Does globalisation have an impact on dual banking system productivity in selected Southeast Asian banking industry?

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Abstract

Purpose – Globalisation has influenced many countries, over the last few decades with financial globalisation and liberalisation bringing regulatory reforms in the banking sector. Thus, this study aims to fill a gap in the literature by examining the influence of globalisation on Islamic and conventional bank productivity in Southeast Asia.

Design/methodology/approach – The sample comprised 155 banks (23 Islamic and 132 conventional) from 4 countries from 2008 to 2017. Panel data techniques will be used, together with data envelopment analysis (DEA)-based Malmquist productivity index (MPI), to investigate the impact of chosen main determinants on bank productivity. A panel regression analysis will be performed after generating the productivity index from the DEA-based MPI frontier.

Findings – According to the findings, Islamic banks are statistically significantly more productive than conventional banks, and the findings of the t-test are corroborated by the findings of nonparametric tests. Furthermore, the findings of the panel regression model reveal that bank specific factors and macroeconomic variables are significant determinants to bank productivity. Surprisingly, the findings also show that the influence of social globalisation elements tends to be negatively related to conventional bank productivity.

Originality/value – This study adds to the existing literature by bridging the globalisation gap in the productivity of the dual banking industry, particularly in the specific context of Southeast Asia, given that the area is representative of Islamic and finance globally.

Keywords Total factor productivity change, Malmquist productivity index, Islamic bank, Conventional bank, Southeast Asia

Paper type Research paper

1. Introduction

The Southeast Asia financial sectors have responded positively to the global revolution and trends in the banking industry. This transformation had a significant impact on the practices of financial activities and the competitive environment in the banking industry. As a result of the global financial crisis (GFC) between mid-2007 and 2009, growing attention is directed at Islamic banking as an alternative to conventional banking particularly after investment collapsed in United States (Rosman *et al.*, 2014). Currently, banking industry continues to develop, at least until another mode of banking is available, and Islamic banking starts to attract more interest from Islamic and contemporary finance. Islamic finance is important to Muslims who need financial instrument that comply with the Islamic legal code *Shariah* (Rosman *et al.*, 2014). Furthermore, Islamic banks also have the ability to reduce the threats endemic to financial transaction that have an impact on economic development (Hassan *et al.*, 2018).

In principle, the Islamic financial system abolish money interest, gambling, excessive ambiguity (*gharar*), speculation and illegal dealings including alcohol, tobacco, pornography and other practices that it finds to be detrimental to the society (Hassan and Aliyu, 2018). Theoretically, Islamic banks providing Shariah products can be differentiated from conventional banks attributed to the variations in complexity, agency cost and development (Beck *et al.*, 2013). Further variations are evident as related to risk-taking, the price of money, income, bank size and so forth (Habib, 2018).

In the operational terms, Islamic banks are different with conventional banks such as practicing the profit and loss sharing (PLS), they could not allow to control the cost of funds due to the uncertainty profit that will be shared with the depositors. Informational and market imperfections could also lead to the higher operations cost to the Islamic banks. Although Islamic and conventional banks can be differentiated from exact other, both banks have the same goal that gives priority to profitability. Clearly put, productivity in generating profitability is an important area for both Islamic and conventional banks. In recognition of the value of profitability for Islamic and conventional banks, a number of studies have primarily focused on evaluating the efficiency of Islamic finance as a way of measuring the performance of banks (Said, 2013; Rosman *et al.*, 2014; Wanke *et al.*, 2016; Sufian and Kamarudin, 2017; Sufian *et al.*, 2017; Kamarudin *et al.*, 2017) whereas, limited research has been conducted to examine the productivity levels of the conventional and Islamic banking sector as intermediaries (Kamarudin *et al.*, 2017). This paper will therefore provide deeper insight and contribute to the literature pertinent to the productivity of the banking sector. Financial performance is a broad concept that takes into consideration of the productivity, profitability and growth. In general, productivity could be defined as the efficiency changes between periods that can be measured on progressive, regressive or constants over the periods, while the profitability is the overall efficiency of the firm, which demonstrates the firm's ability to make a profit. Banks' key objectives are to maximise the shareholder capital. Fortunately, to achieve their objectives, they need to create a high profit and bank need to be productive to generate high profitability. Therefore, if banks wish to increase their profit, they must not neglect the productivity. Bottazi *et al.* (2008) revealed that high productivity can lead to high profitability. Globally, Islamic banking's market share in the financial industry remains small but is rising rapidly in many regions, especially in the Asian and Middle East regions (International Monetary Fund, 2015). According to Houben (2003), Southeast Asia, with its ever-increasing Muslim community, receives scant attention worldwide. This view is also supported by Kamarudin *et al.* (2017). As Islamic finance is gradually becoming an institutionalised component of the global capital market, it has the ability to develop rapidly and contribute to economic development (Imam and Kpodar, 2016).

Moreover, the Muslim population is fast-growing, particularly in the Southeast Asia (SEA) region, which has popularised the ethical character and financial stability of Islamic finance

products and services offered by several countries (Malaysia, Indonesia, Singapore and Brunei) as an important alternative to conventional financing mechanisms. Table 1 represents the top 11 Islamic banks in SEA by assets in 2019. As seen in the table, assets reported as Syariah totalled around USD192,930m in SEA, with three countries accounting for this total: Malaysia, Brunei and Indonesia, with Malaysia accounting for 92.64%. Maybank Islamic is the leading bank, with USD54,459m in assets (28.23%). The country Brunei was followed by Bank Islam Brunei Darussalam, which had assets valued at USD7,385m (3.83%). The assets of Indonesia's Bank Syariah Mandiri are worth the least, at USD6,818m (3.53%).

The 11 leading conventional banks for 2019 in SEA are presented in Table 2, with a total asset value of about USD1,804,223m. The DBS Group has the largest assets of USD404,265m (22.41%) since it is one of Singapore's "Big Three" banks with USD1tn in assets and employs about 80,000 people. The remaining banks are Malaysia, with total assets of USD541,437m (30.01%). Indonesian banks have the lowest asset worth, at USD230,462m (12.77%).

There has been a rapid increase in financial globalisation in the last 20 years, especially in countries with lower average incomes and emerging markets. According to Sufian and Kamarudin (2016), globalisation may also be described as a mechanism for communicating

No	Bank	Country	Total Assets Million (USD)	Percentage (%)
1	Maybank Islamic	Malaysia	54,459	28.23
2	Bank Rakyat	Malaysia	25,846	13.40
3	CIMB Islamic Bank	Malaysia	23,580	12.22
4	RHB Islamic Bank	Malaysia	15,867	8.22
5	Bank Islam Malaysia	Malaysia	15,461	8.02
6	Public Islamic Bank	Malaysia	15,034	7.79
7	AmBank Islamic	Malaysia	10,345	5.36
8	MBSB Bank	Malaysia	10,343	5.36
9	Hong Leong Islamic Bank	Malaysia	7,792	4.04
10	Bank Islam Brunei Darussalam	Brunei	7,385	3.83
11	Bank Syariah Mandiri	Indonesia	6,818	3.53
	TOTAL		*192,930*	*100*
Source(s): The Asian Banker (2021)				

Table 1.
Leading Islamic banks
in SEA (2019)

| No	Bank	Country	Total Assets Million (USD)	Percentage (%)
1	DBS Group	Singapore	404,265	22.41
2	OCBC Bank	Singapore	343,189	19.02
3	United Overseas Bank	Singapore	284,870	15.79
4	Maybank	Malaysia	195,138	10.82
5	CIMB Group Holdings	Malaysia	129,147	7.16
6	Public Bank	Malaysia	101,485	5.62
7	Bank Rakyat Indonesia	Indonesia	89,919	4.98
8	Bank Mandiri	Indonesia	83,357	4.62
9	RHB Bank	Malaysia	58,800	3.26
10	Bank Central Asia	Indonesia	57,186	3.17
11	Hong Leong Financial Group	Malaysia	56,867	3.15
	TOTAL		*1,804,223*	*100*
Source(s): The Asian Banker (2021)				

Table 2.
Leading conventional
banks in SEA (2019)

and incorporating acts affecting firms and individuals such as corporations, financial institutions and governments from various countries. Economic and financial growth has been driven by globalisation through the production and demand of goods and services, capital flows, labour movements between countries, legislative and policy decisions, and so forth.

Globalisation has a wide range of economic, social and political consequences, as seen in Figure 1. Singapore has the highest average index globalisation of 83.8, followed by Malaysia, Brunei and Indonesia, which have 81.4, 63.8 and 63.4 index levels, respectively. This demonstrates that Singapore, as a whole, is a country that has significant impacts on the introduction of globalisation. Economic globalisation involves developments such as increased economic integration and economic interdependence on a global scale. Singapore had the greatest degree of economic globalisation at 94, followed by Malaysia, Brunei and Indonesia, which had 76.8, 66.8 and 48.1 index levels, respectively. These countries are economically active in the globalisation age, particularly Singapore, which has one of the greatest financial systems in the world. Social activity also has an influence on the rise of globalisation, which causes individuals to think more logically, structurally and embrace cultural values from outside, as well as to be more open in terms of information and knowledge. SEA's social globalisation demonstrates that Singapore is a country with numerous social changes as a result of globalisation's influence. Singapore has the highest rating of 89.1, followed by Malaysia, Brunei and Indonesia, which have index levels of 82.2, 74.7 and 54.7, respectively. Political globalisation is the process of incorporating principles that are accepted as a whole because it offers renewal and advantages to the political sphere. Indonesia and Malaysia have the greatest levels of political globalisation (87.3 and 85.3, respectively), followed by Singapore at 68.4 and Brunei at 50.3. Brunei is an absolute monarchy country; therefore, it has minimal influence on globalisation's political activities.

When it comes to globalisation, when there are less obstacles for any firm to come in and open up business and branch here, competition becomes intense as a result of globalisation. If they do not become productive, they will be unable to compete on a global scale, and the repercussions would damage not just the banks but also the country. Furthermore, when banks are not productive, especially during times of hardship such as the GFC, many of them shut and merge with other banks in order to survive the crisis. When a bank shuts, it is difficult to obtain financing, such as a loan. The firm also falls bankrupt, and many workers lose their jobs. As a consequence, we can see that when banks are not productive, economic
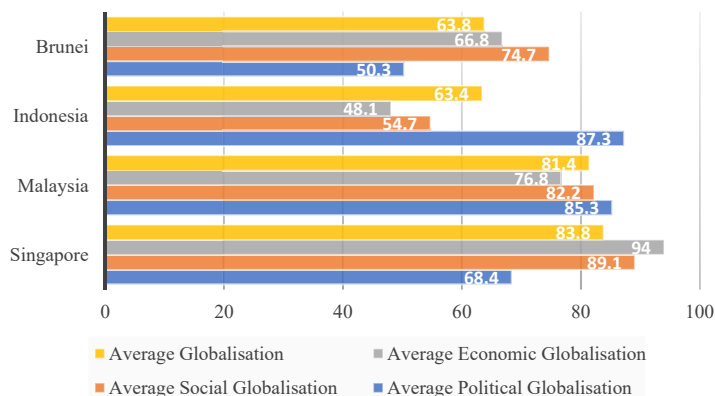
Figure 1.
The comparison of globalisation in SEA (2017)

Source(s): KOF Globalization Index, 2019

growth suffers significantly. The recent GFC has left many countries' financial systems in chaos, prompting researchers to examine the financial sector's productivity. As a result, in the era of globalisation, banks must be productive.

Even though the influence of productivity has been widely studied, identifying the factors that lead to improved productivity in the context of banks has been limited. In this context, it is critical for Islamic banks to maintain productivity in order to remain competitive and contribute to economic growth. As a result, rather than focussing just on Conventional banks, it is more justifiable, if not beneficial, to compare Islamic banks productivity. Due to the differences between conventional and Islamic banks, notably in terms of agency costs, size, maturity and growth, the outcomes of how globalisation impacts the productivity of conventional and Islamic banks may differ.

While limited studies have examined the relationship between globalisation and bank productivity (Njanike, 2010) on Zimbabwe (Sufian and Habibullah, 2014), in Malaysia and (Mastromarco and Simar, 2018) on the 26 noted developed Organisation for Economic Co-operation and Development (OECD) countries and 18 developing countries. However, none of the research examined Islamic banks in SEA, which is the focus of this study. Furthermore, previous studies on the impact of globalisation on bank productivity have always focused on conventional banks rather than Islamic banks.

The lack of a comprehensive study on the productivity of Islamic and conventional banks motivates this study to investigate the level of productivity in the Islamic and conventional banking sectors in SEA. This study differs from others in that it focuses on the impact of economic, social and political globalisation on bank productivity, with a particular emphasis on the conventional and Islamic banking sectors in SEA. This study begins with a brief overview of related studies, followed by data and methodology, empirical results and a conclusion. The key advantage of this work is that it will add to and enhance current studies, literature and information on the bank productivity of Islamic and conventional banks, which is essential to banks, regulators, investors and researchers.

2. Theoretical framework and literature review
2.1 Theoretical framework in productivity and globalisation
2.1.1 Theory of COBB–Douglas production function. The study's objectives are accomplished by estimating a model of profit-maximising firms using the Cobb–Douglas production theory, which is frequently used to explain the relationship of inputs to outputs. Cobb and Douglas (1928) introduced this production theory, which is used to illustrate the relationship between the amount of inputs (two or more capital or labour) and the volume of output (total production) that those inputs can generate. The Cobb–Douglas production function is denoted as follows:

$$Q_t = f(x_t) + \varepsilon \quad t = 1, \ldots, T$$
$$x_t = K_t, \ L_t, \ \theta_t$$

Q_t = Total production (monetary value of all goods produced in a year), x_t = Corresponding vector of inputs, K_t = Input of capital (monetary value of all buildings, equipment and machinery), L_t = Input of labour (total number of person-hours worked in a year), θ_t = Set of other factors that are involved, ε = random error term.

According to Fare *et al.* (1994), productivity may also be divided into smaller parts depending on changes in efficiency or volatility to compensate for lost ground, as well as through innovative technological changes, assuming that the outputs are equal equivalent to outputs, and the growth index total factor productivity change (TFPCH) captures the advancements or changes in technology. As a result, TFPCH may be equated to technological changes (from a technical standpoint), which can be measured as a shift in performance,

which can then be modified by altering the chosen input. Fundamentally, increased productivity leads to increased bank profitability (Kamarudin *et al.*, 2017). In other words, as productivity increases in the banking industry, more output may be generated from the same amount of input. As a result, Cobb–Douglas Production Functions will be used in this study to examine the productivity levels of the Islamic and conventional banking sectors in the SEA regions.

2.1.2 Theory of international trade. Trade globalisation (TrGI) is an important aspect of globalisation since it increases national revenue via trade and capital flows, allowing nations to capitalise on comparative advantages in adopting and fostering innovative approaches and production efficiency (Potrafke, 2015). Adam Smith proposed a new theory of trade called absolute advantage, which focused on a country's ability to produce products more efficiently than another country. Countries would increase productivity through specialisation because their labour force would become more skilled by executing the same tasks. Manufacturing would become more productive as a result of the motivation to create faster and better manufacturing methods in order to increase specialisation (Schumacher, 2020). Dreher (2006) demonstrated a substantial link between TrGI and economic growth demonstrated a substantial link between TrGI and economic growth. In general, the countries' main goal, as indicated by their analysis, was to create a trade surplus in which the value of imports was less than the value of exports, therefore avoiding a trade deficit. As a result, international trade theory indicates that banks may attain productivity via the event of TrGI, as it can bring changes in terms of increased national revenue, fostering innovative approaches and production efficiency, allowing the country's economic progress.

2.1.3 Theory of regulation. The theory of regulation is shown to be appropriate for explaining financial globalisation (FiGI) since it implies that a successful controlling and administrative process may be reached by determining TFPCH, sound governance and its efficacy (Jalilian *et al.*, 2007). The transition from the General Agreement on Tariffs and Trade (GATT) to World Trade Organization (WTO) is seen as a major milestone in recent global trade history. Similarly, the recent GFC showed the tremendous problems posed by unrestricted globalisation to financial sector (FS) regulators throughout the world (Stanley, 2018). Financial regulation is implemented effectively if it is capable of attaining the government's objectives. The World Bank (2001) emphasised the necessity of strengthening the regulatory framework in order to properly regulate and supervise the private sector, including the banking sector. Increased trade openness (fewer restrictions) is also seen to boost productivity, which in turn helps to increase employment and wages as a result of increased investment options (Kahnamoui, 2013). As a result, it has been discovered that strengthening the country's financial regulation might result in higher bank productivity.

2.1.4 Theory of internationalisation. According to Grubel's theory of internationalisation, the major advantage of foreign bank entrance is when the interpersonal globalisation (IpGI) and informational globalisation (InGI) between banks are at a reasonable or low cost (Grubel, 1989). In terms of IpGI, financial instrument, telecommunication and information technology innovations have resulted in a significant transformation in bank management and client interactions in the banking industry. Furthermore, globalisation has made it comparatively easier for banks to set up foreign bank representation, such as branches, representatives (delegates/agents) and subsidiaries (Wengel, 1995). Foreign banking tends to enhance competitiveness and improve operational efficiency, which can assist to boost economic growth (Slager, 2005). Long-term, domestic banks can increase their efficiency by sharing information or utilising surplus expertise from international banks (Wu *et al.*, 2017). Regarding InGI, Dufey and Giddy (1978) argued that the exchange of deposits between banks may be a good way to trade data about different banks, therefore measuring the flow of information related to supply and demand. In this sense, stronger relationships are distinguished by more interaction, which results in a higher exchange of information

(Atmaca *et al.*, 2020). Furthermore, management information systems (MISs) can help alleviate the impact of rising prices by aiding banks in predicting rising prices and, as a result, adjusting interest rates to maximise profits (Sufian and Kamarudin, 2016). Therefore, based on the theory of internationalisation, social globalisation through IpGI and InGI is crucial for improving productivity in the banking sector.

2.1.5 Theory of cultural proximity. The theory of cultural proximity, which may be described as commonalities in history, ethnicity, religion, language and geography, aids in explaining cultural globalisation (CuGI) in the context of social globalisation (Lu *et al.*, 2019). According to Keller and Chinta (1990), CuGI promotes the sharing of knowledge and information due to the affinity of CuGI among businesses in nations with similar or shared principles related to technologies or information transmission. Culture values or principles have an influence on the efficiency of disseminating technology and the speed with which it can make up lost ground (Wang *et al.*, 2014). According to Grubel (1989), national origins give an advantage for multinational [international] banking. In this context, cultural proximity is demonstrated by quick expansion and increased market commitment, where information such as fundamental skills or even a common language may substantially boost the organisation's inventive potential and speed the learning process (Meng, 2009). The findings revealed that the existence of CuGI could assist local organisations in increasing productivity levels because they had acquired technological skills and abilities as a result of their research and development labours, as well as through the overspill of technology innovation from global trading and foreign direct investment (FDI). As a result, cultural proximity theory is applied as an analytical method to examine how CuGI influences productivity levels in the Islamic and conventional banking sectors.

2.1.6 Theory of international relations. The theory of international relations can explain political globalisation (PoGI), a dimension of globalisation (Barrow and Keck, 2017). According to Steger and Wahlrab (2016), PoGI refers to the strengthening and broadening of political interrelationships around the world, involving a variety of players such as individuals, domestic groups, states, global enterprises, nongovernmental organisations (NGOs) and transnational corporations (TNCs) in making decisions about the contribution of tangible (e.g. currency and products) and intangible items (e.g. creativity and security). The rising number and importance of international organisations, which are expected to have more responsibility for coordinating and executing international policy, is indicative of the trend toward PoGI (Shaw, 2000). The failure of Basel II and Basel III as a result of systematic manipulation by big multinational banks provides insight into the politics connected with the Basel process as it relates to the area of international relations (Lall, 2012). Other studies by Chen *et al.* (2018) suggests that politically connected chief executive officers (CEOs) of banks can manipulate bank lending choices by utilising their political power. Political instability, in most cases, breeds immoral behaviour such as corruption, which may significantly impede economic growth and progress (Schumacher, 2013). Nys *et al.* (2015) discovered that banks with political ties are more likely to attract deposits. A country with a strong political system may determine how to capitalise on global trends and incorporate developing technology into its economy, which can boost productivity, profitability, prosperity and job creation in a variety of industries, including the banking industry. As a result, political stability is critical for addressing productivity issues through the implementation of efficient and effective regulatory measures (Roe and Siegel, 2011).

2.2 Literature review
The banking sector's role as a form of financial intermediation within the financial system cannot be underestimated since it contributes to steady economic growth and development. The Islamic banking system performs a similar purpose but differs slightly from the conventional banking system. Islamic banks are seen as a replacement or alternative option

for providing banking goods and services in accordance with Islamic (Shariah) principles. Islamic banks are considered a replacement or complementary choice for the provision of banking goods and services in compliance with Islamic (Shariah) principles.

In this situation, the theory does not actually give a clear prediction as to whether Islamic banks will be more efficient or productive than conventional banks (Beck *et al.*, 2013). While productivity is critical in Islamic banking for achieving high profitability, financing decisions are based on the productivity of the investment in the chosen project. Nonetheless, in this regard, the Shariah Advisory Committee (SAC) performs a critical role in assuring stakeholders' activities which are in accordance with the principles governing Islamic law. Furthermore, the SAC is mainly responsible for decreasing information asymmetries and agency costs within the Islamic Bank. According to Jensen and Meckling (1976), the presence of conflicts of interest between the principle and the agent may have an impact on the overall performance of the organisation.

In this context, information asymmetry and agency conflicts in Islamic banks should be fewer than in their conventional counterparts (Toumi *et al.*, 2012). As a result of the SAC's engagement in supervising the activities of Islamic banks, disputes between the principal and the agent(s) can be avoided, and agency costs can be reduced. External supervision, according to Ang *et al.* (2000), reduces agency costs and hence enhances bank performance, contributing to high productivity. On the other hand, given the several productivity variables that distinguish Islamic banks from conventional banks, such as complexity, degree of maturity and development, the opposite may occur.

Several studies have found that Islamic banks are slightly more productive than conventional banks, while others have found the opposite, and just a few have found that they are similar (no variance) in productivity. Recently, Alexakis *et al.* (2019) showed that both Islamic and conventional banks saw a drop in productivity in 2008/09, with conventional banks suffering the most. Rodoni *et al.* (2017), on the other hand, discovered that Malaysia's banking industry was significantly more efficient than Indonesia's. Nonetheless, Mobarek and Kalanov (2014) discovered that the efficiency of conventional banks was greater than Islamic banks between 2006 and 2009, which might be attributed to the average output score being higher in conventional banks, making such a comparison non-equivalent.

Developing economies lack the level of market integration that developed economies take for granted. The liberalisation of the financial system, particularly in the stock market, has lowered the cost of equity capital, resulting in an increase in the growth rate of investments as well as an expansion of employment and outputs (Askari *et al.*, 2009). Many of Islam's economic precepts are influenced by globalisation in Muslim nations. As a result, while revealing their markets, Muslim nations must be prepared for increasing activity in the banking sector, notwithstanding the possibility of heightened Islamic cultural, social and political turmoil.

Globalisation is basically a method of removing country borders, making it look as though they are merged as one nation (Askari *et al.*, 2009). Although globalisation has transformed the global social environment and social structure, its presence in the political and economic spheres has resulted in economic [financial] shifts in countries all over the world. It is also critical to distinguish between the elements of globalisation, given that globalisation is viewed as promoting not only economic integration but also political and cultural integration (Mukherjee and Dutta, 2018).

Researchers have looked into many aspects of globalisation, such as the impact of globalisation on trade and FDI inflows (Chang *et al.*, 2015; Rao and Vadlamannati, 2011). According to Kim Nguyen and Tien Nguyen (2018), growing TrGI means greater transnational volumes of trade and investment activities between one country and its international partners, which are significantly linked with high rates of bank profitability. They also discovered that FiGI has a significant and positive impact on the competitiveness

of Vietnamese banks. Given the open environment produced by global competition, it will aid in the improvement of the financial system by attracting foreign investment. Similarly, a more open market with fewer trade barriers, FDI and portfolio investment will increase banks' capability to provide high-quality services to consumers at reasonable costs, allowing them to achieve a high level of profitability.

Furthermore, most countries have made significant technological development. It is also apparent that a rising number of foreigners are involved in the banking business in management and leadership capacities as shareholders and executives. Similarly, the increasing corporate culture and professional quality of the job had a significant impact on bank success. However, according to Kim Nguyen and Tien Nguyen (2018), conflicts with local management may occur as a result of differing opinions on regulations that may influence development initiatives, thereby impacting bank performance. Several studies have also found that IpGI has a positive relationship with bank performance (Sufian *et al.*, 2017; Sufian and Kamarudin, 2016).

Knowledge and information, according to Dreher (2006), may be easily accessed, eliminating the need for geographical proximity. According to Currie (2000), the Internet will assist to encourage and increase market competitiveness, allowing banks to lower their operational expenses. Sufian *et al.* (2017) discovered that InGI has a significant positive relationship with the performance of Malaysia's banking industry. Sufian and Kamarudin (2016), on the other hand, observed that InGI had a negative association with the performance of South African banks. The researchers also stated that advancements in technology and FiGI, particularly in foreign direct investment, will increase demand for highly qualified candidates in both developing and developed nations. In another study, Sufian and Habibullah (2014) discovered that InGI had a negative impact on bank productivity since, in developing countries, Internet technology remained underdeveloped due to a scarcity of Internet and telecommunications professionals.

According to Potrafke (2015), it is vital to distinguish between the aspects of globalisation, because globalisation is associated with more economic integration as well as, more importantly, increased cultural integration. Sufian *et al.* (2017) shown in their study that CuGI has a positive relationship with bank efficiency. This finding supports the global advantage hypothesis in its "limited form" (Berger *et al.*, 2000).

Nonetheless, Sufian and Kamarudin (2016) discovered that PoGI showed a positive relationship with bank performance in South Africa, showing that stronger PoGI tended to benefit banks in that country's banking sector. More political integration, according to Dreher (2006), will have an effect on economic and political processes, resulting in higher economic growth. For instance, free trade zone agreements with the Southern African Customs Union (EFTA-SACU), Africa Caribbean Pacific–European Union (EU-ACP), and the European Free Trade Association have resulted in significant benefits for organisations that improve the efficiency of banks and the South African banking industry as a whole.

As a result, in summary, the majority of research found varying and conflicting conclusions on the level of productivity across Islamic banks and conventional banks worldwide. On the other hand, little, if anything, has been done to study the influence of globalisation on the level of productivity of Islamic and conventional banks. Furthermore, considering the extensive participation of Islamic banks, there is still minimal evidence indicating the degree of productivity of both types of banks has been done in the Asian region (Kamarudin *et al.*, 2017). Thus, the final issue that concerns us is globalisation's ignorance. As a result, the author of this study believes that no study has been performed to date to investigate the impact of globalisation on the productivity of banks, particularly Islamic banks. Therefore, this study differs from others in that it focuses on the impact of economic, social and PoGI on bank's productivity, with a particular emphasis on the SEA conventional and Islamic banking sectors.

3. Data and methodology

3.1 Sources of data

The data set used in this study consisted of Islamic banks and conventional banks from SEA countries from 2008 to 2017 give that this region are part of representative of Islamic banking and finance globally (Khan and Bhatti, 2008). This analysis also takes into account the GFC that occurred between 2008 and 2009 and uses a "dummy" variable to represent this time in order to prevent any possible biasedness. The sample size of the study consisted of Islamic and conventional banks from four countries.

All data were obtained from the Fitch Connect database produced by Fitch Solutions. In total, 155 banks (23 Islamic banks and 132 conventional banks) from 4 countries with dual banking system are selected in this study as represented in Table 3. The number of banks selected from Brunei and Singapore is restricted due to the minimal data available from the banks, and for Singapore, just one Islamic bank data is supplied in the Fitch Connect database. The globalisation index created by Dreher (2006). For this study, we are using the latest KOF Globalisation Index 2019 version that collected from 203 countries defined by 43 variables and can be distinguished between *de facto* and *de jure* (see Table A1 in Appendix 1). The KOF Index is based on variables relating to three key dimensions: political, social and economic globalisation. Also, in order to maintain homogeneity, this study omitted all investment banks, insurance firms and finance companies. The currency will be represented in US dollars to compare the chosen banking institutions around the four countries.

3.2 DEA based Malmquist productivity index (MPI)

Charnes *et al.* (1978) developed the data envelopment analysis (DEA) frontier in which they suggested that the higher the output produced from inputs, the greater the degree of productivity associated with the production cycle and widely used in prior research such as Hussain *et al.* (2020), Kamarudin *et al.* (2013) and Sufian and Kamarudin (2014a, b). The efficiency and productivity of an entity are interrelated in the context of this analysis.

Efficiency, however, is static provided that it does not perceive the time taken for output, which is important. Accordingly, this shows that the level of output often changes as productivity measures change or shift. Therefore, calculating productivity is crucial. Basically, the ratio of inputs to outputs can be used to measure productivity. MPI is occasionally referred to as TFP, which can assess any change of efficiency and frontier technology in terms of progress or regress over time (Sufian and Kamarudin, 2014b). In addition, MPI has been used in many DEA research to evaluate improvement in efficiency diversified management science fields across diverse sectors and countries.

Output-based MPI was used to understand and gauge the change in the productivity of banks and also to determine the change in TFPCH to technical change (TECHCH) and efficiency change (EFFCH). According to Fare *et al.* (1994), the changes in scale efficiency change (SECH) and pure technical change (PTECH) resulted from changes in EFFCH. Figure 2 illustrates the interactive relationship among the efficiency indices.

No	Country	No. of Islamic Bank	No. of Conventional Bank
1	Brunei	1	1
2	Indonesia	8	92
3	Malaysia	13	31
4	Singapore	1	8
	Total	*23*	*132*

Source(s): Fitch Connect database

Table 3.
Sample data

The analysis could also be used to analyse the losses or gains related to the productivity factors in order to compare TECHCH and EFFCH values. If EFFCH > TECHCH, then it means that productivity gains are mainly due to efficiency improvements. Whereas, when EFFCH < TECHCH, productivity gains are largely due to technological advancement. The study of the first stage of the banks' TFPCH was then summarised by using output based MPI. During the following years, an output value less than (higher) for a bank meant that it was performing below (above) the frontier.

3.3 First stage: measuring productivity
In order to study productivity, DEA is used as a primary method in this research as it is commonly used and still relevant for estimating productivity, as over 40 years have been shown to be sustained with more than a thousand papers published in a year (Emrouznejad and Yang, 2018). In this research, therefore, the intermediation approach was adopted in classifying banks' inputs and outputs, as supported in other studies (Bhatia *et al.*, 2018; Sufian and Kamarudin, 2014a; Kamarudin *et al.*, 2013). Throughout this analysis, the selection of inputs and outputs was driven by the method as shown in many studies (Alexakis *et al.*, 2019; Kamarudin *et al.*, 2017; Sufian and Habibullah, 2014). As shown in Table 4 all variables used in the non-parametric DEA were based on the MPI model as part of the initial stage of analysis.

An assumption is made by determining the number of inputs and outputs given that the sample size must fulfil this assumption before proceeding with the DEA measurement as shown.
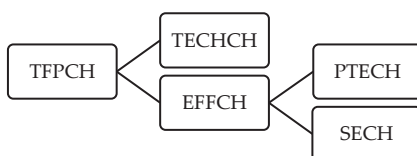
$$n \geq max\{m \times s, \ 3(m + s)\}$$

where

n = number of decision-making units (DMUs),

m = number of inputs,

s = number of outputs.

Source(s): Fare *et al.* (1994)

Figure 2.
Interactive relationship
among the MPI
efficiency indices

Variable	Symbol	Variable Name	Definitions
Outputs	y1	Loan	Net loans
	y2	Investment	Total securities
Inputs	x1	Deposits	Total deposits, money market and short-term funding
	x2	Labour	Personnel expenses
	x3	Physical capital	Book value of fixed assets

Note(s): Casu and Girardone (2006) and Ariss (2010); for Islamic banks, "loans" are identified as "financing activities"

Table 4.
Variables of outputs
and inputs

3.4 Second stage of analysis

After establishing productivity levels with DEA-based MPI frontier, the regression analysis would be carried out. In this study's second stage, multiple panel regression analysis (MPRA) was used to determine the solution to the DEA-MPI issue that included traditional inputs and outputs. MPRA is comprised of the pooled least square (POLS), random effect model (REM), fixed effect model (FEM) and generalised method of moments (GMM). Other academics that have used traditional panel models (POLS, FEM and REM) to study banking and finance (including Islamic banking and finance) include Zins and Weill (2017), Bitar *et al.* (2018), and Ibrahim and Rizvi (2018). This stage entails MPRA models on a number of bank-specific, macroeconomic and globalisation factors, as well as their impact on the TFPCH of Islamic and conventional banks. MPRA could be defined for observation (bank) i (Coelli *et al.*, 1998) in order to examine the relationship between the TFPCH and the explanatory factors, as shown below:

$$y_{i,t} = \beta x_{i,t} + \varepsilon_{i,t} \quad i = 1, \ldots, N, \tag{3.1}$$

where

y_{it} = the TFPCH of bank i at time t,

x_{it} = the matrix of the explanatory variables (determinants),

β = vector of coefficient,

ε_{it} = random error term depicting statistical noise,

i = an individual bank,

t = year,

N = number of observations in the data set.

As a measure of robustness, dynamic panel data, GMM was used as initially developed by Hansen (1982). For dynamic panel models, there are two GMM estimators: (1) the first difference GMM estimator by Arellano and Bond (1991) and (2) the system GMM estimator by Arellano and Bover (1995) and Blundell and Bond (1998). The GMM approach was utilised in this study, which gave an effective solution and relevant information on the extent of productivity in Islamic and conventional banks across a range of institutional and economic situations (Kamarudin *et al.*, 2016a). The GMM's estimator is represented as follows:

$$y_{i,t} = \alpha y_{i,t-1} + \beta' x_{i,t} + \eta_i + \varepsilon_{i,t} \tag{3.2}$$

where

y = a $MPI_{i,t}$ (TFP change) scores of banks i at time t,

x = a set of descriptive variables (bank-specific, macroeconomic and globalisation),

η = an unnoticed bank-specific effect,

ε = error terms,

i = individual bank,

t = time period.

This analysis therefore generalised the MPRA model equation (3.1) based on the GMM estimator equation (3.2) described in the general model below:

General model:

$$\ln(\text{TFPCH})_{i,t} = \alpha(\ln(\text{TFPCH})_{i,t-1}) + \beta_{i,t}\left(\sum Bank - specific_{i,t}\right)$$
$$+ \beta_{i,t}\left(\sum Macroeconomics_{i,t}\right) + \beta_{i,t}\left(\sum Globalisation_{i,t}\right) + \eta_i + \varepsilon_{i,t}$$

(3.3)

where

$\ln(\text{TFPCH})_{i,t}$ = The TFPCH of the *i*-th bank in the period *t* obtained from the DEA-based MPI Model

Bank − specific = Bank specific variables

Macroeconomics = Macroeconomic variables

Globalisation = Globalisation variables

i = Individual bank,

t = Time period,

α = Constant term,

β = Vector of coefficient,

η = Unobserved bank-specific effect,

$\varepsilon_{i,t}$ = Normally distributed disturbance term.

The variables used in the second stage of the study were further broken down into different categories: (1) bank-specific attributes (internal determinants), (2) macroeconomic conditions (external determinants) and (3) globalisation, as shown in Table 5. The bank-specific attribute variables comprised of bank size, credit risk, capitalisation, market power, liquidity and overhead expenses. The macroeconomic condition variables consisted of economic growth, inflation and GFC, which could also have an impact on bank TFPCH. The KOF Globalisation variables are categorised into six groups, namely (1) TrGI, (2) FiGI, (3) IpGI, (4) InGI, (5) CuGI and (6) PoGI which separated into *de facto* and *de jure*.

4. Empirical results
4.1 First stage analysis
The DEA-based MPI approach is used to analyse the study's objective of examining the total factor productivity change (TFPCH) rate in the Islamic and conventional banking sector in SEA. The results are then tested using a parametric (*t*-test) and non-parametric (Mann–Whitney [Wilcoxon] and Kruskal–Wallis) test in order to determine the variances in the productivity (*y*-axis) of Islamic and conventional banks. Table 6 provides a description of the summary statistics used to construct productivity frontier for conventional and Islamic banks. All the parameters are assessed at US$ m.

4.1.1 Productivity of Islamic and conventional banks. Following the analysis of the DEA-based MPI frontier tests by Coelli (2008), Figure 3 shows the trend in productivity levels for Islamic and conventional banks from 2008 to 2017. From Figure 3, Islamic banks' productivity outperformed conventional banks in the years 2008 and 2009 following the GFC. On average, both Islamic and conventional banks have productivity indices greater than 1.00 and it indicates that banks have witnessed productivity gains compared to the previous year. The productivity indices for both banks indicate an inconsistent pattern from 2008 to 2017,

Variable	Description
Dependent	
TFPCH	Total factor productivity change
Independent	
Bank-specific characteristics (internal determinants)	
lnTA (Size of the bank)	Natural logarithm of Total assets
LLPGL (Credit risk)	Loan loss provision over gross loans
TCETA (Capitalisation)	Total common equity over total asset
BDTD (Market power)	Bank's deposit to total deposits of all banks
LOANSTA (Liquidity)	Net loans to total assets
NIETA (Overhead expenses)	Non-interest expenses to total assets
Macroeconomic condition variables	
GDP (Economic growth)	Real gross domestic product growth rate
CPI (Inflation)	Consumer price index growth rate
GFC (Global financial crisis)	Dummy variable that takes a value of "1" for the period crisis and "0" for other periods
Globalisation (KOF Globalisation Index)	
TrGI	Trade Globalisation
TrGIdf	Trade Globalisation, *de facto*
TrGIdj	Trade Globalisation, *de jure*
FiGI	Financial Globalisation
FiGIdf	Financial Globalisation, *de facto*
FiGIdj	Financial Globalisation, *de jure*
IpGI	Interpersonal Globalisation
IpGIdf	Interpersonal Globalisation, *de facto*
IpGIdj	Interpersonal Globalisation. *de jure*
InGI	Informational Globalisation
InGIdf	Informational Globalisation, *de facto*
InGIdj	Informational Globalisation, *de jure*
CuGI	Cultural Globalisation
CuGIdf	Cultural Globalisation, *de facto*
CuGIdj	Cultural Globalisation, *de jure*
PoGI	Political Globalisation
PoGIdf	Political Globalisation, *de facto*
PoGIdj	Political Globalisation, *de jure*

Table 5.
Description of the variables used in the regression model

where productivity indices for Islamic banks peaked in 2008 and 2013 and remain stable thereafter.

The explanation for this situation is that the Muslim population is growing, particularly in the SEA n region, which has made substantial popularity in the ethical character and financial stability of Islamic finance products and services as an alternative to conventional financing mechanisms (Komijani and Hesary, 2018). Moreover, global Sukuk was increasingly popular in 2012 and used by both the corporate sector and sovereigns to raise funds in SEA, in particular Malaysia, followed by Indonesia to promote Shariah-based financial products that would enable the region to dominate more than 70% of the world's Sukuk issues (Komijani and Hesary, 2018). Sukuk played an important role in funding development projects in the Asian region.

Figure 4 represents TFPCH of Islamic and conventional banks in SEA countries from 2008 to 2017. Overall, Islamic banks have higher TFPCH, TECHCH, EFFCH and SECH, while conventional banks have slightly higher PECH than Islamic banks. The explanation for this can be attributed to the growing number of Islamic banks in the high income and upper

Variables	Net loans (y1)	Output Total Investment (y2)	Deposits (x1)	Input Labour (x2)	Capital (x3)
Mean					
Conventional banks	7426.564	2787.981	10505.27	106.314	115.846
Islamic banks	4019.186	938.938	5214.859	56.853	76.628
Minimum					
Conventional banks	0.500	0.020	0.800	0.428	0.008
Islamic banks	0.344	0.053	0.979	0.067	0.029
Maximum					
Conventional banks	241732.007	86833.757	314909.472	2113.572	3834.810
Islamic banks	62276.160	11346.560	74287.733	750.373	2095.493
SD					
Conventional banks	21110.972	7431.583	27668.656	229.572	3834.810
Islamic banks	7274.636	1626.270	8977.123	99.545	177.676

Note(s): $y1$ (total of short-term and long-term loans); $y2$ (total securities); $x1$ (total deposits, money market and Short-term Funding); $x2$ (personnel expenses); $x3$ (fixed assets)

Table 6.
Summary statistics of outputs and input variable in the DEA-based MPI model (US$m)
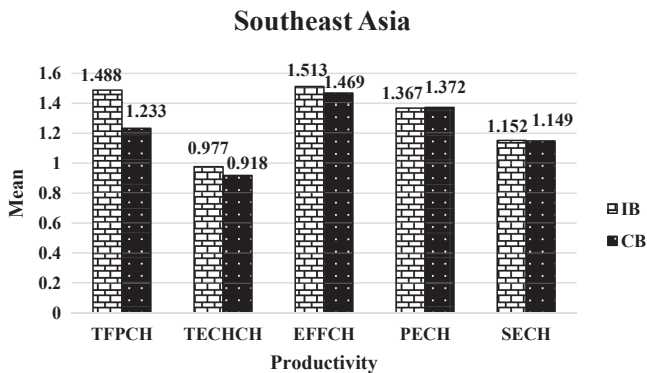

Southeast Asia
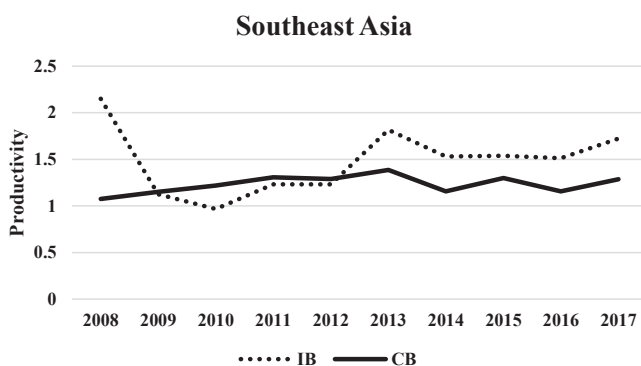
Source(s): Bank annual report and authors own calculation

Figure 3.
Trend on productivity for Islamic and conventional banks from 2008 to 2017

middle-income countries, such as Brunei, Singapore, Malaysia and Indonesia. High Muslim population with their income rates has a positive effect on the growth of the Islamic banking system (Boukhatem and Moussa, 2018).

Besides, as the number of Islamic banks in these regions is growing, particularly in Malaysia and Indonesia, a highly competitive market arises between them. According to Abedifar *et al.* (2016), the coexistence of the Islamic and conventional banks on the market will inspire the banks to be more innovative and increase the productivity of the entire banking system by improving competition.

As can be seen from Figure 4, the TFPCH in both Islamic and conventional banks come from the EFFCH, which means that there is an improvement in the management of the banks. Countries that have implemented a dual legal system based on common law and Islamic law

Southeast Asia

Source(s): Bank annual report and authors own calculation

(Shariah) have made it possible for them to be adaptive in response to the change in macroeconomic conditions that has led to the growth of Islamic banks (Boukhatem and Moussa, 2018).

4.1.2 Robustness tests on productivity of Islamic relatives to the conventional banks. Table 7 indicates a substantial difference between the productivity rates of Islamic and conventional banks in different years resulting from parametric (*t*-test) and non-parametric (Mann–Whitney [Wilcoxon] and Kruskal–Wallis) measures. The empirical findings presented in Table 7 seem to suggest that Islamic banks are slightly more productive than conventional banks in SEA in year 2008, 2013, 2014, 2015, 2016 and 2017. However, the difference is only statistically significant during year 2008. On the other hand, year 2009, 2010, 2011, 2012 in *t*-test suggest that the conventional banks have been relatively more productive than Islamic banks, but the results are not statistically significant. The *t*-test results are further confirmed by the results from nonparametric tests.

When analysing the results further, the findings also show the component of MPI including the TECHCH, EFFCH and decomposition of EFFCH, namely PECH and SECH. The findings present that Islamic banks are relatively more productive attributed to higher EFFCH and statistically significant at year 2016. On the other hand, conventional banks are more TECHCH, but the results are not statistically significant. Likewise, the EFFCH in Islamic banks are higher in 2013, 2014, 2015 and 2016 and lower at 2008 and 2017. When we look on the decomposition of EFFCH, Islamic banks is statistically significant have been progress PECH in year 2016. Besides, the Islamic banks also experienced SECH regress in year 2017 and is statistically significant at 10% levels.

All years of Table 7 present the results from years 2008 to 2017. Based on the results, Islamic banks are statistically significant at 5% levels more productive than conventional banks with mean difference (0.255). These results are attributed to the progress in TECHCH with mean difference (0.059) and its statistically significant at 1% levels with the results from *t*-test are further confirmed by the results from non-parametric test. Therefore, in summary, there is statistically significant difference between the total factor productivity change (TFPCH) of the Islamic and conventional banks in SEA regions. This results in line with the findings from others (Alexakis *et al.*, 2019; Olson and Zoubi, 2008, 2011).

Overall, the mean difference shows that Islamic banks are more productive than conventional banks due to several reasons. First, Khan (1986), Darrat (1988) and Beck *et al.* (2013) concluded that the risk-sharing paradigm in Islamic finance system and higher asset quality can absorb financial shock better than conventional banks. Second, Islamic banks

	No of Obs	PARAMETRIC TEST t-test t (Prb > t)					NONPARAMETRIC TEST Mann–Whitney [Wilcoxon Rank Sum] test z (Prb > z)					Kruskal–Wallis Equality of Population X^2 (Prb > X^2)				
Year		TFPCH	TECHCH	EFFCH	PECH	SECH	TFPCH	TECHCH	EFFCH	PECH	SECH	TFPCH	TECHCH	EFFCH	PECH	SECH
2007–2008	132	−2.153[c]	−3.589[a]	−0.230	−0.378	0.307	−3.644[a]	−3.072[a]	−0.301	−0.416	−0.350	13.276[a]	9.434[a]	0.090	0.173	0.123
Mean Diff		1.076	0.384	0.088	0.109	(0.049)	41.550	36.990	3.620	5.010	(4.210)	41.550	36.99	3.620	5.010	(4.210)
2008–2009	137	0.090	−0.392	0.501	0.457	0.073	−0.615	−0.268	−0.386	−0.694	−0.015	0.378	0.072	0.149	0.482	0.001
Mean Diff		(0.025)	0.039	(0.184)	(0.139)	(0.009)	(7.02)	(3.100)	(4.460)	(8.030)	(0.170)	(7.02)	(3.100)	(4.460)	(8.030)	(0.170)
2009–2010	139	0.841	0.216	0.742	0.444	0.733	−0.781	−0.350	−0.564	−0.518	−0.093	0.610	0.122	0.318	0.268	0.009
Mean Diff		(0.252)	(0.009)	(0.239)	(0.139)	(0.106)	(8.260)	(3.740)	(6.04)	(5.550)	(0.980)	(8.260)	(3.740)	(6.04)	(5.550)	(0.980)
2010–2011	139	0.214	−0.519	0.486	0.249	0.857	−0.646	−0.289	−0.897	−0.210	−0.913	0.418	0.083	0.805	0.044	0.834
Mean Diff		(0.074)	0.029	(0.190)	(0.099)	(0.162)	(6.540)	2.940	(9.120)	(2.140)	(9.280)	(6.540)	2.940	(9.120)	(2.280)	(9.280)
2011–2012	144	0.224	1.444	0.067	0.341	0.600	−0.145	−0.650	−0.453	−0.643	−0.266	0.021	0.422	0.205	0.414	0.071
Mean Diff		(0.057)	(0.080)	(0.016)	(0.112)	(0.107)	1.520	(6.820)	4.770	6.770	(2.790)	1.520	(6.820)	4.770	6.770	(2.790)
2012–2013	148	−0.851	−1.193	−0.596	0.467	−1.039	−0.075	−0.040	−0.094	−0.275	−0.771	0.006	0.002	0.009	0.076	0.595
Mean Diff		0.429	0.058	0.288	(0.122)	0.189	0.750	0.400	0.940	2.720	7.630	0.750	0.400	0.940	2.720	7.630
2013–2014	151	−0.830	1.223	−1.055	−0.597	−0.801	−1.217	−0.611	−0.862	−1.157	−0.005	1.481	0.373	0.743	1.340	0.001
Mean Diff		0.375	(0.053)	0.627	0.265	0.481	(12.060)	(6.050)	(8.540)	(11.470)	(0.050)	(12.06)	(6.050)	(8.540)	(11.470)	(0.050)
2014–2015	147	−0.821	0.481	−1.206	−0.864	−0.103	−0.521	−0.003	−0.744	−0.076	−0.704	0.272	0.001	0.553	0.006	0.495
Mean Diff		0.239	(0.024)	0.329	0.293	0.013	5.130	0.020	7.330	0.750	6.930	5.130	0.020	7.330	(0.750)	6.930

(*continued*)

Table 7.
Summary of
parametric and
nonparametric test on
Islamic and
conventional bank

Table 7.

Year	No of Obs	PARAMETRIC TEST t-test $t\,(P>t)$					NONPARAMETRIC TEST Mann–Whitney [Wilcoxon Rank Sum] test $z\,(P>z)$					Kruskal–Wallis Equality of Population $X^2\,(P>X^2)$				
		TFPCH	TECHCH	EFFCH	PECH	SECH	TFPCH	TECHCH	EFFCH	PECH	SECH	TFPCH	TECHCH	EFFCH	PECH	SECH
2015–2016	146	−1.449	−0.064	−1.495	−1.844[c]	0.733	−2.180[b]	−0.722	−2.172[b]	−2.429[b]	−0.107	4.752[b]	0.521	4.717[b]	5.900[b]	0.011
Mean Diff		0.356	0.003	0.366	0.439	(0.114)	21.320	7.060	21.250	23.760	(1.050)	21.320	7.060	21.250		(1.050)
2016–2017	147	−1.050	−3.341[a]	1.549	0.721	1.867[c]	−0.709	−2.552[b]	−0.176	−0.291	−0.326	0.502	6.513[b]	0.031	2.860	0.106
Mean Diff		0.435	0.275	(0.760)	(0.579)	(0.257)	6.970	23.760	1.740	2.860	(3.210)	6.970	25.120	1.740	2.860	(3.210)
ALL YEARS	1,430	−2.014[b]	−2.957[a]	−0.328	0.044	−0.060	−0.897	0.084	−0.105	−0.112	−0.223	0.805	3.783[c]	0.011	0.012	0.050
Mean Diff		0.255	0.059	0.044	(0.006)	0.004	29.030	63.000	(3.420)	3.610	(7.240)	29.030	63.000	(3.420)	3.610	(7.240)

Note(s): [a], [b], [c] indicates significance at the 1%, 5% and 10% levels, respectively
In bracket indicate the productivity mean of conventional banks are higher than Islamic banks

have lower credit risk and insolvency risk than conventional banks as the charge rents and loan quality made by Islamic banks on their customer is not affected by interest rate fluctuation than of conventional banks (Abedifar *et al.*, 2013). This is the reason Islamic banks more stable compared to conventional banks.

Third, the Islamic system that prohibits interest, gambling, speculation, excessive uncertainty and other restrictions influence the banking business sustainability and enhance the social wellbeing as a safer alternative than conventional banks through financial outreach (Aliyu *et al.*, 2017). Lastly, Islamic banks tend to be more productive because they are risk averse and have strong preference which make them excellent in capitalised than conventional banks for investing in the real economy (Abedifar *et al.*, 2016).

4.2 Second stage analysis

4.2.1 Summary statistics. Table 8 presents summary statistics of the independent variables for all banks included in the sample. These statistics provide information regarding the variable distribution. Specifically, mean value measuring the average of the underlying variables over examined period. Standard deviation (Std.Dev.) measures how much a variable shows variation or diversification from the average value. Minimum (Min) and maximum (Max) values show the lowest and highest value in the study sample.

The bank specific and macroeconomic variables have positive means ranging from 0.039 to 58.143 for conventional banks and 0.128 to 62.049 for Islamic banks. The mean value of bank size is 3.253 in conventional banks and 3.379 in Islamic banks. However, the minimum and maximum values of the credit risk in conventional banks are −13.870 and 29.230. While for Islamic banks are −1.800 and 15.970, respectively. This implies that the constructed credit risk is well-distributed. The liquidity standard deviation reveals that this ratio is more volatile as compared to other bank specific variables in conventional banks. While in Islamic banks, capitalisation is more volatile than others bank specific variables.

The globalisation variables have a positive index means ranging from 40.713 to 85.577 in conventional banks and 60.788 to 87.304 in Islamic banks. The mean for TrGI is 58.513 in conventional banks and 70.837 in Islamic banks. The TrGI, de facto standard deviation reveals that this index is more volatile as compared to other globalisation index in both types of banks. The PoGI, de facto mean value (85.577) is the highest in conventional banks indicating that political can create conducive banking sector environment. However, the mean value of InGI, de facto (87.304) is the highest in Islamic banks, indicating that on average Islamic banks have significant greater exchange of information.

4.2.2 Regression results. In this section, the MPRA approach is used to determining the relationship between banks' total factor productivity change (TFPCH) rate and the explanatory variables in the Islamic and conventional banking sector in SEA. We estimate several specifications, specifically, we consider bank-specific determinants, macroeconomic variables and globalisation index as well in the specification. There are 18 panel regression models are presented from Tables A2 and A3 in Appendix 2.

We first verify whether heteroskedasticity is present by applying the Breusch–Pagan test. The results of the test are given in Tables A2 and A3 in Appendix 2. The approximate test statistics reveal a heteroskedasticity problem in the models. To address the issue of heteroskedasticity, the generalised least square (GLS) technique is employed to estimate the effect of bank specific determinants, macroeconomic variables and the globalisation index on the productivity of the banks proxied by the TFPCH.

Tables A2 and A3 in Appendix 2 present the empirical results for the conventional and Islamic banks. There are 18 different models. In model 1 to 3, only bank specific, macroeconomic and TrGI with *de facto* and *de jure* were included into the model. In model 4 to 6, FiGI was included along with the bank specific determinants and macroeconomic variables. These six models are classified under the economic globalisation. Meanwhile,

	Obs	Mean	Std.Dev	Min	Max
Conventional Bank					
Bank Size	1,243	3.253	0.864	1.163	5.588
Credit Risk	1,243	0.927	2.012	−13.870	29.230
Capitalisation	1,243	15.138	10.750	−3.275	96.451
Market Power	1,243	0.039	0.121	0.003	0.995
Liquidity	1,243	58.143	16.736	0.132	92.338
Overhead Expenses	1,243	2.954	2.114	0.054	22.399
Economic Growth	1,243	5.217	1.622	−2.466	15.240
Inflation	1,243	4.716	2.279	−0.739	10.227
Global Financial Crisis	1,243	0.197	0.398	0.000	1.000
Trade Globalisation	1,243	58.513	16.552	43.263	96.967
Trade Globalisation, *de facto*	1,243	48.332	25.705	27.496	99.551
Trade Globalisation, *de jure*	1,243	68.704	8.444	58.644	94.385
Financial Globalisation	1,243	59.883	10.639	51.559	93.490
Financial Globalisation, *de facto*	1,243	56.884	16.757	43.212	97.451
Financial Globalisation, *de jure*	1,243	62.830	8.515	48.058	89.901
Interpersonal Globalisation	1,243	49.138	20.064	32.801	89.754
Interpersonal Globalisation, *de facto*	1,243	40.713	25.031	22.477	96.451
Interpersonal Globalisation, *de jure*	1,243	57.562	15.425	43.126	84.983
Informational Globalisation	1,243	71.156	10.542	52.125	90.589
Informational Globalisation, *de facto*	1,243	77.261	14.195	48.025	99.761
Informational Globalisation, *de jure*	1,243	65.051	7.683	56.225	81.457
Cultural Globalisation	1,243	59.756	11.931	47.364	87.312
Cultural Globalisation, *de facto*	1,243	55.575	18.640	34.829	97.066
Cultural Globalisation, *de jure*	1,243	63.937	9.119	51.038	77.558
Political Globalisation	1,243	82.507	8.055	43.900	87.279
Political Globalisation, *de facto*	1,243	85.577	5.128	49.681	89.185
Political Globalisation, *de jure*	1,243	83.081	5.539	38.119	87.017
Islamic Bank					
Bank Size	187	3.379	0.561	1.850	4.322
Credit Risk	187	1.038	1.947	−1.800	15.970
Capitalisation	187	11.798	13.086	2.930	83.344
Market Power	187	0.129	0.127	0.001	0.604
Liquidity	187	62.049	11.968	28.008	79.848
Overhead Expenses	187	2.237	1.581	0.517	7.980
Economic Growth	187	4.734	2.329	−2.466	15.241
Inflation	187	3.219	1.892	−0.739	10.227
Global Financial Crisis	187	0.128	0.335	0.000	1.000
Trade Globalisation	187	70.837	20.648	18.882	96.967
Trade Globalisation, *de facto*	187	69.628	25.569	27.496	99.551
Trade Globalisation, *de jure*	187	72.115	7.897	58.644	94.385
Financial Globalisation	187	65.791	9.397	51.559	93.490
Financial Globalisation, *de facto*	187	70.449	15.178	43.212	97.451
Financial Globalisation, *de jure*	187	60.788	7.516	48.058	89.901
Interpersonal Globalisation	187	67.325	19.201	32.801	89.601
Interpersonal Globalisation, *de facto*	187	62.094	23.804	22.477	96.263
Interpersonal Globalisation, *de jure*	187	72.555	15.049	43.126	84.983
Informational Globalisation	187	79.710	7.450	52.125	89.675
Informational Globalisation, *de facto*	187	87.304	8.311	48.025	99.761
Informational Globalisation, *de jure*	187	72.117	6.974	56.225	80.093
Cultural Globalisation	187	69.054	11.212	47.364	87.312
Cultural Globalisation, *de facto*	187	69.856	15.604	34.829	97.066
Cultural Globalisation, *de jure*	187	68.251	8.481	51.038	77.558
Political Globalisation	187	82.589	8.795	43.900	87.279
Political Globalisation, *de facto*	187	85.683	8.345	49.681	89.185
Political Globalisation, *de jure*	187	79.760	9.397	38.119	87.017

Table 8.
Summary statistics

Source(s): Bank annual report and authors own calculation

models 7 to 9 are consider the impact of IpGI on the TFPCH of banks. Models 10 to 12 consider the impact of InGI, and models 13 to 15 included the CuGI. These nine models are classified under the social globalisation. Finally, models 16 to 18 include the PoGI as well into the specification model.

The model performs reasonably well because the F-statistics for all regression models are statistically significant at 5% levels or better. Tables A2 and A3 in Appendix 2 summarise that the size of the bank (lnTA), show a positive relationship with TFPCH for conventional banks and its statistically significance at 1% levels. This result suggests bigger (smaller) size banks tend to have higher (lower) productivity. Hauner (2005) proposes several reasons for the favourable influence effect of the bank's size on the efficiency of the bank; (1) it is associated with market power, given big banks should outlay less based on their inputs; (2) there could be rising return on a scale via reallocating costs that are fixed (e.g. risk management or research) over a greater range of service offerings or via efficiency gains by utilising an expert team of professionals. The favourable association between productivity and size of bank may be anticipated given economies of scale (Goddard *et al.*, 2004). For instance, Ibrahim and Rizvi (2017) found that lnTA has a positive and significant relation with bank performance.

Besides that, we find that there is a negative and significant relationship between credit risk (LLPGL) and productivity of conventional banks. LLPGL is the possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations. This indicates that banks have an issue in evaluating LLPGL regarding poor management costs, resulting in higher LLPGL (Berger and DeYoung, 1997). Moreover, LLPGL is the main cause of bank failure and is the most visible risk to bank managers (Garr, 2013). Ozili (2017) recognised that, when the quality of lending is not good in a given market, high loan loss provisions could occur, which could lead to higher non-performing loans, eventually leading towards lower bank profitability. This can explain why banks with high-risk-taking behaviour have a large number of non-performing loans, leading to a negative impact on the productivity and profitability of the bank. In particular, Sufian (2012) and Salim *et al.* (2017) found that there is negative link between bank performance and LLPGL.

The findings suggest that market power (BDTD) is significantly positively related with conventional and Islamic banks productivity (Tables A2 and A3 in Appendix 2). Under the structure of the conduct performance (SCP) framework, BDTD hypothesis contends that conspiracy amongst organisations having BDTD will incur greater profitability and generate higher prices (Bain, 1951). The hypothesis associated with BDTD suggests that banks having high BDTD tend to increase the price of their services like borrowings and funding advances and non-conventional actions and reduced interest rates on consumer deposits, thereby making super-normal profits. The relative BDTD (RMP) hypothesis proposed by Berger (1995) contends that banks in gaining greater market share can increase their profitability not through collusive behaviour but through differentiating their products from others and providing excellent service quality as an exceptional value proposition in charging higher charges. Ye *et al.* (2012) showed that high BDTD leads to high profitability as leaders in the markets can provide excellent quality services through differentiating their products from others.

The result given in the table also reveals that bank liquidity (LOANSTA) has a significant and negative effect on the Islamic banks productivity. This implies that banks having less liquidity have a tendency to be more productive. Garcia-Herrero *et al.* (2009) articulate that bank having greater loans are able to perform better and display consistent levels of performance. According to Rehman *et al.* (2017), Islamic banks are more concerned with liquidity risk compared to conventional banks because restricted investment options for Islamic banks are the key factor restricting banks from using liquidity sensibly as well as diversifying their portfolios. Hassan *et al.* (2019) found that Islamic banks outperform conventional banks in the management of liquidity.

Turning to the effect of macroeconomics variables, we find that there is a positive and significant relationship between inflation (CPI) and productivity in Islamic banks. Molyneux and Thornton (1992), Pasiouras and Kosmidou (2007), and Hasanov *et al.* (2018) support the findings as they also reported that CPI is significantly and positively related to bank performance and profitability. If CPI is fully predicted, and interest rates are adjusted based on revenue, which will increase faster than costs, the outcome would have a beneficial impact on bank profitability; banks will charge a higher rate of interest to gain higher profits. Further, as a result of asymmetric information on CPI expectations, the bank's management will have greater opportunities to learn what the predicted CPI will be relative to customers' expectations of the bank. Molyneux and Thornton (1992), Pasiouras and Kosmidou (2007), and Hasanov *et al.* (2018) concur with these findings in their studies, reporting that CPI is significantly and positively related to bank performance and profitability.

Furthermore, the estimated coefficient of GFC provides evidence of the positive relationship to the Islamic bank productivity. According to Mollah *et al.* (2017), structured governance of Islamic banks has played a significant part in their financial success. Moreover, Cerović *et al.* (2017) and Alqahtani and Mayes (2018) reveal that Islamic banks were more sturdy during GFC. Islamic banks were shown to be much better in maintaining the supply of credit to the overall economy during these panic situations given their lending was less susceptible towards changes in deposits compared to conventional banks (Farooq and Zaheer, 2015). On the other hand, the results also show that GFC has a negatively significant effect to conventional banks productivity. The negative sign implies that the higher GFC is, the lower the productivity of banks. Conventional banks were more liable to react to the panicked reaction of depositors such as the withdrawal of bank deposits and that the lending of Islamic banks was less susceptible to changes in customer deposits (Farooq and Zaheer, 2015). Hasan and Dridi (2011) and Alexakis *et al.* (2019) results also are in favour of our study.

4.3 Robustness test

On the whole, the preliminary findings obtained from the POLS as an estimation model since the Breusch–Pagan and Lagrangian Multiplier (BP and LM) test is not significant at any level show BDTD and GFC are the factors which significantly affect the level of TFPCH on Islamic and conventional banks. In addition, lnTA and LLPGL have a significant effect only on the conventional banks TFPCH. Moreover, liquidity (LOANSTA) and CPI have a significant association only with TFPCH on Islamic banks. However, this study continues with the analysis using the GMM estimation approach to achieve robust results. Accordingly, the key results are focused on the regression model in this estimation technique.

As we have used a selection of bank-specific determinants, macroeconomic variables and globalisation indices, the probability of endogeneity may be presumed. There are several issues related to the endogeneity. The first issue is the correlation between the explanatory (descriptive) variables and error term. The second issue is the correlation between the lagged dependent variable and the new error term. In the presence of endogeneity, empirical findings will be misleading. Therefore, to avoid this issue, the GMM method was employed given this method considers simultaneity bias (endogeneity) of explanatory variables, inverse causality and omitted variables using lagged dependent variables as instruments. In a single system, the GMM integrates all the regression equations in differences and levels, each with its instrumental variable set. The data regression methods of the panel therefore provide an efficient solution and allow valuable inferences to be drawn on the level of performance of banks under different economic and institutional conditions.

The requirements for the instruments are, that, they must display a strong correlation with the endogenous regressors but must exhibit no correlation with the error term. In this study, the (weakly) exogeneity of the explanatory variables was adopted where they were

considered to be not correlated with the future realisation of the error term, but due to the past and present error terms. The instruments of the lagged values of the TFPCH scores and other descriptive variables (i.e. bank-specific, macroeconomic and globalisation) in the regression will also affect the reliability and consistency of the GMM estimator.

Therefore, to address this issue, two specification tests were employed as suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The first test, the Hansen test, was employed to address any restrictions concerning the validity of the instruments. This was performed by examining the sample being equivalent to the "moment conditions" employed in the estimation process. The second test was the Arellano–Bond (AR2) test which was employed to analyse the hypothesis that error term is not serially correlated.

The results are given in Table 9 and Table 10. Several remarks on the results of the analysis are justified. First, the results for most variables involved remain stable over the different regressions that are performed. Secondly, the Hansen and Arellano–Bond (AR2) tests revealed that our instruments fulfil the postestimation specification test and no second order serial correlation is detected. Therefore, we conclude that GMM estimation technique is appropriate in this study.

From Tables 9 and 10, it can be found that the coefficient of the variables remains almost the same. They show the same sign, the same order of magnitude and remain significant as in the POLS regression models (although at different rates sometimes). However, it can be observed that the coefficient of lnTA from Table 10 turn into significantly positive at 1% level for Islamic banks. This result suggests bigger (smaller) size banks tend to have higher (lower) productivity.

The results from presented in Table A2 suggest that LLPGL exhibit negative sign. On the other hand, the coefficient of LLPGL from Table 9 turn into significantly mixed (positive and negative) relationship with TFPCH when lagged dependent variable is introduces in the GMM regression model. The coefficient of LLPGL is positive after controlling the variable of IpGI in model 7.

The results from POLS suggest that there is no relationship between capitalisation (TCETA) and bank productivity in Islamic and conventional banks. However, in GMM regression model, the coefficient becomes positive and significantly influences the Islamic and conventional TFPCH (Tables 9 and 10). This implies that more productive banks incur greater profitability leading to more significant equity to asset ratios. In this way, well-capitalised banks are much more able to withstand unforeseen events and are unlikely to be destabilised in the face of adversity, thereby creating a haven for depositors (Shawtari *et al.*, 2015). In particular, Beck *et al.* (2013) and Rosman *et al.* (2014) found that there is positive link between bank efficiency and TCETA.

The results of BDTD on Islamic and conventional banks show a similar finding from both POLS and GMM estimation that is reported in Tables A2, A3, 9 and 10. However, the variable turns insignificant for Islamic banks in the GMM regression model.

Meanwhile, liquidity (LOANSTA) turns from a negative sign in Table A3 to a significant and positive influence on Islamic and conventional TFPCH (Tables 9 and 10). The positive LOANSTA coefficient indicates that higher (less) LOANSTA generally shows higher (less) productivity. As a result, bank borrowing tends to be highly valued compared to alternative outputs from banks such as securities and investment. Sufian (2009) and Kamarudin *et al.* (2014) are researchers who have also observed a positive association between bank performance and LOANSTA findings.

The results from POLS suggest that there is no relationship between overhead expenses (NIETA) and bank productivity in Islamic and conventional banks. However, in GMM regression model, the coefficient becomes negative and significantly influences the Islamic and conventional TFPCH (Tables 9 and 10). This means that lower (higher) operational costs

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	0.146 (0.586)	0.334 (0.333)	0.004 (0.605)	0.490 (0.535)	0.566 (0.438)	0.249 (0.483)	0.430 (0.367)	0.407 (0.349)	0.415 (0.390)
Bank-Specific Variables									
Ln(TFPCH$_{t-1}$)	-0.195[a] (0.042)	-0.194[a] (0.042)	-0.195[a] (0.041)	-0.195[a] (0.042)	-0.193[a] (0.042)	-0.195[a] (0.042)	-0.194[a] (0.042)	-0.194[a] (0.042)	-0.195[a] (0.042)
LnTA	0.261[a] (0.068)	0.289[a] (0.074)	0.255[a] (0.069)	0.276[a] (0.070)	0.287[a] (0.072)	0.262[a] (0.068)	0.287[a] (0.074)	0.288[a] (0.072)	0.279[a] (0.077)
LLPGL	-0.043[b] (0.020)	-0.047[b] (0.019)	-0.043[b] (0.021)	-0.046[b] (0.019)	-0.047[b] (0.019)	-0.045[b] (0.019)	0.013[b] (0.019)	-0.047[b] (0.019)	-0.047[b] (0.019)
TCETA	0.012[a] (0.004)	0.013[a] (0.004)	0.012[a] (0.004)	0.012[a] (0.004)	0.013[a] (0.004)	0.012[a] (0.004)	0.013[a] (0.004)	0.013[a] (0.004)	0.013[a] (0.004)
BDTD	0.292 (0.400)	0.395 (0.274)	0.234 (0.371)	0.485 (0.367)	0.494[c] (0.295)	0.367 (0.372)	0.412 (0.266)	0.472[c] (0.285)	0.342 (0.252)
LOANSTA	0.004[c] (0.003)	0.003 (0.003)	0.005[c] (0.003)	0.003 (0.003)	0.003 (0.003)	0.004 (0.002)	0.003 (0.003)	0.003 (0.003)	0.004 (0.003)
NIETA	-0.024 (0.015)	-0.025[c] (0.014)	-0.024 (0.015)	-0.023 (0.015)	-0.024[c] (0.014)	-0.023 (0.015)	-0.024[c] (0.014)	-0.025[c] (0.014)	-0.023 (0.014)
Macroeconomic Variables									
GDP	-0.014 (0.023)	-0.015 (0.022)	-0.018 (0.024)	-0.014 (0.022)	-0.018 (0.022)	-0.011 (0.023)	-0.017 (0.022)	-0.018 (0.022)	-0.015 (0.021)
CPI	0.018 (0.022)	0.009 (0.024)	0.021 (0.024)	0.013 (0.023)	0.001 (0.027)	0.018 (0.023)	0.004 (0.025)	0.003 (0.026)	0.008 (0.025)
GFC	-0.072 (0.092)	-0.078 (0.073)	-0.079 (0.081)	-0.061 (0.075)	-0.095 (0.076)	-0.059 (0.093)	-0.099 (0.077)	-0.101 (0.077)	-0.092 (0.077)
Globalisation Variables									
TrGI	0.001 (0.008)								
TrGIdif		-0.002 (0.003)							
TrGIdj			0.004 (0.008)						
FrGI				-0.004 (0.007)					
FrGIdif					-0.005 (0.005)				
FrGIdj						-0.001 (0.006)			
IpGI							-0.003 (0.003)		
IpGIdif								-0.003 (0.003)	
IpGIdj									-0.003 (0.004)
Wald x^2	170.30[a]	171.69[a]	171.13[a]	170.05[a]	171.96[a]	171.35[a]	174.52[a]	176.17[a]	174.08[a]
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.495	0.488	0.499	0.496	0.480	0.495	0.484	0.477	0.495
Hansen p-value	0.165	0.131	0.180	0.143	0.160	0.157	0.153	0.154	0.153
Observations	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086

(*continued*)

Table 9.
GMM regression results on conventional banks

Variable	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18
Constant	1.224^c (0.665)	1.051^c (0.591)	1.291^c (0.729)	0.597 (0.494)	0.547 (0.379)	0.128 (0.396)	0.806 (0.600)	0.919 (0.697)	0.685 (0.611)
Bank-Specific Variables									
Ln(TFPCH$_{t-1}$)	−0.192^a (0.042)	−0.193^a (0.042)	−0.190^a (0.043)	−0.194^a (0.042)	−0.189^a (0.045)	−0.192^a (0.042)	−0.194^a (0.041)	−0.194^a (0.041)	−0.194^a (0.041)
LnTA	0.298^a (0.071)	0.289^a (0.070)	0.304^a (0.073)	0.289^a (0.072)	0.305^a (0.077)	0.263^a (0.068)	0.263^a (0.069)	0.273^a (0.071)	0.254^a (0.068)
LLPGL	−0.048^a (0.018)	−0.047^a (0.018)	−0.048^a (0.019)	−0.047^b (0.019)	−0.056^a (0.018)	−0.042^b (0.019)	−0.046^b (0.019)	−0.046^b (0.019)	−0.045^b (0.019)
TCETA	0.014 (0.004)	0.013 (0.004)	0.014^c (0.004)	0.013^c (0.004)	0.014^a (0.004)	0.013^c (0.004)	0.012 (0.004)	0.013 (0.004)	0.012^c (0.004)
BDTD	0.448^c (0.258)	0.443^c (0.256)	0.434^c (0.261)	0.442 (0.287)	0.516^c (0.289)	0.320 (0.269)	0.216 (0.289)	0.142 (0.349)	0.281 (0.286)
LOANSTA	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)	0.003 (0.003)	0.003 (0.002)	0.004^c (0.002)	0.004^c (0.002)	0.004^c (0.002)	0.004^c (0.002)
NIETA	−0.025^c (0.014)	−0.024^c (0.014)	−0.026^c (0.014)	−0.025^c (0.014)	−0.017 (0.013)	−0.025 (0.015)	−0.022 (0.015)	−0.023 (0.015)	−0.023 (0.015)
Macroeconomic Variables									
GDP	−0.031 (0.024)	−0.032 (0.025)	−0.024 (0.022)	−0.016 (0.022)	−0.026 (0.025)	−0.018 (0.024)	−0.019 (0.022)	−0.009 (0.023)	−0.014 (0.021)
CPI	−0.002 (0.024)	0.004 (0.023)	−0.007 (0.027)	0.008 (0.024)	0.006 (0.022)	0.022 (0.023)	0.019 (0.023)	0.021 (0.023)	0.021 (0.024)
GFC	−0.268 (0.138)	−0.304^c (0.163)	−0.157^c (0.089)	−0.118 (0.083)	−0.160^c (0.088)	−0.069 (0.072)	−0.214 (0.169)	−0.057 (0.075)	−0.069 (0.075)
Globalisation Variables									
InGI	−0.012^c (0.007)								
InGIdf		−0.009^c (0.005)							
InGIdj			−0.015 (0.009)						
CuGI				−0.006 (0.006)					
CuGIdf					−0.006^c (0.003)				
CuGIdj						0.002 (0.004)			
PoGI							−0.006 (0.006)		
PoGIdf								−0.009 (0.009)	
PoGIdj									−0.005 (0.008)
Wald x^2	169.38^a	173.15^a	164.18^a	172.85^a	137.48^a	172.52^a	175.64^a	174.39^a	175.54^a
AR(1) p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) p-value	0.477	0.491	0.456	0.493	0.407	0.456	0.497	0.477	0.479
Hansen p-value	0.173	0.173	0.169	0.127	0.103	0.169	0.169	0.174	0.172
Observations	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086

Note(s): ^{a}, ^{b}, ^{c} indicates significance at the 1%, 5% and 10% levels, respectively

Figure in the parentheses () are standard errors

Table 9.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	-3.036[b] (1.245)	-2.744[b] (1.115)	-4.113[b] (1.938)	-4.014[b] (1.851)	-3.454[b] (1.697)	-3.476[a] (1.155)	-2.969[b] (1.212)	-2.725[b] (1.065)	-3.238[b] (1.497)
Bank-specific variables									
Ln(TFPCH$_{t-1}$)	-0.265[a] (0.090)	-0.264[a] (0.089)	-0.268[a] (0.092)	-0.270[a] (0.087)	-0.264[a] (0.092)	-0.267[a] (0.084)	-0.266[a] (0.091)	-0.266[a] (0.092)	-0.263[a] (0.091)
LnTA	0.561[b] (0.255)	0.590[b] (0.253)	0.537[b] (0.268)	0.488[c] (0.279)	0.467[b] (0.225)	0.738[b] (0.308)	0.526[b] (0.224)	0.516[b] (0.239)	0.565[b] (0.222)
LLPGL	0.068 (0.046)	0.067 (0.046)	0.066 (0.045)	0.068 (0.046)	0.063 (0.042)	0.064 (0.042)	0.067 (0.045)	0.068 (0.045)	0.063 (0.043)
TCETA	0.014 (0.009)	0.016[c] (0.009)	0.010 (0.011)	0.004 (0.021)	0.009 (0.015)	0.015 (0.015)	0.014 (0.011)	0.012 (0.013)	0.017[b] (0.008)
BDTD	-0.358 (1.373)	-0.369 (1.356)	-0.332 (1.431)	-0.147 (1.404)	-0.158 (1.344)	-0.392 (1.368)	-0.273 (1.341)	-0.268 (1.319)	-0.314 (1.368)
LOANSTA	0.032[a] (0.012)	0.031[a] (0.012)	0.033[a] (0.012)	0.030[b] (0.013)	0.033[a] (0.012)	0.029[c] (0.015)	0.031[b] (0.013)	0.030[b] (0.013)	0.032[a] (0.012)
NIETA	-0.094 (0.083)	-0.101 (0.081)	-0.092 (0.087)	-0.081 (0.113)	-0.072 (0.109)	-0.149[c] (0.083)	-0.087 (0.107)	-0.086 (0.114)	-0.095 (0.093)
Macroeconomic variables									
GDP	-0.109 (0.074)	-0.106 (0.072)	-0.116 (0.079)	-0.089 (0.064)	-0.090 (0.067)	-0.096 (0.065)	-0.095 (0.063)	-0.091 (0.061)	-0.098 (0.068)
CPI	0.175 (0.132)	0.179 (0.134)	0.155 (0.121)	0.210 (0.147)	0.198 (0.158)	0.192 (0.121)	0.197 (0.148)	0.200 (0.142)	0.184 (0.149)
GFC	0.135 (0.459)	0.143 (0.458)	0.196 (0.464)	0.293 (0.484)	0.288 (0.496)	0.291 (0.520)	0.259 (0.484)	0.275 (0.487)	0.235 (0.466)
Globalisation variables									
TrGI	0.013 (0.012)								
TrGIdf		0.007 (0.008)							
TrGIdj			0.029 (0.025)						
FiGI				0.032 (0.034)					
FiGIdf					0.019 (0.021)				
FiGIdj						0.015 (0.025)			
IpGI							0.012 (0.013)		
IpGIdf								0.010 (0.011)	
IpGIdj									0.013 (0.016)
Wald x^2	54.08[a]	55.20[a]	55.13[a]	57.58[a]	65.17[a]	54.33[a]	55.34[a]	55.82[a]	64.40[a]
AR(1) p-value	0.025	0.025	0.026	0.025	0.027	0.024	0.026	0.026	0.026
AR(2) p-value	0.352	0.356	0.328	0.328	0.353	0.336	0.359	0.365	0.358
Hansen p-value	0.489	0.490	0.483	0.489	0.486	0.418	0.499	0.506	0.485
Observations	159	159	159	159	159	159	159	159	159

(*continued*)

Table 10.
GMM regression results on Islamic banks

Variable	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18
Constant	−3.621 (2.334)	−2.699 (1.843)	−4.797[a] (2.875)	−3.288[a] (1.282)	−3.003[a] (1.146)	−3.186[b] (1.348)	−2.732[b] (1.083)	−3.612[b] (1.103)	−3.098[a] (1.071)
Bank-specific variables									
Ln(TFPCH$_{i,-1}$)	−0.264[a] (0.090)	−0.265[a] (0.089)	−0.262[a] (0.092)	−0.264[a] (0.089)	−0.260[a] (0.089)	−0.266[a] (0.089)	−0.266[a] (0.090)	−0.265[a] (0.089)	−0.266[a] (0.091)
LnTA	0.661[a] (0.218)	0.744[a] (0.240)	0.526[b] (0.217)	0.633 (0.283)	0.628[b] (0.296)	0.709[a] (0.269)	0.737[a,b] (0.288)	0.762[a] (0.282)	0.768[a] (0.286)
LLPGL	0.059 (0.039)	0.057 (0.035)	0.066 (0.045)	0.068 (0.045)	0.066 (0.045)	0.063[c] (0.038)	0.058[c] (0.034)	0.062[c] (0.036)	0.060[c] (0.036)
TCETA	0.018[c] (0.009)	0.022[b] (0.008)	0.014 (0.010)	0.016[c] (0.008)	0.015 (0.009)	0.230[a] (0.006)	0.022[a] (0.006)	0.024[a] (0.007)	0.023[a] (0.007)
BDTD	−0.405 (1.355)	−0.465 (1.349)	−0.323 (1.349)	−0.460 (1.355)	−0.493 (1.338)	−0.439 (1.339)	−0.429 (1.328)	−0.515 (1.335)	−0.528 (1.326)
LOANSTA	0.031[b] (0.013)	0.031 (0.013)	0.030[b] (0.013)	0.030[b] (0.013)	0.029[b] (0.013)	0.031[a] (0.012)	0.031[a] (0.012)	0.029[b] (0.012)	0.030[b] (0.012)
NIETA	−0.124 (0.084)	−0.151[c] (0.084)	−0.084 (0.094)	−0.111 (0.069)	−0.114 (0.071)	−0.129 (0.082)	−0.147 (0.089)	−0.141[c] (0.085)	−0.155 (0.095)
Macroeconomic variables									
GDP	−0.087 (0.065)	−0.091 (0.067)	−0.086 (0.062)	−0.108 (0.073)	−0.103 (0.070)	−0.100 (0.073)	−0.095 (0.073)	−0.115 (0.083)	−0.103 (0.076)
CPI	0.179 (0.139)	0.167 (0.127)	0.198 (0.153)	0.181 (0.131)	0.176 (0.130)	0.176 (0.121)	0.165 (0.119)	0.156 (0.119)	0.161 (0.118)
GFC	0.336 (0.567)	0.275 (0.557)	0.357 (0.529)	0.159 (0.468)	0.160 (0.466)	0.226 (0.496)	0.250 (0.509)	0.109 (0.596)	0.194 (0.553)
Globalisation variables									
lnGI	0.014 (0.027)								
lnGIdf		−0.001 (0.016)							
lnGIdj			0.036 (0.041)						
CuGI				0.014 (0.016)					
CuGIdf					0.011 (0.014)				
CuGIdj						0.008 (0.013)			
PoGI							−0.001 (1.000)		
PoGIdf								0.012 (0.017)	
PoGIdj									0.005 (0.014)
Wald x^2	55.59[a]	58.27[a]	56.46[a]	54.34[a]	54.01[a]	58.13[a]	58.03[a]	79.23[a]	62.37[a]
AR(1) *p*-value	0.026	0.026	0.027	0.025	0.025	0.025	0.025	0.025	0.026
AR(2) *p*-value	0.362	0.355	0.375	0.358	0.368	0.354	0.351	0.353	0.352
Hansen *p*-value	0.495	0.491	0.496	0.491	0.483	0.502	0.494	0.501	0.492
Observations	159	159	159	159	159	159	159	159	159

Note(s): [a],[b],[c] indicates significance at the 1%, 5% and 10% levels, respectively
Figure in the parentheses () are standard errors

Table 10.

might result in higher (lower) quality management. NIETA is used to measure the quality of bank administration and operations and can be defined as the ratio of non-interest expenses to the amount of total assets. Several studies such as Muda *et al.* (2013) and Sufian (2016) confirm the adverse relationship between NIETA and performance.

Notwithstanding, economic growth significantly and negatively affect bank productivity in Islamic banks. According to Kamarudin *et al.* (2017), adverse relationship may arise as banks decrease their costs in areas such as credit screening and monitoring, which would inevitably lower the bank's profitability level, provided the amount of input. Our finding is also consistent with the findings of previous study, such as Sufian and Majid (2009) and Kamarudin *et al.* (2016b) that indicate that economic growth has a negative impact on bank productivity.

In order to resolve the issue of whether globalisation is important to the determination of productivity, this analysis re-estimates equation (3.3) to incorporate the six-dimensional globalisation indicators, namely (1) TrGI, (2) FiGI, (3) IpGI, (4) InGI, (5) CuGI and (6) PoGI. These six dimensions of will can be divided into *de facto* and *de jure* globalisation. Although *de facto* globalisation measures real international flows and activities, *de jure* globalisation measures policies and requirements that, in theory, facilitate and promote flows and activities (Gygli *et al.*, 2019). The relationship between the six dimensions of globalisation and bank productivity is independently evaluated to prevent multicollinearity issues.

TrGI is positive but appears to have a statistically insignificant influence on TFPCH of both Islamic and conventional banks. The positive coefficient implies that the higher the trade level in the country, the higher productivity of the bank. Hsieh *et al.* (2013), Sufian and Habibullah (2014) and Kim Nguyen and Tien Nguyen (2018) also reported the positive association between TrGI and banks' performance.

FiGI is found to have no significant influence on both Islamic and conventional banks. Negative coefficient was recorded in all models performed on conventional banks, while positive coefficient was recorded on Islamic banks. The positive association on TFPCH of Islamic banks indicates that more open financial environment characterised fewer barriers on trade, and foreign direct investment can improve the banking system by attracting more foreign investment. While negative association on TFPCH of conventional banks indicate that banks having more FiGI do not perform well.

IpGI also appears statistically insignificant influence on TFPCH of both Islamic and conventional banks. Negative coefficient was recorded in all models performed on conventional banks, while positive coefficient was recorded on Islamic banks. The positive TFPCH association of Islamic banks suggests that global interaction networks have greatly lowered transaction fees across the world and have helped to promote foreign trade and eliminate obstacles that could impact bank productivity. Sufian and Kamarudin (2016) and Sufian *et al.* (2017) also reported the positive relation of IpGI with banks productivity while other study showed contrasting results (Sufian and Habibullah, 2014).

We find that there is negative and significantly relationship between InGI, InGI, *de facto* (InGIdf) and the conventional bank's productivity. Internet-based information can help foster and improve competitiveness in the market, thus helping banks to reduce their overall costs. However, this study reveals a contrary finding. This may be due to the fact that SEA is a developing country where many households do not have Internet access while those households who have access to online banking do not intend to use financial services over the Internet for various reasons. In fact, many users still find online banking insecure primarily due to poor information and understanding of technology and the Internet. Moreover, in emerging countries, network technology is underdeveloped due to a limited number of Internet and telecommunications experts. Sufian and Habibullah (2014) and Sufian and Kamarudin (2016) also reported the negative association between InGI and banks' productivity.

CuGI, *de facto* (CuGIdf), also significantly and negatively affect conventional bank productivity. Social globalisation influence CuGIdf on the number of McDonald's restaurants, Ikea stores, traded in cultural goods and personal services, and international trademark as in KOF Globalisation Index. The breadth of McDonald outlets has become a visual means of measuring the scale of globalisation for most individuals. Western culture has grown rapidly its effect on all facets of global life including growth in the economy. Majority of previous study suggested that CuGI had a favourable effect on productivity in the banking sector (Sufian *et al.*, 2017; Sufian and Habibullah, 2014; Sufian, 2016).

However, this study reveals adverse outcomes. This implies that greater social integration significantly lowers the productivity of conventional banks in SEA. Culture has the potential to influence individual attitudes and perceptions of decision-making. The relentless expansion of market economies and digital technologies often under the influence of Western multinationals brings new threats to indigenous communities and traditions in many non-Western societies. In an attempt to alleviate financial risk, conventional banks in SEA have followed a Western banking regime. As a result, excessive protocol and a lengthy process make the banks unproductive in the FS. CuGI also appears to have a negative statistically insignificant influence on TFPCH of Islamic banks. The negative link suggests differences in history, regulatory adaptability, and perception make Islamic finance benefits in Muslim-majority countries relative to the Western world as they have underperformed in politically democratic countries and performed well in intermediate or entirely Sharia-compliant countries (Bitar *et al.*, 2017).

Finally, PoGI is negatively but statistically insignificantly related to the TFPCH of Islamic and conventional banks. The negative coefficient indicate that increase in the regulations such as stricter capital and LOANSTA requirements can make certain banking activities and service become less attractive. According to Aliyu *et al.* (2017), throughout the case of a favourable regulatory setting for Islamic institutions, the organisation finds it easier to operate in less stable nations than in Western countries with a high political profile. Our findings of the insignificant impact of PoGI is also consistent with the findings of previous study, such as Martens and Raza (2010).

5. Conclusion
This research empirically examines total factor productivity of Islamic and conventional banks in four SEA countries with dual-banking systems. The DEA-based MPI method is used to examine the TFPCH rate in SEA's Islamic and conventional banking sectors. According to the empirical findings, there is a statistically significant difference in the productivity of Islamic and conventional banks. This finding lends credence to the theory that Islamic and conventional banks differ in terms of agency, complexity, maturity and development. This study also discovered that Islamic banks outperformed conventional banks in the SEA region.

An MPRA technique is utilised to further investigate the relationship between banks' total factor productivity change (TFPCH) rate and the explanatory factors in SEA's Islamic and conventional banking sectors. Several specifications, including bank-specific determinants, macroeconomic variables and globalisation indicators, are estimated. To address heteroskedasticity, the GLS approach is used to assess the influence of the explanatory factors on bank productivity as proxied by the TFPCH. Furthermore, to get robust results, this study continues with the analysis utilising the GMM estimation technique. Accordingly, the main findings are based on the regression model in this estimation technique.

The findings of this study have numerous important implications for bankers, policymakers and investors. The study identifies many driving factors of bank productivity that may help bank managers enhance their institutions' productivity. It also

aids in understanding how macroeconomic factors influence banking sector productivity. The analytical studies also allow academics and business practises to better understand how numerous determinants such as bank-specific characteristics, macroeconomic conditions and globalisation indicators affect the productivity of Islamic and conventional banks in SEA.

Progressive productivity in Islamic and conventional banks is critical for the country's economic progress, especially in light of globalisation. The empirical research on the effect of globalisation on bank productivity is inconclusive. This research's contradictory nature may be attributable, in part, to the fact that it often solely considers the economic dimensions of globalisation. As a result, the purpose of this study is to contribute to the literature by investigating the impact of economic globalisation on the productivity of Islamic and conventional banks, as well as other non-economic aspects of globalisation such as social and PoGI. The empirical findings show that lnTA, LLPGL, TCETA, BDTD, LOANSTA, NIETA, economic growth, inflation and the GFC all have an impact on bank productivity.

The findings show that there is a difference in the influence of bank specific characteristics, macroeconomic factors and globalisation indicators on the productivity of Islamic and conventional banks. One of the primary reasons for this might be that Islamic banks are at a different stage of maturity and growth than their conventional counterparts. Another possibility is that Islamic banks have restricted access to the statutory LOANSTA requirement (SLR), which makes it profitable for conventional banks to invest in T-bills. These might be the reasons why productivity determinants have a different impact on both types of banks.

Authorities may concentrate on the execution of new rules and policies for future initiatives and ventures by analysing a specific dimension of globalisation. When it comes to globalisation factors, TrGI is favourable for both types of banks, but it appears to have little impact on productivity. Nonetheless, the government cannot overlook it. The positive coefficient suggests that the greater the country's trade level, the higher the bank's productivity. Policymakers should enhance transnational trade volumes and investment activities between one country and its international partners, allowing countries to capitalise on comparative advantages in adopting and fostering innovative approaches and productive production. In terms of FiGI, it has a negative impact on conventional bank productivity while having a favourable impact on Islamic bank productivity. However, none of the results are statistically significant. This implies that policymakers must strike a balance between a restrictive financial environment and regulatory barriers to FDI and portfolio investment in order to minimise destabilisation of conventional banks and enhance the productivity of Islamic banks.

Indeed, the findings of this study on the impact of globalisation in SEA point to the necessity for regulators to implement new rules, since the data demonstrate that InGI, InGI, *de facto* (InGIdf), and CuGI, *de facto* (CuGIdf) have significant effects on levels of productivity in conventional banks. The government plays an important role in assisting local banks in their operation management and upgrading information technology, which is required to support the productivity growth of domestic banks, through MIS. Furthermore, MIS can help minimise the impact of rising prices by aiding banks in predicting rising costs and, as a result, adjusting interest rates to maximise profits. Not only that, but the government must educate and build a cohesive communication infrastructure so that individuals may access financial services via the Internet. Moreover, the government's new policies must be capable of keeping up with new information and communication systems, thereby creating an effective international network of interaction and opening up new opportunities to attract skilled people from other countries working in management and leadership roles and positions to improve corporate culture and the professional style of work.

PoGI has a detrimental influence on the productivity of both types of banks, although it appears to be insignificant. Nonetheless, a nation with a solid political system may determine

how to capitalise on global trends and incorporate developing technology into the country's economy, which can boost productivity, profitability, wealth and job creation in a variety of sectors, including the banking industry. However, as more foreign banks enter the financial industry, competition becomes more intense. As a result, increasing competitive pressure from global competitors has created several challenges for domestic banks as they seek to adhere to international standards.

Due to its limitations, this study provides an opportunity and a motivation to seek additional insight into a deeper knowledge and analysis of the productivity levels of two banking types. First, future research might look at various measures of bank production, such as the production approach and the revenue approach, since this study employs the intermediation approach to determine the bank's input and output specifications. Second, non-parametric frontier analysis may be integrated with the parametric stochastic frontier data analysis approach to get more robustness empirical evidence. Third, further study is needed to understand how globalisation affects bank performance. The globalisation indexes' components might be examined to see which are most strongly linked to bank productivity. Therefore, this research provides incentives for institutions to make strategic decisions that will increase bank productivity.

References

Abedifar, P., Molyneux, P. and Tarazi, A. (2013), "Risk in Islamic banking", *Review of Finance*, Vol. 17, pp. 2035-2096.

Abedifar, P., Hassan, I. and Tarazi, A. (2016), "Finance-growth nexus and dual-banking systems: relative importance of Islamic banks", *Journal of Economic Behavior and Organization*, Vol. 132, pp. 198-215.

Alexakis, C., Izzeldin, M., Johnes, J. and Pappas, V. (2019), "Performance and productivity in Islamic and conventional banks: evidence from the global financial crisis", *Economic Modelling*, Vol. 79 No. C, pp. 1-14.

Aliyu, S., Yusof, R.M. and Naiimi, N. (2017), "The role of moral transaction mode for sustainability of banking business: a proposed conceptual model for Islamic microfinance banks in Nigeria", *International Journal of Social Economics*, Vol. 44, pp. 2238-2256.

Alqahtani, F. and Mayes, D. (2018), "Financial stability of Islamic banking and the global financial crisis: evidence from the gulf cooperation council", *Economic Systems*, Vol. 42 No. 2, pp. 346-360.

Ang, J., Cole, R. and Lin, J. (2000), "Agency costs and ownership structure", *The Journal of Finance*, Vol. 55 No. 1, pp. 1-39.

Arellano, M. and Bond, S. (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", *Review of Economic Studies*, Vol. 58 No. 2, pp. 277-297.

Arellano, M. and Bover, O. (1995), "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics*, Vol. 68 No. 1, pp. 29-51.

Ariss, R.T. (2010), "Competitive conditions in Islamic and conventional banking: a global perspective", *Review of Financial Economics*, Vol. 19 No. 3, pp. 101-108.

Askari, H., Iqbal, Z. and Mirakhor, A. (2009), "Chapter 4: globalization and its implication for Muslim countries", in Askari, H., Iqbal, Z. and Mirakhor, A. (Eds), *New Issues in Islamic Finance and Economics: Progress and Challenges*, John Wiley & Sons (Asia), pp. 111-128.

Atmaca, S., Schoors, K. and Verschelde, M. (2020), "Bank loyalty, social networks and crisis", *Bank Loyalty, Social Networks and Crisis*, Vol. 112, p. 105269.

Bain, J. (1951), "Relation of profit rate to industry concentration: American manufacturing, 1936-1940", *The Quarterly Journal of Economics*, Vol. 65 No. 3, pp. 293-324.

Barrow, C. and Keck, M. (2017), "Globalization theory and state theory: the false antinomy", *Studies in Political Economy*, Vol. 98 No. 2, pp. 177-196.

Beck, T., Kunt, A.D. and Merrouche, O. (2013), "Islamic vs conventional banking: business model, efficiency and stability", *Journal of Banking and Finance*, Vol. 37, pp. 433-447.

Berger, A. (1995), "The relationship between capital and earnings in banking", *Journal of Money, Credit and Banking*, Vol. 27 No. 2, pp. 432-456.

Berger, A. and DeYoung, R. (1997), "Problem loans an cost efficiency in commercial banks", *Journal of Banking and Finance*, Vol. 21, pp. 849-870.

Berger, A., DeYong, R., Genay, H. and Udell, G. (2000), "Globalization of financial institutions: evidence from cross-border banking performance", *Brookings-Wharton Papers on Financial Services*, Vol. 3, pp. 23-158.

Bhatia, V., Basu, S., Mitra, S.K. and Dash, P. (2018), "A review of bank efficiency and productivity", *OPSEARCH*, Vol. 55, pp. 557-600.

Bitar, M., Madies, P. and Taramasco, O. (2017), "What makes Islamic banks different? A multivariate approach", *Economic Systems*, Vol. 41 No. 2, pp. 215-235.

Bitar, M., Pukthuanthong, K. and Walker, T. (2018), "The effect of capital ratios on the risk, efficiency and profitability of banks: evidence from OECD countries", *Journal of International Financial Markets, Institutions and Money*, Vol. 53 No. C, pp. 227-262.

Blundell, R. and Bond, S. (1998), "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, Vol. 87 No. 1, pp. 115-143.

Bottazi, G., Secchi, A. and Tamagni, F. (2008), "Productivity, profitability and financial performance", *Industrial and Corporate Change*, Vol. 17 No. 4, pp. 711-751.

Boukhatem, J. and Moussa, F.B. (2018), "The effect of Islamic banks on GDP growth: some evidence from selected MENA countries", *Borsa Istanbul Review*, Vol. 18 No. 3, pp. 231-247.

Casu, B. and Girardone, C. (2006), "Bank competition, concentration and efficiency in the single European market", *The Manchaster School*, Vol. 74 No. 4, pp. 441-468.

Cerović, L., Nikolaj, S.S. and Maradin, D. (2017), "Comparative analysis of conventional and Islamic banking: importance of market regulation", *Ekonomska Misao*, Vol. 26, pp. 241-263.

Chang, C.-P., Lee, C.-C. and Hsieh, M.-C. (2015), "Does globalization promote real output? Evidence from quantile cointegration regression", *Economic Modelling*, Vol. 44, pp. 25-36.

Charnes, A., Cooper, W. and Rhodes, E. (1978), "Measuring the efficiency of decision making units", *European Journal of Operational Research*, Vol. 2 No. 6, pp. 429-444.

Chen, H.-K., Liao, Y.-C., Lin, C.-Y. and Yen, J.-F. (2018), "The effect of the political connections of government bank CEOs on bank performance during the financial crisis", *Journal of Financial Stability*, Vol. 36, pp. 130-143.

Cobb, C. and Douglas, P. (1928), "A theory of production", *American Economic Review*, Vol. 18 No. 1, pp. 139-165.

Coelli, T. (2008), *A Guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer) Program*, Working Paper of the University of New England/Centre for Efficiency and Productivity Analysis (CEPA).

Coelli, T., Rao, D. and Battese, G. (1998), *An Introduction to Efficiency and Productivity Analysis*, Kluwer Academic Publishers, Boston.

Currie, W. (2000), *The Global Information Society*, John Wiley, Chichester.

Darrat, A. (1988), "The Islamic interest-free banking system: some empiricale vidence", *Applied Economics*, Vol. 20, pp. 417-425.

Dreher, A. (2006), "Does globalization affect growth? Evidence from a new index of globalization", *Applied Economics*, Vol. 38 No. 10, pp. 1091-1110.

Dufey, G. and Giddy, J. (1978), *The International Money Market*, Prentice-Hall, New York.

Emrouznejad, A. and Yang, G.-l. (2018), "A survey and analysis of the first 40 years of scholarly literature in DEA: 1978-2016", *Socio- Economic Planning Sciences*, Vol. 61, pp. 4-8.

Fare, R., Grosskopf, S., Norris, M. and Zhang, Z. (1994), "Productivity growth, technical progress, and efficiency change in industrialized countries", *American Economic Review*, Vol. 84 No. 1, pp. 66-83.

Farooq, M. and Zaheer, S. (2015), "Are Islamic banks more resiliet during financial panics?", *Pacific Economic Review*, Vol. 20 No. 1, pp. 101-124.

Garcia-Herrero, A., Gavila, S. and Santabarbara, D. (2009), "What explains the low profitability of Chinese banks?", *Journal of Banking and Finance*, Vol. 33 No. 11, pp. 2080-2092.

Garr, D.K. (2013), "Determinants of credit risk in the banking industry of Ghana", *Developing Country Studies*, Vol. 3 No. 11, pp. 64-78.

Goddard, J., Molyneux, P. and Wilson, J. (2004), "Dynamics of growth and profitability in banking", *Journal of Money, Credit, and Banking*, Vol. 36 No. 6, pp. 1069-1090.

Grubel, H. (1989), "Multinational banking", in Enderwick, P. (Ed.), *Multinational Service Firms*, Routlege, New York.

Gygli, S., Haelg, F., Potrafke, N. and Sturm, J.-E. (2019), "The KOF globalisation index – revisited", *The Review of International Organizations*, Vol. 14, pp. 543-574.

Habib, S.F. (2018), "Chapter 3: Islamic banking versus conventional banking", in Habib, S.F. (Ed.), *Fundamentals of Islamic Finance and Banking*, John Wiley & Sons, pp. 47-78.

Hansen, L.P. (1982), "Large sample properties of generalized method of moments estimators", *Econometrica*, Vol. 50 No. 4, pp. 1029-1054.

Hasan, M. and Dridi, J. (2011), "The effects of the global crisis on Islamic and Conventional Banks: a comparative study", *Journal of International Commerce, Economics and Policy*, Vol. 2 No. 2, pp. 163-200.

Hasanov, F., Bayramli, N. and Al-Musehel, N. (2018), "Bank-specific and macroeconomic determinants of bank profitability: evidence from an oil-dependent economy", *International Journal of Financial Studies*, Vol. 6 No. 78, pp. 1-21.

Hassan, M. and Aliyu, S. (2018), "A contemporary survey of Islamic banking literature", *Journal of Financial Stability*, Vol. 34, pp. 12-43.

Hassan, M., Aliyu, S., Paltrinieri, A. and Khan, A. (2018), "A review of Islamic investment literature", *Economic Paper*, Vol. 38 No. 4, pp. 345-380.

Hassan, M., Khan, A. and Paltrinieri, A. (2019), "Liquidity risk, credit risk and stability in Islamic and conventional banks", *Research in International Business and Finance*, Vol. 48, pp. 17-31.

Hauner, D. (2005), "Explaining efficiency differences among large German and Austrian banks", *Applied Economics*, Vol. 37 No. 9, pp. 969-980.

Houben, V. (2003), "Southeast Asia and Islam", *The Annals of the American Academy of Political and Social Science*, Vol. 588, pp. 149-170.

Hsieh, M.-F., Chen, P.-F., Lee, C.-C. and Yang, S.-J. (2013), "How does diversification impact bank stability? The role of globalization, regulations, and governance environments", *Asia-Pacific Journal of Financial Studies*, Vol. 42, pp. 813-844.

Hussain, H.I., Kot, S., Kamarudin, F. and Mun, W.C. (2020), "The nexus of competition freedom and the efficiency of microfinance institutions", *Journal of Competitiveness*, Vol. 12 No. 2, pp. 67-89.

Ibrahim, M. and Rizvi, S. (2017), "Do we need bigger Islamic banks? An assessment of bank stability", *Journal of Multinational Financial Management*, Vol. 40 No. C, pp. 77-91.

Ibrahim, M. and Rizvi, S. (2018), "Bank lending, deposits and risk-taking in times of crisis: a panel analysis of Islamic and conventional banks", *Emerging Markets Review*, Vol. 35 No. C, pp. 31-47.

Imam, P. and Kpodar, K. (2016), "Islamic banking: good for growth?", *Economic Modelling*, Vol. 59, pp. 387-401.

International Monetary Fund (2015), *IMF Annual Report 2015: Tackling Challenges Together*, International Monetary Fund, NW Washington, DC, available at: https://www.imf.org/external/pubs/ft/ar/2015/eng/pdf/ar15_eng.pdf.

Jalilian, H., Kirkpatrick, C. and Parker, D. (2007), "The impact of regulation on economic growth in developing countries: a cross-country analysis", *World Development*, Vol. 35 No. 1, pp. 87-103.

Jensen, M. and Meckling, W. (1976), "Theory of the firm: managerial behavior, agency costs and ownership structure", *Journal of Financial Economics*, Vol. 3 No. 4, pp. 305-360.

Kahnamoui, F. (2013), "Do trade restrictions or openness affect economic growth differently in the presence of export credits?", *Business and Economics Journal*, Vol. 69, pp. 1-11.

Kamarudin, F., Nordin, B.A.A. and Nassir, A.M. (2013), "Price efficiency and returns to scale of banking sector in gulf cooperative council countries: empirical evidence from Islamic and conventional banks", *Economic Computation and Economic Cybernetics Studies and Research*, Vol. 47 No. 3, pp. 215-236.

Kamarudin, F., Md Nassir, A., Yahya, M.H., Said, R.M. and Nordin, B.A. (2014), "Islamic banking sector in gulf cooperative council countries: analysis on revenue, cost and profit efficiency concepts", *Journal of Economic Cooperationa and Development*, Vol. 35 No. 2, pp. 1-42.

Kamarudin, F., Sufian, F. and Nassir, A.M. (2016a), "Does country governance foster revenue efficiency of Islamic and conventional banks in GCC countries?", *EuroMed Journal of Business*, Vol. 11 No. 2, pp. 181-211.

Kamarudin, F., Sufian, F. and Nassir, A. (2016b), "Global financial crisis, ownership and bank profit efficiency in the Bangladesh's state owned and private commercial banks", *Contaduría y Administración*, Vol. 61, pp. 705-745.

Kamarudin, F., Chiun, Z.H., Sufian, F. and Mohamad Anwar, N. (2017), "Does productivity of Islamic banks endure progress of regress? Empirical evidence using data envelopment analysis based malmquist productivity index", *Humanomics*, Vol. 33 No. 1, pp. 84-118.

Keller, R. and Chinta, R. (1990), "International technology transfer: startegies for success", *Academy of Management*, Vol. 4 No. 2, pp. 33-43.

Khan, M. (1986), "Islamic interest-free banking: a theoretical analysis", *Palgrave Macmillan Journal*, Vol. 33, pp. 1-27.

Khan, M. and Bhatti, M. (2008), "Islamic banking anf finance: on its way to globalization", *Managerial Finance*, Vol. 34 No. 10, pp. 708-725.

Kim Nguyen, H.T. and Tien Nguyen, D. (2018), "Globalisation and bank performance in Vietnam", *Malaysian Journal of Economic Studies*, Vol. 55 No. 1, pp. 49-70.

Komijani, A. and Hesary, F.T. (2018), *An Overview of Islamic Banking and Finance in Asia*, ADBI Working Paper Series, No. 853, eSocialSciences.

Lall, R. (2012), "From failure to failure: the politics of international banking regulation", *Review of International Political Economy*, Vol. 19 No. 4, pp. 609-638.

Lu, J., Liu, X. and Cheng, Y. (2019), "Cultural proximity and genre proximity: how do Chinese viewers enjoy American and Korean TV dramas?", *SAGE Open*, Vol. 9 No. 1, pp. 1-10.

Martens, P. and Raza, M. (2010), "Is globalisation sustainable?", *Sustainability*, Vol. 2, pp. 280-293.

Mastromarco, C. and Simar, L. (2018), "Globalization and productivity: a robust nonparametric world Frontier analysis", *Economic Modelling*, Vol. 69, pp. 134-149.

Meng, C. (2009), *Multinational Banking in China: Theory and Practic*, Edward Elgar Publishing, Northampton, MA.

Mobarek, A. and Kalonov, A. (2014), "Comparative performance analysis between conventional and Islamic banks: empirical evidence from OIC countries", *Applied Economics*, Vol. 46 No. 3, pp. 253-270.

Mollah, S., Hassan, M., Farooque, O. and Mobarek, A. (2017), "The governance, risk-taking, and performance of Islamic banks", *Journal of Financial Services Research*, Vol. 51 No. 2, pp. 195-219.

Molyneux, P. and Thornton, J. (1992), "Determinants of European bank profitability: a note", *Journal of Banking and Finance*, Vol. 16, pp. 1173-1178.

Muda, M., Shaharuddin, A. and Embaya, A. (2013), "Comparative analysis of profitability determinants of domestic and foreign Islamic banks in Malaysia", *International Journal of Economics and Financial Issues*, Vol. 3 No. 3, pp. 559-569.

Mukherjee, D. and Dutta, N. (2018), "What determines governance across nations: do economic and social globalization play a role?", *Economic Modelling*, Vol. 69, pp. 103-113.

Njanike, K. (2010), "The impact of globalisation on banking service quality in Zimbabwe (2003-2008)", *Annals of the University of Petroşani, Economics*, Vol. 10 No. 1, pp. 205-216.

Nys, E., Tarazi, A. and Trinugroho, I. (2015), "Political connections, bank deposits, and formal deposit insurance", *Journal of Financial Stability*, Vol. 19, pp. 83-104.

Olson, D. and Zoubi, T. (2008), "Using accounting ratios to distinguish between Islamic and conventional banks in the GCC region", *The International Journal of Accounting*, Vol. 43, pp. 45-65.

Olson, D. and Zoubi, T. (2011), "Efficiency and bank profitability in MENA countries", *Emerging Markets Review*, Vol. 12, pp. 94-110.

Ozili, P. (2017), "Bank profitability and capital regulation: evidence from listed and non-listed banks in Africa", *Journal of African Business*, Vol. 18 No. 2, pp. 143-168.

Pasiouras, F. and Kosmidou, K. (2007), "Factors influencing the profitability of domestic and foreign commercial banks in the European Union", *Reseacrh in International Business and Finance*, Vol. 21, pp. 222-237.

Potrafke, N. (2015), "The evidence on globalisation", *The World Economy*, Vol. 38, pp. 509-552.

Rao, B. and Vadlamannati, K.C. (2011), "Globalization and growth in the low income African countries with the extreme bounds analysis", *Economic Modelling*, Vol. 28, pp. 795-805.

Rehman, A.A., Benamraoui, A. and Dad, A.M. (2017), "A comparative study of Islamic and conventional banks' risk management practices: empirical evidence from Pakistan", *Journal of Banking Regulation*, Vol. 19 No. 3, pp. 222-235.

Rodoni, A., Salim, M., Amalia, E. and Rakhmadi, R. (2017), "Comparing effeciency and productivity in Islamic banking: case study in Indonesia, Malaysia and Pakistan", *Journal of Islamic Economics*, Vol. 9 No. 2, pp. 227-242.

Roe, M. and Siegel, J. (2011), "Political instability: effects on financial development, roots in the severity of economic inequality", *Journal of Comparative Economics*, Vol. 39 No. 3, pp. 279-309.

Rosman, R., Wahab, N.A. and Zainol, Z. (2014), "Efficiency of Islamic bank during the financial crisis: an analysis of Middle Eastern and Asian countries", *Pacific-Basin Finance Journal*, Vol. 28, pp. 76-90.

Said, A. (2013), "Risks and efficiency in the Islamic banking systems: the case of selected Islamic banks in MENA region", *International Journal of Economics and Financial Issues*, Vol. 3 No. 1, pp. 66-73.

Salim, R., Arjomandi, A. and Dakpo, K. (2017), "Banks' efficiency and credit risk analysis using by production approach: the case of Iranian banks", *Applied Economics*, Vol. 49 No. 30, pp. 2974-2988.

Schumacher, I. (2013), "Political stability, corruption and trust in politicians", *Economic Modelling*, Vol. 31, pp. 359-369.

Schumacher, R. (2020), "Altering the pattern of trade in the wealth of nations: Adam smith and the historiography of international trade theory", *Journal of the History of Economic Thought*, Vol. 42 No. 1, pp. 19-42.

Shaw, M. (2000), *Theory of the Global State*, Cmbridge University Press, Cambridge.

Shawtari, F.A., Ariff, M. and Razak, S.A. (2015), "Efficiency assessment of banking sector in Yemen using data envelopment window analysis: a comparative analysis of Islamic and conventional banks", *Benchmarking: An International Journal*, Vol. 22 No. 6, pp. 1115-1140.

Slager, A. (2005), *Internationalization of Banks: Strategic Patterns and Performance*, SUERF, Vienna.

Stanley, L. (2018), "Financial globalization, institutions and growth", in Stanley, L., Gallagher, K. and Ghosh, J. (Eds), *Emerging Market Economies and Financial Globalization*, Anthem Press, New York, pp. 63-86.

Steger, M. and Wahlrab, A. (2016), *What Is Global Studies?: Theory and Practice*, Routledge, New York, NY.

Sufian, F. (2009), "Assesing the impact of mergers and acquisitions on bank profit efficiency", *International Journal Decision Sciences*, Vol. 1 Nos 3/4, pp. 258-285.

Sufian, F. (2012), "For which option is credit risk more representative on China banks' total factor productivity: efficiency change or technological progress?", *China Finance Review International*, Vol. 2 No. 2, pp. 180-202.

Sufian, F. (2016), "Financial crisis, exchange rate regimes, organizational forms, and bank efficiency: does globalization matter?", *Emerging Economy Studies*, Vol. 2 No. 1, pp. 27-71.

Sufian, F. and Habibullah, M.S. (2014), "Banks' total factor productivity growth in a developing economy: does globalisation matter?", *Journal of International Development*, Vol. 26, pp. 821-852.

Sufian, F. and Kamarudin, F. (2014a), "Efficiency and returns to scale in the Bangladesh banking sector: empirical evidence from the slack-based DEA method", *Engineering Economics*, Vol. 25 No. 5, pp. 549-557.

Sufian, F. and Kamarudin, F. (2014b), "The impact of ownership structure on bank productivity and efficiency: evidence from semi-parametric malmquist productivity index", *Cogent Economics and Finance*, Vol. 2 No. 1, pp. 1-27.

Sufian, F. and Kamarudin, F. (2016), "The impact of globalization on the performance of Banks in South Africa", *Review of International Business and Strategy*, Vol. 26 No. 4, pp. 517-542.

Sufian, F. and Kamarudin, F. (2017), "Forced mergers on bank efficiency and productivity: evidence from semi-parametric malmquist productivity index", *Global Business Review*, Vol. 18 No. 1, pp. 19-44.

Sufian, F. and Majid, M.-Z.A. (2009), "Post-crisis productivity change in non-bank financial institutions: efficiency increase or technological progress?", *Journal of Transnational Management*, Vol. 14 No. 2, pp. 124-154.

Sufian, F., Kamarudin, F. and Nassir, M.A. (2017), "Globalization and bank efficiency nexus: empirical evidence from the Malaysian banking sector", *Benchmarking: An International Journal*, Vol. 24 No. 5, pp. 1-8.

The Asian Banker (2021), *The Largest Banks Rankings*, The Asian Banker, available at: https://www.theasianbanker.com/ab500/2018-2019/largest-islamic-banks-2019.

Toumi, K., Louhichi, W. and Vivian, J.-L. (2012), "Alternative financial decision principles: theoretical foundations of Islamic banks' capital structure", in Barnett, W. and Jawadi, F. (Eds), *Recent Developments in Alternative Finance: Empirical Assessments and Economic Implications (International Symposia in Economic Theory and Econometrics*, Emerald Group Publishing, pp. 157-172.

Wang, J., Liu, X., Wei, Y. and Wang, C. (2014), "Cultural proximity and local firms' catch up with multinational enterprises", *World Development*, Vol. 60, pp. 1-13.

Wanke, P., Azad, M., Barros, C.P. and Hassan, M. (2016), "Predicting efficiency in Islamic banks: an integrated multicriteria decision making (MCDM) approach", *Journal of International Financial Markets, Institutions and Money*, Vol. 45, pp. 126-141.

Wengel, J.T. (1995), "International trade in banking services", *Journal of International Money and Finance*, Vol. 14 No. 1, pp. 47-64.

World Bank (2001), *Private Sector Development Strategy Directions for the World Bank Group*, World Bank, Wahington, DC.

Wu, J., Chen, M., Jeon, B. and Wang, R. (2017), "Does foreign bank penetration affect the risk of domestic banks? Evidence from emerging economies", *Journal of Financial Stability*, Vol. 31 No. C, pp. 45-61.

Ye, Q., Xu, Z. and Fang, D. (2012), "Market structure, performance, and efficiency of the Chinese banking sector", *Economic Change and Restructuring*, Vol. 45, pp. 337-358.

Zins, A. and Weill, L. (2017), "Islamic banking and risk: the impact of Basel II", *Economic Modelling*, Vol. 64, pp. 626-637.

Appendix
The Appendix files are available online for this article.

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