.1288	57.1092
	p-value	*<0.0001****	*0.0000****	*<0.0001****	*0.0000****	*0.0000****	*0.0000****
OLS or Random Effects *Breusch Pagan*	*LM*	1399.43	4137.82	853.525	3923.48	2375.26	9417.37
	p-value	*<0.0001****	*0.0000****	*<0.0001****	*0.0000****	*0.0000****	*0.0000****
Fixed Effects or Random Effects *Hausman*	*H*	0.639611	4.82545	3.06029	27.8167	36.1902	4.31411
	p-value	*0.423852*	*0.0280***	*0.0802273**	*<0.0001****	*<0.0001****	*0.03779***
Time Dummies *Wald Joint*	*Chi-Square*	27.8783	28.1662	12.2454	28.0019	93.4482	67.4995
	p-value	*0.000498****	*0.00044****	*0.140587*	*0.00047****	*<0.0001****	*<0.0001****

- *Author's Own*

- ** Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *nan: "not a number" resulted from a numeric calculation with an undefined result, such as '0/0'. This exists only in vectors with numeric datatype. Also, the sample consists of a short 2-year time period.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*

- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*

Table 7:56 *Diagnostic Tests for Linear Regression Assumptions of G20 Panel Data Sample – Financial Stability and Transparency Models in Relation to Innovation and Growth Ratio: Evidence Duality vs. Separation of CEO /Chairperson Roles*

OLS Assumptions and Diagnosis		AQ		CAR		ESGDS	
		IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation	IGR in Duality	IGR in Separation
Autocorrelation *Wooldridge*	*t*	22.1725	94.8359	18.1439	45.6983	94.7781	139.476
	p-value	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*0.0000****
Normality *Test Statistics*	*Chi-Square*	1496.22	2911.04	818.246	916.293	380.881	266.762
	p-value	*0.0000****	*0.0000****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****
Heteroskedasticity *White's*	*LM*	20.6602	131.039	1.21963	51.8747	0.310064	37.5176
	p-value	*<0.0001****	*<0.0001****	*0.54345*	*<0.0001****	*<0.0001****	*<0.0001****
Cross-Sectional Dependence *Pearson CD Asymptotic*	*Z*	NAN	NAN	12.3456	NAN	0.856388	NAN
	p-value	*NAN*	*NAN*	*<0.0001****	*NAN*	*<0.0001****	*NAN*
OLS or Fixed Effects *Joint Significance*	*F Statistic*	9.5668	30.4565	11.3573	14.3249	36.0846	18.3674
	p-value	*<0.0001****	*0.0000****	*<0.0001****	*0.0000****	*0.0000****	*0.0000****
OLS or Random Effects *Breusch Pagan*	*LM*	1015.62	7127.37	989.499	4201.9	2380.64	6157.34
	p-value	*<0.0001****	*0.0000****	*<0.0001****	*0.0000****	*0.0000****	*0.0000****
Fixed Effects or Random Effects *Hausman*	*H*	17.7292	16.7548	0.02009	0.515486	35.9898	17.5982
	p-value	*<0.0001****	*<0.0001****	*0.887286*	*0.472774*	*<0.0001****	*<0.0001****
Time Dummies *Wald Joint*	*Chi-Square*	48.8842	81.6005	32.5383	34.4026	269.943	448.82
	p-value	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****	*<0.0001****

- *Author's Own*

- ** Significant at 10%; ** significant at 5%; *** significant at 1%.*
- *nan: "not a number" resulted from a numeric calculation with an undefined result, such as '0/0'. This exists only in vectors with numeric datatype. Also, the sample consists of a short 2-year time period.*
- *Wooldridge test for autocorrelation in panel data - Null hypothesis: No first-order autocorrelation*
- *Test for normality of residual - Null hypothesis: error is normally distributed.*
- *White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present*
- *Cross-Sectional Dependence - Null hypothesis: No cross-sectional dependence.*
- *Wald joint test on time dummies - Null hypothesis: No time effects*
- *Joint Asymptotic test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the fixed effects alternative.*
- *Breusch-Pagan Test - A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favor of the random effects alternative.*
- *Hausman Test - A low p-value counts against the null hypothesis that the random effects model is consistent, in favor of the fixed effects model.*

Table 7:57 *Innovation and Growth Ratio and Governance Disclosure Quality of Banks in G20 Countries*

GDS				
	OLS	**FE**	**RE**	**GLMM**
Constant	70.2016	74.0360	73.4470	4.289
	*0.0000***	*0.0000***	*0.0000***	*0.0000***
IGR	0.8697	-0.0841	0.0584	0.000
	*<0.0001***	*0.1051*	*0.2275*	*0.790*
Distribution for GLMM Models				*Gamma*
Link Function for GLMM Models				*Log*
R-squared	*0.0533*	*0.7453*		
Adjusted R-squared	*0.0531*	*0.0006*		
F (1, 551)	*52.1060*			*0.071*
P-value(F)	*<0.0001****			*0.790*
S.E. of regression	*15.6663*	*8.6275*	*16.0994*	
Schwarz criterion	*40768.6*	*39034.5*	*41002.2*	*11672.9*
Akaike criterion	*40755.7*	*35443.3*	*40989.3*	*11601.5*
Durbin-Watson	*0.1898*	*0.6175*	*0.6175*	

- *Author's Own*

Table 7:58 *Innovation and Growth Ratio and Social Disclosure Quality of Banks in G20 Countries*

SDS				
	OLS	**FE**	**RE**	**GLMM**
Constant	15.4188	16.8191	15.3940	2.541
	*<0.0001****	*0.0000****	*<0.0001****	*<0.0001****
IGR	0.2847	-0.0589	-0.0134	-0.006
	*0.0163***	*0.2025*	*0.7725*	*0.044***
Distribution				*Poisson*
Link Function				*Log*
R-squared	*0.0107*	*0.8223*		
Adjusted R-squared	*0.0105*	*0.0006*		
F (1, 548)	*5.8033*			*4.043*
P-value(F)	*0.01632***			*0.0441***
S.E. of regression	*12.1521*	*5.6089*	*12.2851*	*3.048*
Schwarz criterion	*27429.4*	*25893.0*	*27506.6*	*3675.7*
Akaike criterion	*27417.1*	*22504.7*	*27494.3*	*3607.9*
Durbin-Watson	*0.1103*	*0.5837*	*0.5837*	

- *Author's Own*

Table 7:59 *Innovation and Growth Ratio and Environmental Disclosure Quality of Banks in G20 Countries*

EDS				
	OLS	**FE**	**FE**	**GLMM**
Constant	26.2615	28.5662	27.7399	3.352
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.4905	-0.1232	0.1250	0.00801
	*0.0011***	*0.6071*	*0.3920*	*0.061**
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Log*
R-squared	*0.0156*	*0.5723*		
Adjusted R-squared	*0.0151*	*0.0002*		
F (1, 309)	*10.8818*			*3.519*
P-value(F)	*0.001085****			*0.061**
S.E. of regression	*18.7802*	*13.4714*	*18.7152*	*4.286*
Schwarz criterion	*15982.1*	*16772.6*	*15998.3*	*2493.3*
Akaike criterion	*15971.1*	*15057.0*	*15987.3*	*2465.8*
Durbin-Watson	*0.4496*	*1.0332*	*1.0332*	

- *Author's Own*

Table 7:60 *The Impact of Technological Innovation and Growth on Return on Equity of G20 Banks in the Presence of Duality vs. Separation of CEO/Chairperson Roles*

Dependent: ROE / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**GLMM**
Duality of Roles				
Constant	0.0744	0.08054	0.0816	-2.662
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.0019	0.000208	0.00057	0.014
	*0.0003***	*0.5436*	*0.0703**	*0.0010***
Separation of Roles				
Constant	0.1133	0.0979396	0.0972	-2.275
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	-0.0036	0.000044	-0.000061	-0.0071
	*<0.0001***	*0.9011*	*0.0557**	*0.005***
Duality Model	***OLS***	***FE***	***RE***	
Number of Observations				
Distribution for GLMM Models				*Poisson*
Link Function for GLMM Models				*Log*
R-squared	*0.0249*	*0.5823*		
Adjusted R-squared	*0.0242*	*0.0002*		
F (1, 216)	*13.7446*			*7.752*
P-value(F)	*0.00027****			*0.005****
S.E. of regression	*0.0495*	*0.0354*	*0.0499*	*0.000016*
Schwarz criterion	*-4227.0*	*-3804.8*	*-4207.4*	*1840.6*
Akaike criterion	*-4237.4*	*-4937.9*	*-4217.8*	*1816.3*
Durbin-Watson	*0.5068*	*1.1473*	*1.1473*	
Separation Model	***OLS***	***FE***	***RE***	
Number of Observations				
R-squared	*0.0590*	*0.6903*		
Adjusted R-squared	*0.0587*	*0.0000*		
F (1, 463)	*45.6074*			
P-value(F)	*<0.0001****			
S.E. of regression	*0.0637*	*0.0393*	*0.0651*	
Schwarz criterion	*-9120.6*	*-9163.8*	*-8965.1*	
Akaike criterion	*-9132.9*	*-12011.8*	*-8977.4*	
Durbin-Watson	*0.4017*	*1.1573*	*1.1573*	

- *Author's Own*

Table 7:61 *The Impact of Technological Innovation and Growth on Management Efficiency of G20 Banks in the Presence of Duality vs. Separation of CEO/Chairperson Roles*

Dependent: CTI / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**GLMM**
Duality of Roles				
Constant	65.4446	64.3086	63.5984	63.621
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	-0.0931	0.219786	0.1868	0.166
	0.5418	*0.0736**	*0.0783**	*0.031***
Separation of Roles				
Constant	55.4230	56.953	57.2836	4.024
	*<0.0001****	*0.0000****	*0.0000****	*<0.0001****
IGR	0.6646	0.30341	0.3804	0.007
	*<0.0001****	*0.0007****	*<0.0001****	*<0.0001****
Duality Model	***OLS***	***FE***	***RE***	
Number of Observations				
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Identity*
R-squared	*0.0009*	*0.6588*		
Adjusted R-squared	*0.0001*	*0.0042*		
F (1, 215)	*0.3734*			*4.656*
P-value(F)	*0.5418*			*0.031****
S.E. of regression	*13.2326*	*8.4343*	*13.3055*	*8.987*
Schwarz criterion	*10768.8*	*10866.2*	*10784.5*	*9888.4*
Akaike criterion	*10758.4*	*9742.3*	*10774.1*	*9826.2*
Durbin-Watson	*0.5377*	*1.5627*	*1.5627*	
Separation Model	***OLS***	***FE***	***RE***	
Number of Observations	***4641***			
Distribution for GLMM Models				*Poisson*
Link Function for GLMM Models				*Log*
R-squared	*0.0347*	*0.6421*		
Adjusted R-squared	*0.0345*	*0.0051*		
F (1, 458)	*28.9672*			*34.267*
P-value(F)	*<0.0001****			*<0.0001****
S.E. of regression	*15.5887*	*10.1924*	*15.6514*	*13.264*
Schwarz criterion	*28797.8*	*29101.7*	*28826.5*	*-488.8*
Akaike criterion	*28785.5*	*26273.8*	*28814.2*	*-556.3*
Durbin-Watson	*0.6061*	*1.5958*	*1.5958*	

- *Author's Own*

Table 7:62 *The Impact of Technological Innovation and Growth on Net Interest Margin of G20 Banks in the Presence of Duality vs. Separation of CEO/Chairperson Roles*

Dependent: NIM / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**GLMM**
Duality of Roles				
Constant	2.4359	2.89249	2.9530	2.854
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.1290	0.00386616	0.0107	0.0071
	*<0.0001***	*0.6307*	*0.1478*	*0.082**
Separation of Roles				
Constant	3.5730	3.35808	3.3304	3.331
	*<0.0001***	*0.0000***	*0.0000***	*<0.0001***
IGR	-0.0518	-0.001268	-0.0032	-0.008
	*0.0003***	*0.7913*	*0.4955*	*0.049***
Duality Model	***OLS***	***FE***	***RE***	
Number of Observations				
Distribution for GLR Models				*Normal*
Link Function for GLE Models				*Identity*
R-squared	*0.1625*	*0.9130*		
Adjusted R-squared	*0.1619*	*0.0005*		
F (1, 213)	*60.9068*			*3.026*
P-value(F)	*<0.0001****			*0.082**
S.E. of regression	*1.2294*	*0.4333*	*1.3282*	*1.078*
Schwarz criterion	*4254.9*	*2828.2*	*4457.6*	*1688.4*
Akaike criterion	*4244.6*	*1715.8*	*4447.3*	*1626.6*
Durbin-Watson	*0.1808*	*0.9531*	*0.9531*	
Separation Model	***OLS***	***FE***	***RE***	
Number of Observations	***3378***			
Distribution for GLR Models				*Normal*
Link Function for GLE Models				*Identity*
R-squared	*0.0209*	*0.9011*		
Adjusted R-squared	*0.0206*	*0.0000*		
F (1, 456)	*13.0170*			*3.882*
P-value(F)	*0.000343****			*0.049***
S.E. of regression	*1.5812*	*0.5404*	*1.5961*	*1.210*
Schwarz criterion	*12695.9*	*8650.0*	*12760.6*	*6116.9*
Akaike criterion	*12683.6*	*5850.9*	*12748.4*	*6091.7*
Durbin-Watson	*0.1241*	*1.0922*	*1.0922*	

- *Author's Own*

Table 7:63 *The Impact of Technological Innovation and Growth on Regulatory Capital Adequacy of G20 Banks in the Presence of Duality vs. Separation of CEO/Chairperson Roles*

Dependent: CAR / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**GLMM**
Duality of Roles				
Constant	14.7386	14.9051	14.8665	14.934
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.0381	0.002434	0.0012	-0.019
	0.3867	*0.9358*	*0.9653*	*0.343*
Separation of Roles				
Constant	15.3225	15.2107	15.2175	15.035
	*<0.0001***	*0.0000***	*0.0000***	*<0.0001***
IGR	-0.0022	0.0229205	0.0188	0.022
	0.9356	*0.2972*	*0.3374*	*0.190*
Duality Model	***OLS***	***FE***	***RE***	
Number of Observations				
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Identity*
R-squared	*0.0025*	*0.7030*		
Adjusted R-squared	*0.0014*	*0.0000*		
F (1, 163)	*0.7532*			*0.900*
P-value(F)	*0.3867*			*0.343*
S.E. of regression	*3.1256*	*1.8743*	*3.1279*	*1.117*
Schwarz criterion	*4873.0*	*4839.7*	*4875.4*	*3821.2*
Akaike criterion	*4863.3*	*4038.4*	*4865.7*	*3797.0*
Durbin-Watson	*0.3083*	*0.9736*	*0.9736*	
Separation Model	***OLS***	***FE***	***RE***	
Number of Observations	***3117***			
Distribution for GLR Models				*Inverse Gaussian*
Link Function for GLE Models				*Identity*
R-squared	*0.000009*	*0.6889*		
Adjusted R-squared	*-0.0003*	*0.0009*		
F (1, 418)	*0.0065*			*1.721*
P-value(F)	*0.9356*			*0.190*
S.E. of regression	*3.1471*	*1.8862*	*3.1480*	*4.251*
Schwarz criterion	*16006.8*	*15722.3*	*16009.6*	*13095.1*
Akaike criterion	*15994.8*	*13189.6*	*15997.6*	*13028.7*
Durbin-Watson	*0.2828*	*0.8601*	*0.8601*	

- *Author's Own*

Table 7:64 *The Impact of Technological Innovation and Growth on Asset Quality (Credit Risk) of G20 Banks in the Presence of Duality vs. Separation of CEO/Chairperson Roles*

Dependent: AQ / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**GLMM**
Duality of Roles				
Constant	1.9207	1.56262	1.7024	1.606
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	-0.0847	0.004598	-0.0174	-0.015
	*0.0006***	*0.7149*	*0.1595*	*0.061**
Separation of Roles				
Constant	2.0132	2.45975	2.3831	0.889
	*<0.0001***	*<0.0001***	*<0.0001***	*<0.0001***
IGR	0.0681	-0.0365673	-0.0269	-0.006
	*0.0112***	*0.0003****	*0.0054****	*0.033***
Duality Model	***OLS***	***FE***	***RE***	
Number of Observations				
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Identity*
R-squared	*0.0528*	*0.6948*		
Adjusted R-squared	*0.0520*	*0.0002*		
F (1, 209)	*12.0224*			*3.524*
P-value(F)	*0.000639****			*0.061**
S.E. of regression	*1.5133*	*0.9488*	*1.5400*	*0.238*
Schwarz criterion	*4250.6*	*4408.4*	*4291.9*	*3432.1*
Akaike criterion	*4240.5*	*3347.3*	*4281.8*	*3376.7*
Durbin-Watson	*0.2590*	*0.6860*	*0.6860*	
Separation Model	***OLS***	***FE***	***RE***	
Number of Observations	***3267***			
Distribution for GLMM Models				*Normal*
Link Function for GLMM Models				*Log*
R-squared	*0.0172*	*0.8318*		
Adjusted R-squared	*0.0169*	*0.0073*		
F (1, 449)	*6.4894*			*4.548*
P-value(F)	*0.011185***			*0.330***
S.E. of regression	*2.2984*	*1.0236*	*2.3371*	*2.931*
Schwarz criterion n	*14732.3*	*12581.0*	*14833.3*	*3000.8*
Akaike criterion	*14711.1*	*9839.7*	*14821.1*	*2970.4*
Durbin-Watson	*0.1236*	*0.6369*	*0.6369*	

- *Author's Own*

Table 7:65 *The Impact of Technological Innovation and Growth on Transparency (ESGDS) of G20 Banks in the Presence of Duality Versus Separation of CEO/Chairperson Roles*

Dependent: ESGDS / Split: CEOD / Independent: IGR				
	OLS	**FE**	**RE**	**GLMM**
Duality of Roles				
Constant	26.0703	28.6138	28.8391	28.696
	*<0.0001***	*<0.0001***	*0.0000***	*<0.0001***
IGR	0.5629	-0.142713	-0.0875	-0.106
	*<0.0001***	*0.0036***	*0.0541**	*0.013**
Separation of Roles				
Constant	30.5574	32.3382	31.9276	3.351
	*<0.0001***	*0.0000***	*0.0000***	*<0.0001***
IGR	0.4432	0.018674	0.0894	0.0011
	*<0.0001***	*0.7297*	*0.0784**	*0.533*
Duality Model	***OLS***	***FE***	***RE***	
Number of Observations				
Distribution for GLMM Models				*Gamma*
Link Function for GLMM Models				*Identity*
R-squared	*0.0757*	*0.8798*		
Adjusted R-squared	*0.0750*	*0.0123*		
F (1, 217)	*29.4866*			*6.251*
P-value(F)	*<0.0001****			*0.013***
S.E. of regression	*8.0190*	*3.1483*	*8.4535*	*1.368*
Schwarz criterion	*9695.5*	*8436.4*	*9842.5*	*7841.9*
Akaike criterion	*9685.1*	*7295.8*	*9832.0*	*7826.3*
Durbin-Watson	*0.1007*	*0.4553*	*0.4553*	
Separation Model	***OLS***	***FE***	***RE***	
Number of Observations	***3475***			
Distribution for GLMM Models				*Poisson*
Link Function for GLMM Models				*Log*
R-squared	*0.0294*	*0.7458*		
Adjusted R-squared	*0.0291*	*0.0001*		
F (1, 462)	*16.2775*			*0.388*
P-value(F)	*0.000006****			*0.5330*
S.E. of regression	*11.0747*	*6.0869*	*11.1800*	*13.9000*
Schwarz criterion	*26588.3*	*25699.4*	*26655.1*	*462.8*
Akaike criterion	*26576.0*	*22844.2*	*26642.8*	*395.3*
Durbin-Watson	*0.1166*	*0.3951*	*0.3935*	

- *Author's Own*

7.4. Appendix D: Multicollinearity Test Results Pre-Exclusion of Independent Variables – General Preliminary Insights

Table 7:66 *Pearson Correlation Matrix* (PCM) – Country-Specific G7 Banking Sample – Independent Variables Pre-Exclusion (values in percentage %)

	PAR	II	EPARTIC	RDGDP	ERP	CCFA	CC	IBANKING	DT	BigD	DTS	ICTIC	MBDVS	M2MS	MPS	IUPP	IGR
IGR	-0.55	0.07	-0.41	-0.01	0.56	-0.58	-0.54	0.34	-0.48	-0.21	-0.10	0.59	-0.43	0.07	-0.04	0.02	1.00
IUPP	0.09	0.68	0.44	0.42	-0.37	0.30	0.19	0.44	0.15	0.36	0.12	0.13	0.36	0.12	-0.36	1.00	
MPS	-0.07	-0.35	-0.27	-0.19	0.18	0.22	0.21	-0.51	-0.67	-0.77	-0.74	0.21	-0.01	0.19	1.00		
M2MS	-0.02	-0.04	0.20	0.06	0.24	0.31	0.34	0.22	-0.69	-0.33	-0.47	0.26	0.58	1.00			
MBDVS	0.60	0.41	0.61	0.39	-0.33	0.71	0.62	0.10	0.18	0.21	0.05	-0.10	1.00				
ICTIC	-0.15	0.15	-0.43	0.40	0.40	-0.34	-0.23	0.06	-0.51	-0.27	-0.36	1.00					
DTS	0.21	0.38	0.19	0.05	-0.44	-0.07	-0.23	0.33	**0.81**	**0.89**	1.00						
BigD	-0.04	0.43	0.30	-0.22	-0.78	0.18	-0.11	0.75	**0.83**	1.00							
DT	0.28	0.38	0.51	-0.12	-0.73	0.22	-0.06	0.40	1.00								
IBANKING	-0.48	0.49	0.13	-0.23	-0.36	-0.12	-0.20	1.00									
CC	0.47	0.05	0.47	0.18	-0.31	**0.95**	1.00										
CCFA	0.57	0.17	0.44	0.28	-0.46	1.00											
ERP	-0.30	-0.39	-0.50	0.17	1.00												
RDGDP	0.73	0.37	0.06	1.00													
EPARTIC	0.31	0.38	1.00														
II	0.24	1.00															
PAR	1.00																

0	No Correlation
> 0 - < 0.300	Negligible
>= 0.300 - < 0.400	Low
>= 0.400 - < 0.600	Moderate
>= 0.600 - < 0.800	Strong
> = 0.800	Very Strong *(Multicollinearity violation)*

- *Author's Own*

Table 7:67 *Variance Inflation Factor (VIF)* – Country-Specific G7 Banking Sample – Independent Variables Pre-Exclusion

Independent Variable	VIF
IUPP	48.534
MPS	90.934
M2MS	28.271
MBDVS	106.309
ICTIC	327.396
DTS	29.529
BigD	67.319
DT	73.24
IBANKING	208.549
ERP	24.362
RDGDP	850.591
EPARTIC	33.298
II	99.14
PAR	788.62

- *Author's Own*

The above table presents the rationale of excluding multiple independent variables that were tested pre the regression analysis and described by the researcher in the methodology chapter of the empirical assessment in essay three, namely the number of application patents by residents (PAR), Research and Development Expenditures Share of GDP (R&D.GDP), Innovation Index (II), Electronic Participation (E-Partic), Digital Transformation in Business (DT), Digital Skills (DTS), Machine to Machine Broadband Subscriptions (M2MS), and Internet Users Per Population (IUPP).

According to the logical views of the researcher based on the findings of both PCM and VIF shown above, the rationale behind the exclusion of the aforementioned independent variables, is that they might be considered as an output (or dependent) resulted from direct and indirect calculations, indexing, activities of (on) the chosen variables in

our study. For instance, the independent variable chosen to be included in our investigation representing the usage of Internet banking services by individuals (I.Banking) is found to be 1) highly positively correlated with Big Data Analytics performed by businesses (Big.D) while moderately correlated with 2) the Internet users share of population (IUPP), 3) the percentage of businesses purchases of Cloud Computing solutions (CC) including 4) clouds specialised in Accounting and Finance activities (CC.FA), 5) the innovation index (II), and6) the activities of Digital Transformation by businesses (DT). Also, I.Banking is found to be negatively moderately correlated with 7) mobile (cellular) phone subscriptions and 8) the number of patent applications registered by residents (PAR).

Furthermore, the chosen independent variable included in our study representing the percentage Big Data analytics performed by businesses (BIG.D) is found to be highly positively correlated with digital transformation (DT) activities, and digital skills (DTS) as the correlation coefficients of PCM Table shown above reached a percentage of above 80%.

On another note, reBDVS) used in the regression analysis as a proxy of the adaptation level of digital channels and technical connectivity is found to have strong positive correlation with four measures including 1) the number of patents which might indicate that the solutions invented by residents are centred and based on the data and information flow of mobile broadbands, 2) E-Partic indicating that MBDVS might be directly or indirectly included in the indexing methodology of electronic participation activities, 3) Cloud Computing, including the specialised Accounting and Finance clouds (CC.FA) that may be due to the fact that cloud computing solutions' functionality is dependent on data produced by digital channel activities as measured by the MBDVS).

More interestingly, and big data analytics and digital transformation activities are found to be replacing the enterprise resource planning (ERP) systems as the correlation coefficient suggest a strong negative relationship between Big.D and DT with ERP, thereby lowering the percentage of ERP system usage by businesses.

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