

# **FinTech, SME efficiency and national culture: Evidence from OECD countries**

**Abstract:** Small and Medium Enterprises (SMEs) play a vital role in an economy; therefore, it is important to study the avenues that contribute towards their viability. As a result, we examine the impact of financial technologies (FinTechs) on SME efficiency. Using the Generalized Method of Moments methodology and 1,617 SME firms from 22 OECD countries during the period 2011-2018, we find that FinTechs are positively associated with SME efficiency. Interesting results emerge when we incorporate culture. Masculine societies positively moderate the link between FinTechs and SME efficiency. We also find that individualistic and long-term oriented cultures negatively affect the association between FinTechs and SME efficiency. Our findings have multiple implications. This study suggests the need for countries to introduce policies supporting FinTech startups in order to improve SME efficiency. Moreover, if the SME managers aim to achieve higher firm efficiency, then adopting FinTechs may act as a mechanism to attain this objective. Further, it may be important to consider both FinTechs and culture when evaluating cross-border investments.

**Keywords:** FinTech; SMEs; Firm efficiency; Culture

## **1. Introduction**

Small and Medium Enterprises (SMEs) are considered to be a critical part of an economy, given their significant contribution towards gross domestic product, tax revenue and employment (Lu, 2018; Rosavina et al., 2019). For example, SMEs contribute almost 50% to the United Kingdom (UK) economy (Lu, 2018). Therefore, it is important to identify specific mechanisms that may improve the efficiency of SMEs and thereby enhance their ability to survive. The fourth industrial revolution, which incorporates technology into business activities, has introduced novel technologies to the business world. Such advanced technologies are significantly changing the way businesses operate. Financial technology (FinTech), which constitutes a key player in the fourth industrial revolution, amalgamates finance and technology (Chang et al., 2020; Lee & Shin, 2018) and encompasses platforms such as mobile payments, peer-to-peer lending and robotic investment advice (Schueffel, 2016). Further, FinTechs do not require financial institutions to act as intermediaries between lenders and borrowers (Rosavina et al., 2019; Wang et al., 2015). For example, peer-to-peer lending involves linking borrowers and lenders via the internet wherein lenders evaluate credit risk based on the information provided by borrowers and then choose their lending preferences (Guo et al., 2016; Odinet, 2018; Sangwan et al., 2020; Stern et al., 2017). Therefore, FinTechs are redefining the financial services industry (Anagnostopoulos, 2018) and are thereby expected to affect SMEs (Lee & Shin, 2018).

FinTechs increase the likelihood for SMEs to borrow at lower interest rates (Baber, 2019; Odinet, 2018). Moreover, these technologies expedite the process of loan applications and thereby help borrowers obtain funds quickly (Rosavina et al., 2019; Sangwan et al., 2020), which may enhance the ability of SMEs to utilise the funds at an opportune time. Furthermore, FinTechs may help SMEs in attaining investment management advice at a lower cost (Gomber et al., 2018; Lee

& Shin, 2018). Therefore, FinTechs are expected to affect revenues and costs of SMEs (Lee & Shin, 2018). As a result, there is an immediate requirement for academics and practitioners to research FinTechs (Gai et al., 2018; Hua et al., 2019; Ozili, 2018). However, the literature on FinTechs is scarce (Hua et al., 2019).

There is irrefutable evidence that SMEs are facing financial constraints (Beck & Demirguc-Kunt, 2006). Therefore, the recent period has witnessed a rapid rise in the FinTech industry as the channel for driving the credit supply to SMEs (Lee & Shin, 2018; Lu, 2018; Sheng, 2020). Although the extant literature sheds light on how FinTechs influence SME lending (Sheng, 2020; Creehan, 2019), prior research fails to examine the link between FinTechs and SME efficiency. Therefore, our study addresses this research gap by adding to the discussion on whether FinTech acts as an effective tool in enhancing the efficiency of SMEs which have attracted attention from academia and practitioners.

Culture involves a society's values and beliefs held by its individuals (Bogatyreva et al., 2019; Tian et al., 2018) and thereby can impact firms in a number of ways. For example, it may affect capital structure (Chui et al., 2002), research and development expenditure (Shao et al., 2013), dividends (Shao et al., 2010), growth (Boubakri & Saffar, 2016) and takeover policy (Frijns et al., 2013). Further, relevant to our study, culture is believed to have an impact on the extent of innovation activities (Desmarchelier & Fang, 2016; Piteli et al., 2019; Tian et al., 2018) and thereby FinTech startups. Rinne et al. (2013) substantiate a relationship between culture and the level of creativity. Similarly, Cox and Khan (2017) find that innovation is characterised by specific cultural traits. As a result, culture is likely to moderate the association between FinTechs and SME efficiency. Therefore, we concomitantly incorporate the effects of FinTech and cultural determinants on SME efficiency. Studies assessing the preparedness of SMEs in the context of the

growth of financial technology and the heterogeneity of culture are currently lacking. Indeed, as per our knowledge, no prior research examines whether culture moderates the link between FinTechs and SME efficiency. Therefore, our study fills this gap by investigating the interconnection between SME efficiency, FinTech and national cultures, which is currently only at the embryonic stage.

Our study offers multiple contributions. First, we examine the association between FinTechs and SME efficiency in OECD countries from 2011 to 2018. Whereas Haddad and Hornuf (2019) evidence that there are various economic and technological factors that determine FinTech formations, our study substantiates that SMEs experience an increase in their efficiency by adopting FinTechs. Therefore, we contribute towards the emerging literature on FinTech. Second, we extend the research on national culture. We show that individualistic, masculine and long-term oriented cultural dimensions moderate the association between FinTechs and SME efficiency. This suggests the importance of considering national culture when determining whether FinTechs enhance SME efficiency. Third, we apply the theory of reasoned action to help explain how the adoption of FinTechs enhances the efficiency of SMEs. Fourth, this study adopts a more robust econometric methodology to suggest a positive link between FinTechs and SME efficiency. Specifically, this technique controls for unobservable heterogeneity and endogeneity.

Our study is structured in the following manner. The second section explains the theoretical framework, provides an overview of the literature and develops hypotheses. The third section describes the methodology adopted for this study. The fourth section presents the results, while the fifth section concludes this study.

## **2. Theoretical framework and hypotheses development**

According to the Theory of Reasonable Action (TRA), an individual's behaviour is dependent on the beliefs/intentions held towards that behaviour (Fishbein & Ajzen, 1975; Troudi & Bouyoucef, 2020; Uçanok & Karabatı, 2013; Vanyushyn, 2008). Such intentions are significantly affected by their attitude (positive or negative) towards the achievement of an objective, their perceived behavioural control, and their subjective norms (Fishbein & Ajzen, 1975). According to TRA, if a person believes that positive outcomes occur by engaging in specific behaviour, they are more likely to engage in that behaviour (Liu et al., 2017). Empirically, Lee et al. (2012) substantiate that TRA influences SMEs' decision-making.

SME managers may be apprehensive of innovations due to the financial costs involved in adopting innovative technologies (Maldonado-Guzmán et al., 2017) and/or because of the uncertainty revolving around new technologies (McAdam et al., 2004). Although such barriers suggest SME managers may not utilise innovative technologies, we argue that they would be more likely to be receptive to FinTechs. SMEs have relatively limited resources and thereby their survival is contingent on them adopting new technologies (such as FinTechs) in the highly competitive global marketplace (Kim et al., 2018; Madrid-Guijarro et al., 2009). Cefis and Marsili (2006) and Hassan et al. (2018) evidence that the survival rate of SMEs improves with the use of innovative technologies. Therefore, SME managers are expected to adopt FinTechs because they may view FinTechs as a mechanism to increase their firm's efficiency and thereby competitiveness. Following are the multiple reasons why SME managers may believe that FinTechs are likely to improve their firm's efficiency.

SMEs benefit from lower interest rates when borrowing from FinTech firms (Baber, 2019; Odinet, 2018). There are multiple mechanisms that may help explain such lower borrowing cost. First, FinTech firms usually have fewer employees because they mainly operate online rather than

through branches where more staff members are required; thus, a smaller number of staff could reduce the operating costs significantly (Lee & Shin, 2018; Lu, 2018). This benefit of lower operating costs could then be transferred to SMEs in the form of lower interest rates. Further, in the FinTech environment, it is the investors rather than the FinTechs who lend money (Anagnostopoulos, 2018). Therefore, FinTechs are not expected to hold large capital reserves to protect themselves from credit risk, which may also reduce interest rates (Odinet, 2018). Lastly, FinTechs are capable of incorporating more factors in assessing the credit risk of borrowers due to the use of big data (Jagtiani & Lemieux, 2019; Langley & Leyshon, 2017; Lu, 2018). This allows FinTechs to accurately evaluate the credit risk of borrowers (Jagtiani & Lemieux, 2019; Yan et al., 2015), which may potentially enable SMEs to qualify for loans at a lower interest rate.

There are also other mechanisms that may explain how FinTechs reduce expenses for SMEs. FinTechs are capable of processing loan applications more quickly than traditional banking loans (Rosavina et al., 2019; Sangwan et al., 2020), which helps reduce search costs for SMEs (Gomber et al., 2018). Fuster et al. (2019) find that FinTech lending is faster than other platforms. Furthermore, FinTechs are expected to enable SMEs to send or receive foreign currency as well as manage their exposure to foreign transactions in a less costly manner (Chuen & Teo, 2015; Lee & Shin, 2018). Moreover, FinTechs enable SMEs to pay costs such as rent, electricity and creditor bills without the need to visit banks by offering mobile payment solutions, thereby suggesting a reduction in travelling costs (Chuen & Teo, 2015; Lee & Shin, 2018; Ozili, 2018). In addition, FinTechs, through robo-advice, provide wealth management guidance at a lower cost than a real-life individual (Gomber et al., 2018; Lee & Shin, 2018), indicating that SMEs may be able to invest their surplus cash in a cost-effective manner. FinTechs are also expected to improve revenue for SMEs, as providing rapid access to funds (Rosavina et al., 2019; Sangwan et al., 2020) may enable

SMEs to be in a better position to take advantage of business opportunities at an appropriate time. As a result, FinTechs are more likely to enhance the efficiency of SMEs. Based on the above argument, we propose the following hypothesis:

*H1: There is a positive association between FinTechs and SME efficiency*

According to Majidi (2007), culture exerts a significant impact on people's perceptions and interpretations of the environment and consequently their rationality to make decisions, including business and strategic decisions. Hofstede (1980) defines culture as the collective programming of mental and mind framework which distinguishes one group of people from another group of people. In addition, Hofstede (1980) suggests that people group together based on shared attitudes, values and beliefs, which can define and direct human behaviour in certain social and business systems. Hofstede (1980, 1994, 2011, 2013) articulates the Culture Distance Index (CDI) to examine the cultural difference between different countries from six cultural clusters: power distance; individualism or collectivism; masculinity or femininity; uncertainty avoidance; long-term orientation; and indulgence or restraint.

The first cultural dimension, power distance, refers to the level of acceptance of unequal power distribution by less powerful members of society. In cultures with a greater level of power distance, there is an unequal distribution of power where powerful individuals possess significant influence (Kanagaretnam et al., 2011; Kashefi-Pour et al., 2020). Further, people in such societies consider themselves less likely to succeed due to the concentration of power among only a few people (Ortas & Gallego-Alvarez, 2020; Tian et al., 2018), which may dissuade potential entrepreneurs from converting their plans into reality (Bogatyreva et al., 2019). Moreover, in high power distance societies, it may be difficult for people to question authority, which hinders innovation (Cox & Khan, 2017; Prim et al., 2017). This is likely to curtail FinTech startups, which

in turn reduces SME efficiency. Shane (1993) finds that high power distance cultures negatively affect innovation. Based on the above argument, we propose the following hypothesis:

*H2a: In high power distance cultures, there is a negative association between FinTechs and SME efficiency*

The second cultural dimension, individualism or collectivism, defines people's preference towards the social framework. Individualism refers to a loosely-knit social framework where people only look after themselves and their immediate families. Individualistic cultures are characterised by limited social interactions, poor teamwork and lack of collaboration (Černe et al., 2013; Eby & Dobbins, 1997; Rosenbusch et al., 2011). Such limited communication with stakeholders in individualistic cultures may adversely affect innovation (Černe et al., 2013; Rosenbusch et al., 2011). Indeed, Černe et al. (2013) find that societies lacking individualistic traits limit innovation. This suggests that individualistic cultures may reduce FinTech startups and thereby curtail SME efficiency. Based on the above argument, we propose the following hypothesis:

*H2b: In an individualistic culture, there is a negative association between FinTechs and SME efficiency*

Masculinity versus femininity, which is the third cultural dimension, refers to whether members of a society have a preference for achievement, heroism, assertiveness and material reward for success or cooperation, modesty, caring for the weak and quality of life. Entrepreneurship is usually considered to show traits demonstrative of masculinity such as the desire to achieve material reward and aggressively targeting opportunities that further their entrepreneurial performance (Bogatyreva et al., 2019; Piteli et al., 2019). McGrath et al. (1992)



find that entrepreneurial individuals are characterised by masculine features. In addition, masculine societies depict greater acceptance of challenges and also show initiative, suggesting that they are more likely to innovate (Tian et al., 2018). Singh (2006) provides evidence that cultures with greater masculinity are positively associated with innovation. We, therefore, contend that masculine societies increase the number of FinTech startups and thereby increase SME efficiency. Based on the above argument, we propose the following hypothesis:

*H2c: In masculine cultures, there is a positive association between FinTechs and SME efficiency*

The fourth cultural dimension, uncertainty avoidance, refers to how members of a society feel uncomfortable with uncertainty and ambiguity, and the way members deal with unexpected things. The dimension of uncertainty avoidance measures the extent to which people are comfortable with accepting unknown/uncertain situations (Kwok & Tadesse, 2006). In a culture with high uncertainty avoidance, individuals are fearful of uncertainty and prefer scenarios that are more predictable (Chui & Kwok, 2008). This is likely to inhibit new ideas and innovation, as these concepts are aligned with unorthodoxy and require nonconformist behaviour towards established norms (Ortas & Gallego-Alvarez, 2020; Piteli et al., 2019). Shane (1993) finds that cultures with a greater tendency to avoid uncertainty are associated with lower innovation. Therefore, given that FinTechs are associated with innovative technologies, there may be fewer FinTech startups in high uncertainty avoidance societies, thereby reducing SME efficiency. Based on the above argument, we propose the following hypothesis:

*H2d: In uncertainty avoidance cultures, there is a negative association between FinTechs and SME efficiency*

The fifth dimension, long-term orientation versus short-term orientation, was added in 1991 based on research conducted by Michael Bond in the context of Chinese employees and managers. The long-term orientation dimension refers to a society's tendency to search for virtue, and people in such a society believe that truth relies primarily on situation, context and time; while short-term orientation can be interpreted as dealing with establishing the absolute truth in society. Long-term oriented cultures are aligned with a more pragmatic approach and concentrate on long-term financial return, and thus these societies may attach lower importance to short-term value creation (Hassan et al., 2011; Ortas & Gallego-Alvarez, 2020). As a result, these cultures are less focused on the present and take more time to “get ready for an actual shift from intention to start-up activities” (Ayoun & Moreo, 2009; Bogatyreva et al., 2019, p. 318; Venaik et al., 2013). Therefore, long-term oriented societies are unlikely to induce innovation because innovation requires more time to plan (DePasse & Lee, 2013; Somekh, 1998; Tian et al., 2018). Hence, this study argues that long-term oriented cultures are likely to be linked with fewer FinTechs, which in turn curtails SME efficiency. Based on the above argument, we propose the following hypothesis:

*H2e: In long-term oriented cultures, there is a negative association between FinTechs and SME efficiency*

A sixth dimension, indulgence versus restraint, was introduced in 2010 based on research conducted by Michael Minkov. The indulgence dimension refers to a society with relatively free gratification of basic natural human motives involved with enjoying life and having fun, while restraint refers to a society that restricts the gratification of needs and regulates the needs by strict social norms (Hofstede, 2013). Cultures scoring high on indulgence are involved in enjoying life whereas people in restraint cultures show restraint in having such feelings (Ismail & Lu, 2014;

Ortas & Gallego-Alvarez, 2020). Therefore, high indulgence may lead people to leave their employment in the case of dissatisfaction (MacLachlan, 2013), which may persuade individuals to start their own businesses. Further, societies with greater indulgence are expected to have more understanding of new experiences and thereby be in a better position to innovate (Prim et al., 2017). Empirical evidence suggests that indulgence is positively linked with innovation (Cox & Khan, 2017; Lažnjak, 2011). Therefore, we expect greater FinTechs in indulgent societies and thereby higher SME efficiency, leading us to hypothesise the following:

*H2f: In indulgent cultures, there is a positive association between FinTechs and SME efficiency*

### **3. Methodology**

Following Haddad and Hornuf (2019), we collect FinTech data from Crunchbase, while we obtain other financial characteristics from Osiris. We omit financial firms from our study because these firms may have distinct corporate structure (Alam et al., 2019). Moreover, we focus on OECD countries, as they share similar characteristics yet are characterised by varied cultures (Carlin et al., 2013; Pacek et al., 2019). Further, the study period encompasses the period from 2011 to 2018. After considering the missing information for the variables in our below-mentioned models, the total firm-year observations are 7285 and 6657 for the first and second models respectively. We start collecting our data from 2011 in order to avoid any impact from the global financial crisis of 2008-10 (Aidukaite, 2019), while 2018 was the latest year for which the data was available. In addition, it was only after the global financial crisis that FinTechs became prominent and thereafter FinTech startups started growing (Baber, 2019; Lee & Shin, 2018; Odinet, 2018). Moreover, following Arend (2006), Brooksbank (1991), Chu (2009) and George et al. (2005), we define a firm as being an SME if it has less than 500 employees. We utilise Hofstede's (1980, 1994, 2011,

2013) CDI to determine the culture of each country in our sample. It constitutes six dimensions, i.e. power distance, individualism or collectivism, masculinity or femininity, uncertainty avoidance, long-term or short-term orientation, and indulgence or restraint (Bogatyreva et al., 2019; Huang & Crotts, 2019; Ketkar et al., 2012). We adopt Hofstede’s (2011) framework to collect the six cultural dimensions because it is “the most accepted and broadly used measure of culture today and has been validated by a number of recent studies” (Arosa et al., 2015, p. 184; Ketkar et al., 2012). Following Zasuwa (2019), we collect the data pertaining to cultural dimensions from the website of Geert Hofstede<sup>1</sup>.

In order to test our hypotheses, we use the following models:

$$SMEefficiency_{i,t} = \beta_1 SMEefficiency_{i,t-1} + \beta_2 Fintechs_{i,t} + \beta_k Controls_{i,t} + Industry + Year + \varepsilon \quad (1)$$

$$\begin{aligned} SMEefficiency_{i,t} = & \beta_1 SMEefficiency_{i,t-1} + \beta_2 Fintechs_{i,t} + \beta_3 FinTechs_{i,t} * Power + \\ & \beta_4 FinTechs_{i,t} * Individualistic + \beta_5 FinTechs_{i,t} * Uncertainty avoidance + \beta_6 FinTechs_{i,t} * Masculine \\ & + \beta_7 FinTechs_{i,t} * Long-term orientation + \beta_8 FinTechs_{i,t} * Indulgence + \beta_9 Power + \\ & \beta_{10} Individualistic + \beta_{11} Masculine + \beta_{12} Uncertainty avoidance + \beta_{13} Long-term orientation + \\ & \beta_{14} Indulgence + \beta_k Controls_{i,t} + Industry + Year + \varepsilon \end{aligned} \quad (2)$$

In the above models, subscripts  $i$  and  $t$  represent firm and year respectively. Additionally, *Industry* and *Year* depict industry and year effects respectively. We use return on invested capital (ROIC) to ascertain the SME’s efficiency, as it measures a firm’s financial efficiency in utilising the money invested in it (Alam et al., 2020; Chen & Ma, 2011; Churet & Eccles, 2014; Lee, 2019). ROIC is determined by the proportion of earnings to invested capital (Gupta & Gupta, 2015; Sørensen, 2002). Further, we take the natural log of FinTechs to determine our main independent

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<sup>1</sup> The cultural dataset of Geert Hofstede can be accessed at the following website: <https://geerthofstede.com/research-and-vsm/dimension-data-matrix/>.

variable, as the use of natural logarithm as opposed to absolute value reduces heteroscedasticity (Alam et al., 2017). Moreover, in order to address multicollinearity issues in our interaction model, we mean centre our main variables before creating the interaction terms (Nguyen et al., 2015; Wan & Yiu, 2009).

This study utilises the following control variables. First, large firms benefit from economies of scale and possess more experience (Kamshad, 1996; Revilla & Fernández, 2012), which suggests higher efficiency among large firms. Firm size is determined through the natural log of total assets (Ghafran & O'Sullivan, 2017; Gull et al., 2018). Second, high-growth firms are likely to possess more resources (Mouelhi & Ghazali, 2018; Rice et al., 2012), which could be helpful in enhancing the efficiency of firms. Firm growth is determined through yearly growth in sales (Abbasi et al., 2020; Alam et al., 2020; Arun et al., 2015). Third, greater debt levels suggest financial difficulties, which hinder firms' ability to borrow (Atiya, 2001; Gharsalli, 2019). This indicates that highly leveraged firms may be less likely to invest in efficiency-enhancing techniques. Leverage is measured as the proportion of total debt to total assets (Nguyen et al., 2015; Zalata et al., 2019). Fourth, high cash holdings suggest more liquidity and thereby greater ability to invest in various projects (Chen et al., 2019; Hsu & Liu, 2018). This may enable firms to proceed with investments that improve efficiency. Following Li et al. (2020) and Trejo-Pech et al. (2015), cash holding is determined as the proportion of cash to sales. Additionally, all of our variables are in US dollars (Alam et al., 2017).

Further, this study implements the Generalized Method of Moments (GMM) to examine our research questions for multiple reasons. First, we use a panel data structure where cross-sections (1217 firms) are considerably greater than time for each cross-section (8 years) (Asongu et al., 2018). Second, it is considered to be robust to firm-specific heterogeneity and the bias arising

from the correlation between explanatory variables and error term (Alam et al., 2020; Hillier et al., 2011). Third, it provides better estimates “in the presence of the unknown heteroscedasticity and autocorrelation that often arise in a dynamic panel” (David et al., 2006, p. 596). Countries in our sample might have distinct characteristics and therefore heteroscedasticity is expected to be an important issue to address, while the presence of a lagged dependent variable suggests autocorrelation should also be tackled (Alam et al., 2019). Fourth, current firm efficiency may be affected by the level of last year’s efficiency (Casu & Girardone, 2009). As a result, this study includes dependent variable lag as an independent variable, which makes the use of a fixed or random effect model unsuitable (Alam et al., 2020). Despite these advantages, it is important to note that GMM is not a perfect method, as it is known to be biased in the case of omitted time-varying variables (Cardillo et al., 2020; Wintoki et al., 2012).

We adopt two-step GMM estimation as opposed to one-step estimation because the former is considered to be more efficient (Musolesi & Nosvelli, 2007; Zhao & Dong, 2017). However, the two-step system GMM may suffer from downwardly biased standard errors (Nguyen et al., 2015); therefore, our study applies Windmeijer’s (2005) finite-sample correction. Further, the use of difference GMM may magnify gaps in our unbalanced panels, thereby we adopt system GMM (Alam et al., 2019; Roodman, 2009). Moreover, system GMM provides improved estimation compared to difference GMM (Asongu et al., 2018; Beyzatlar & Yetkiner, 2017).

Following Abdallah et al. (2015), we perform two tests to assess the suitability of the GMM in this study, which are shown in Table 4. First, the Hansen-J test is insignificant. This suggests that the instruments utilised in this study are appropriate because they are unlikely to be correlated with the error term (Abdallah et al., 2015; Hillier et al., 2011). Second, second-order autocorrelation in the first differenced residuals (AR (2) test) is insignificant, which indicates that

our model may not suffer from second-order autocorrelation (Teixeira & Queirós, 2016). We also perform an additional test to assess the existence of an instrument proliferation problem. Given that the number of instruments used is less than the number of groups, this study may not suffer from instrument proliferation issues (Alam et al., 2019; Asongu et al., 2018).

## **4. Results and discussion**

### *4.1. Main results*

Table 2 presents the firm observations by country. It shows that Japan has the highest observations (2251) over the study period, which accounts for 30.9% of all OECD countries. In contrast, Austria has the fewest observations (4), which only account for 0.05%. Table 3 presents the descriptive statistics, which show that the mean value of FinTechs is 2.928 with a standard deviation of 1.413, suggesting variation in FinTechs among OECD countries. It also shows that our sample consists of societies with a wide range of beliefs, given the high standard deviations of the cultural dimensions. For example, power distance has a standard deviation of 16.002 (mean value: 43.825). Similarly, the standard deviation (mean) of masculinity is 62.558 (28.005).

**Table 1:** Definition of variables

Variables	Definitions	Sources
<i>ROIC</i>	Proportion of earnings to invested capital	Osiris
<i>ROE</i>	Proportion of earnings to equity	Osiris
<i>FinTechs</i>	Natural log of the number of FinTechs	Crunchbase
<i>Power</i>	Cultural dimension of power distance	Hofstede
<i>Individualistic</i>	Cultural dimension of individualism	Hofstede
<i>Masculine</i>	Cultural dimension of masculinity	Hofstede
<i>Uncertainty avoidance</i>	Cultural dimension of uncertainty avoidance	Hofstede
<i>Long-term orientation</i>	Cultural dimension of long-term orientation	Hofstede
<i>Indulgence</i>	Cultural dimension of indulgence	Hofstede
<i>Cash holdings</i>	Proportion of cash to sales	Osiris
<i>Firm size</i>	Natural log of assets	Osiris
<i>Leverage</i>	Proportion of debt to assets	Osiris
<i>Firm growth</i>	Annual growth in sales	Osiris



**Table 2: Firm observations by country<sup>2</sup>**

Country	Frequency	Percent
Australia	37	0.51
Austria	4	0.05
Belgium	46	0.63
Denmark	179	2.46
Finland	115	1.58
France	485	6.66
Germany	762	10.46
Greece	270	3.71
Ireland	39	0.54
Israel	628	8.62
Italy	94	1.29
Japan	2,251	30.9
Netherlands	43	0.59
Norway	95	1.3
Poland	143	1.96
Republic of Korea	4	0.05
Spain	66	0.91
Sweden	576	7.91
Switzerland	97	1.33
Turkey	310	4.26
United Kingdom	1,022	14.03
United States of America	19	0.26
<b>Total</b>	<b>7,285</b>	<b>100</b>

Source: Authors' calculation.

<sup>2</sup> In order to address the potential bias stemming from including Japan (constituting 30.9% of our sample), we performed a separate regression excluding Japan and found similar results. The results can be provided upon request.

**Table 3:** Descriptive statistics

Variables	Mean	Std. Dev.	Min.	Max.
<i>ROIC</i>	0.138	0.376	-9.333	8.627
<i>ROE</i>	0.092	0.277	-6.525	6.345
<i>FinTechs</i>	2.928	1.413	0.000	7.100
<i>Power</i>	43.825	16.002	11.000	68.000
<i>Individualistic</i>	60.868	16.512	18.000	91.000
<i>Masculine</i>	62.558	28.005	5.000	95.000
<i>Uncertainty avoidance</i>	70.511	24.877	23.000	100.000
<i>Long-term orientation</i>	64.487	20.451	21.000	100.000
<i>Indulgence</i>	51.884	13.850	29.000	78.000
<i>Cash holdings</i>	0.142	0.156	0.000	1.000
<i>Firm size</i>	11.200	1.428	3.278	15.862
<i>Leverage</i>	0.594	6.188	0.007	375.941
<i>Firm growth</i>	0.111	0.463	-1.000	9.660

All variables are defined in Table 1. Source: Authors' calculation.

We report our GMM estimation in Table 4. Column 1 reports that FinTechs have a positive and significant association with SME efficiency. This suggests that FinTechs enable SMEs to attain funds at a lower interest rate (Baber, 2019; Odinet, 2018) and also help reduce other expenses such as wealth management advisory fee, search costs for loans and foreign currency transfer fee (Chuen & Teo, 2015; Gomber et al., 2018; Lee & Shin, 2018). Therefore, we accept our hypothesis 1. In relation to our control variables, we evidence that firm growth, leverage and cash holdings are significant and in line with the study's expectations. Firm growth is positively associated with SME efficiency, suggesting that growing firms have more resources available (Mouelhi & Ghazali, 2018; Rice et al., 2012) and thereby are able to improve their efficiency. Further, cash holdings have a positive link with SME efficiency. This indicates that higher liquidity enhances the ability to invest (Chen et al., 2019; Hsu & Liu, 2018), which helps improve the firm's efficiency. Lastly, leverage is negatively associated with SME efficiency. This supports the view that highly leveraged firms find it difficult to borrow (Atiya, 2001), which curtails their efficiency.

Column 2 of Table 4 reports the GMM estimation pertaining to our six cultural dimensions. Individualistic cultures negatively moderate the association between FinTechs and SME efficiency. Individualistic societies are aligned with lower social interactions and limited teamwork, thereby such poor communication with stakeholders may ultimately hinder innovation (Černe et al., 2013; Rosenbusch et al., 2011). This lowers investment in innovative technologies such as FinTechs and thereby curtails SME efficiency. Hence, we accept hypothesis 2b. Further, there is a positive moderating impact of masculine culture on the association between FinTechs and SME efficiency. Masculine societies show a higher tendency to accept challenges and thereby are more able to innovate (Tian et al., 2018), which increases the number of FinTech startups and thus results in higher SME efficiency. Therefore, hypothesis 2c is supported by our empirical results.

Moreover, long-term oriented cultures have a negative moderating impact on the link between FinTechs and SME efficiency. Long-term oriented societies utilise more time to take decisions (Ayoun & Moreo, 2009), which, considering that innovation requires more planning (DePasse & Lee, 2013; Tian et al., 2018), limits FinTech startups and thus reduces SME efficiency. As a result, our results support hypothesis 2e. Furthermore, we find that power distance and uncertainty avoidance exert a negative but insignificant moderating impact on the link between FinTechs and SME efficiency. Additionally, indulgence exerts a positive but insignificant moderating impact on the association between FinTechs and SME efficiency. Thereby, our empirical results do not support hypotheses 2a, 2d and 2f. Based on the empirical results, we conclude that, out of the six dimensions of national culture, individualistic and long-term orientation dimensions have a significantly negative moderating impact on the link between FinTechs and SME efficiency, while the masculine dimension exerts a significantly positive

moderating impact. Power distance, uncertainty avoidance and indulgence have an insignificant moderating impact.

**Table 4:** GMM estimation (FinTechs and SME efficiency)

	Model 1	Model 2
<i>SMEefficiency<sub>i,t-1</sub></i>	-0.2648* (0.1362)	-0.3286*** (0.0941)
<i>FinTechs</i>	0.0403*** (0.0102)	0.0618** (0.0246)
<i>FinTechs*Power</i>		-0.0019 (0.0025)
<i>FinTechs*Individualistic</i>		-0.0026* (0.0013)
<i>FinTechs*Masculine</i>		0.0014* (0.0008)
<i>FinTechs*Uncertainty avoidance</i>		-0.0009 (0.0022)
<i>FinTechs*Long-term orientation</i>		-0.0031** (0.0012)
<i>FinTechs*Indulgence</i>		0.0002 (0.0016)
<i>Power</i>		-0.0042 (0.0027)
<i>Individualistic</i>		-0.0036** (0.0017)
<i>Masculine</i>		-0.0028** (0.0014)
<i>Uncertainty avoidance</i>		0.0030 (0.0024)
<i>Long-term orientation</i>		-0.0008 (0.0013)
<i>Indulgence</i>		-0.0010 (0.0019)
<i>Cash holdings</i>	0.3128*** (0.0592)	0.3023*** (0.0540)
<i>Firm size</i>	-0.0053 (0.0070)	-0.0084 (0.0064)
<i>Leverage</i>	-0.0013*** (0.0002)	-0.0012*** (0.0002)
<i>Firm growth</i>	0.0423*** (0.0112)	0.0408*** (0.0115)
Constant	-0.0873 (0.1123)	0.2161** (0.0911)
Observations	7,285	6,657
Year effects	YES	YES
Industry effects	YES	YES
Number of groups	1,617	1,498
Number of instruments	32	84
AR(2): <i>p</i> -value	0.845	0.943
Hansen <i>J</i> test: <i>p</i> -value	0.261	0.33

Standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

#### *4.2. Robustness test*

As part of our robustness test, we use an alternative measure to ascertain the efficiency of SMEs, namely return on equity (ROE). Prior studies (Lui, 2013; Turcsanyi & Sisaye, 2013; Xu et al., 2019) also adopt ROE as a variable to measure a firm's efficiency. It is determined by the proportion of earnings to shareholders' investment (Abraham et al., 2016; Keffala & Peretti, 2016).

Table 5 reports the results from GMM estimation, where we employ a different definition of SME efficiency. Column 1 of Table 5 finds that FinTechs are positively associated with SME efficiency. Column 2 of Table 5 shows that individualism and long-term oriented cultures negatively moderate the link between FinTechs and SME efficiency, while masculinity positively moderates this link. As a result, we conclude that the results are consistent with our main findings.

**Table 5:** Robustness test

	Model 1	Model 2
<i>SMEefficiency<sub>i,t-1</sub></i>	-0.0785 (0.0836)	-0.0903 (0.0733)
<i>FinTechs</i>	0.0174** (0.0083)	0.0069 (0.0525)
<i>FinTechs*Power</i>		-0.0031 (0.0066)
<i>FinTechs*Individualistic</i>		-0.0060** (0.0028)
<i>FinTechs*Masculine</i>		0.0051*** (0.0018)
<i>FinTechs*Uncertainty avoidance</i>		-0.0051 (0.0065)
<i>FinTechs*Long-term orientation</i>		-0.0056* (0.0030)
<i>FinTechs*Indulgence</i>		-0.0018 (0.0061)
<i>Power</i>		0.0003 (0.0069)
<i>Individualistic</i>		-0.0024 (0.0032)
<i>Masculine</i>		-0.0049* (0.0028)
<i>Uncertainty avoidance</i>		-0.0008 (0.0065)
<i>Long-term orientation</i>		0.0012 (0.0022)
<i>Indulgence</i>		-0.0063 (0.0044)
<i>Cash holdings</i>	0.3161*** (0.0705)	0.6773* (0.3953)
<i>Firm size</i>	0.0041 (0.0065)	0.1064** (0.0509)
<i>Leverage</i>	-0.0007*** (0.0002)	0.0016 (0.0012)
<i>Firm growth</i>	0.0308 (0.0245)	0.0169 (0.0612)
Constant	0.0000 (0.000)	-1.4957** (0.6374)
Observations	7,299	6,669
Year effects	YES	YES
Industry effects	YES	YES
Number of groups	1,617	1,498
Number of instruments	32	57
AR(2): <i>p</i> -value	0.643	0.63
Hansen <i>J</i> test: <i>p</i> -value	0.188	0.182

Standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## 5. Conclusion

Given the significant contribution of SMEs towards an economy (Lu, 2018), it is vital to identify the mechanisms that may improve their efficiency and thereby enable them to survive for a longer period. FinTechs, which are playing a major role in the development of the fourth industrial revolution, are expected to have a wide-ranging impact on the operations of SMEs (Chang et al., 2020; Lu, 2018; Rosavina et al., 2019). FinTechs enable SMEs to borrow at a lower interest rate (Baber, 2019; Odinet, 2018), help them gain access to funds at a quicker pace (Rosavina et al., 2019; Sangwan et al., 2020) and lower their investment advisory costs (Gomber et al., 2018; Lee & Shin, 2018). Yet, there is no empirical study examining whether FinTechs improve SME efficiency.

Utilising GMM methodology and data from OECD countries over the period 2011-2018, we find a positive association between FinTechs and the efficiency of SME firms. Further, using Hofstede's CDI and its six cultural dimensions, we evidence that culture plays a role in the relation between FinTechs and SME efficiency. Our study shows that individualistic and long-term oriented cultures have a negative moderating impact on the association between FinTechs and SME efficiency, while masculine culture positively moderates the link between FinTechs and SME efficiency. Moreover, we report an insignificant moderating effect of power distance, uncertainty avoidance and indulgence cultures on the relationship between FinTechs and SME efficiency. Additionally, we find that our findings are robust to using an alternative definition of SME efficiency.

Our study has important practical and managerial implications. First, our results support the efforts of policy-makers towards devising policies that aim to increase FinTech startups. For example, Australia established an innovation hub in 2015 to assist FinTech businesses in licensing



and regulatory issues (Zetsche et al., 2017). Second, culture may need to be incorporated when formulating policies to support FinTech startups, as this study suggests that policy-makers may have to provide greater support to potential FinTech entrepreneurs in the case of individualistic or long-term oriented cultures. Third, to the extent that SME managers aim to attain higher firm efficiency, our evidence shows that adopting FinTechs acts as a medium to achieve this aim. Lastly, this study is expected to be helpful for firms in assessing cross-border investment decisions. For instance, the potential benefit from investing in countries with greater availability of FinTechs may be hampered if those countries are characterised as individualistic or long-term oriented societies.

We also present a number of research avenues that may be helpful for future researchers. First, our results related to cultural dimensions may be dependent on using Hofstede's framework; therefore, we recommend future research to employ other frameworks such as GLOBE or World Values Survey (Bogatyreva et al., 2019). Moreover, we may have a more detailed understanding of a culture's impact on the link between FinTechs and SME efficiency by adopting these alternative frameworks. This is because these other approaches offer more dimensions than covered by the Hofstede framework (House et al., 2002; Ketter & Arfsten, 2015). Second, although we utilise a more advanced econometric technique for our analysis, we acknowledge that our GMM methodology is not devoid of any weakness. Indeed, GMM may show biased estimation results when there are omitted time-varying variables (Cardillo et al., 2020). Third, investigating whether institutional quality affects the relationship between FinTechs and SME efficiency is likely to identify other factors that may moderate this relationship. Fourth, qualitative analysis through interviews or surveys may be fruitful in offering an in-depth analysis. Lastly, it might be

interesting to identify the various types of FinTechs and thereafter ascertain whether the positive impact of FinTechs on SME efficiency is contingent on a specific type of FinTech.

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