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DOES ELECTRONIC PAYMENT SERVICES CREATE VALUE TO BANK PERFORMANCE? EVIDENCE FROM SOUTHEAST ASIA

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ABSTRACT

This study examines the nexus between four electronic payment channels' transaction values and bank performance of Malaysia, Singapore and Thailand for 2010–2020. We find that, the impact of credit and charge card's transaction value on banks' return on equity (ROE) is significantly positive across various econometric specifications, including firm fixed effect panel regression, two-way clustering method and generalised method of moment. Instead, the impacts of the other three payment channels (e-money, debit card and internet and mobile banking) are negative but not significance across all econometric specification. These suggest that only the credit and charge card is economically relevant to the banks' shareholders. We further add that only credit and charge card significantly improves banks' operating income, while all four payment channels are not significantly related to revenue growth of the banks. In the additional analysis, we find that e-money, debit card, internet and mobile banking are negatively influencing the relationship between banks' operating income and ROE. In summary, our study implies that majority of the electronic payment services offered by banks are not economically sustainable in the long run.

Keywords: Banks, performance, digital, cashless, payment

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INTRODUCTION

Over the past decade, banking sector has been revolutionised by the information technology. Innovative financial services using information technology (IT) gives to the prevalence of electronic payment in today. Various innovative electronic payment services available today include credit card, debit card, e-money, mobile banking and internet banking. Although digital transaction system enhances stability to banking system through digital financial inclusion (Banna & Alam, 2021); however, market competition in banking sector instead increases as new players come into the industry (OECD, 2020). The trade-off between cost and benefit leading to the long-term banks' performance is an unknown, and this is an important empirical issue of research.

Electronic payment is a form of financial exchange between buyer and seller that is facilitated through electronic channels. While technology can bring higher efficiency to customer services (Kurnia et al., 2010), integrating technology into banking transaction system, for example, via QR code payment, provides much convenience to consumers (Lim, 2019). Hence, digitalising banking services not only lower bank's operating cost, but it also increases transparency and speed of transaction, which enhances the user experience. However, the bad side is that more intense market competition between banks is emerged when the technologies were matured and common to all banks. With that, the added value of using the online banking system becomes less significant, and what is the effect to bank performance in the long run is yet to be fully explored in banking literature. Therefore, this study fills the research gap by examining the relationship between transaction values of various electronic payments and bank performance over the last decade (2010–2020).

The technology and infrastructure of electronic payment system in developed countries have been well-established compared to developing countries. In literature, there are many studies examining the impacts of implementing electronic payment on bank's performances using the sample from developed economies such as the U.S. and Europe countries. However, limited empirical evidence was provided based on the banks in developing countries. The research gap between developed countries and developing countries was highlighted in Gao and Owolabi (2008). To the best of our knowledge, among the limited studies in the scope of Southeast Asia, the attention is put on the issues of adoption (e.g., Poon, 2008; Huam et al., 2008; Garry et al., 2010; Taasim & Yusoff, 2017), challenges (e.g., Sulaiman et al., 2005; Chai, 2006) as well as the advantages and disadvantages of the electronic payments (e.g., Kadar et al., 2018).

The past studies based on developing countries' sample are less focusing on the impact of electronic payment towards bank performances. Yet, summarising the findings of the past studies based on developed countries' sample, inconclusive findings were shown, where a strand of studies documented positive impact of electronic payment on bank's performances (DeYoung et al., 2007; Dandapani et al., 2008; Kurnia et al., 2010; Aduda & Kingoo, 2012; Onay & Ozsoc, 2013, Tunay et al., 2015; Yang et al., 2018) while another strand of studies documented negative impact of electronic payment on bank's performances (Hernando & Nieto, 2007; Malhotra & Singh, 2009; Alber, 2011; Onay & Ozsoc, 2013; Itah & Emmanuel, 2014; Kamboh & Leghari, 2016).

Instead of keeping focus on developed versus developing countries, this study tends to provide a general finding based on the lump-sum sample comprising of developed and developing countries. Therefore, we focus on banks in Southeast Asia including Singapore, Malaysia and Thailand. Different with the Western countries, Southeast Asia exhibits shorter history of digital banking development. Along the way of promoting various digital transaction systems in those countries, the banks may have to bear the financial costs of adopting multiple transaction systems in order to satisfy the customers' heterogenous demand before a centralised digital banking system was established. The bank performance become one of the critical issues in maintaining the sustainability of digital banking development.

In fact, various efforts were put by the government of the countries along the development of digital banking system. In Malaysia, the federal bank namely Bank Negara Malaysia (BNM) has taken various steps to increase usage of electronic payments with the aim to move towards forming a cashless society. The Monetary Authority of Singapore (MAS) is also undergoing an evolution in payment ecosystem towards accomplishing Smart Nation Vision. Bank of Thailand (BOT) aims to transform Thailand into Digital Thailand through leveraging its well-developed digital technologies and infrastructure. In these countries, due to market liberalisation policies, many non-bank fintech companies provide electronic payment services (Grab Holdings Inc., Sea Ltd., Ant Group Co. Ltd., Singtel etc.) in competing with the conventional banks. This brings more intensified competition to the banking industry. Therefore, the conventional banks are no longer the only institution providing payment services in the countries. With that, raising the volume of electronic payment transaction values become the winning strategy for the banks. Yet, literature has limited evidence showing the impact of each channel of electronic payment's transaction values on bank performance in Southeast Asia region.

The findings of this study shed light on the issue discussed above as Malaysia, Singapore and Thailand are on their way to digital society. This is to gauge whether the banks can improve their short-term and long-term performances from the electronic payments offered. In addition, the empirical findings are important for banks to better formulate their strategies as well as for policy makers to set electronic payment policies appropriately. Therefore, to enlarge the body of knowledge in the related literature, this paper aims to examine the nexus between aggregate level of transaction values by each electronic payments and bank performance measured by return on equity (ROE). Besides, we further examine how the electronic payments' transaction values affect operational performance of the banks. We use the proxy of revenue growth and operating income of the banks to measure their operational performance. In summary, we find that only credit and charge card's transaction values show consistent significant positive effect on ROE across the three econometric specifications (pooled OLS fixed effect, two-way clustering regression and generalized method of moment), while the other electronic payments' transaction values show unstably negative effect on ROE across the three econometric specifications. In the additional test, we show that increasing transaction values of e-money, debit card and internet and mobile banking significantly reduce the positive effect of operating income and ROE.

LITERATURE REVIEW

Theoretical Review on Technology Innovation and Bank Performance

The concept of innovation can be studied from the evolutionary and resource-based perspective. The evolutionary perspective originated from the Theory of Economic Development (Schumpeter, 1934) which is macro-level analysis. On the other hand, resource-based perspective was originated from the Theory of the Growth of the Firm (Penrose, 1959) which being micro-level analysis.

From the evolutionary perspective, the Schumpeter's Theory of Innovation claimed that innovation is the driver behind economic development, which encourage industrial transformation and structural changes in the economy (Schumpeter, 1934). Innovation will create a new business to replace an existing process and the rise of new products as suggested by the A-U model (the Abernathy-Utterback model). The A-U model, which was developed by Abernathy and Utterback (1978), expanded Schumpeter's theory of innovation. This model suggests that firm focus on product innovation in the early stage and technology innovation in the transition stage. When the development is at a stable stage, the firm's primary focus will be on incremental product and technological innovation

as it grows and prospers. In Southeast Asia as illustrated by Singapore's Smart Nation and Committee for the Future Economy initiatives, Malaysia' launch of digital free trade zone and vision for Industry 4.0 transformation and Thailand 4.0 initiatives give priority to the technological transformation development (Mitra, 2018). The diffusion of ICT technologies has fostered the expansion of e-commerce, banking, finance and payment systems. This forced bank to change the way providing financial products and services in this modern era to survive in the highly competitive market (El-Chaarani & El Abiad, 2018). Sujud and Hachem (2017) revealed that bank innovation positively affects bank's profitability and return on assets (ROA).

Meanwhile, the resource-based perspective argue that organisation develops sustainable competitive advantage through a set of unique resources (Barney, 1991; Foss, 1997). Penrose (1959) demonstrates that "services" provided are determined by the "pool of resources" and innovation of the organisation. Ross et al. (1996) argued that the human asset, technology asset and relationship asset play major role in developing a firm's long-term competitive advantage. Mata et al. (1995) explained that IT skills serve as sources of sustained competitive advantage of a firm due to this skill is rare and firm specific. A bank can position themselves on the basis of IT resources. Bank are investing heavily in electronic payment technology to claim a share in this market. Application of technology that modernise payment system enhances customer's experience, improve bank's effectiveness and efficiency. Adhitya and Sembel (2020) found that technology adoption strengthens bank's financial performance and increase bank's competitiveness. Kinyanzui et al. (2018) argued that acceptance of technology is one of the major strategies of bank to enhance operational efficiency. Technological innovation creates competitive advantage (Hobe & Alas, 2016) by improving bank's performance, attracting new customers and provides financial products and services that meet needs and wants of customers. This is corroborated with studies such as Abualloush et al. (2017) and Kołodziej (2017) that demonstrates vital role of innovation in generating competitive advantage and improving the effectiveness of banking activity.

Empirical Review on Electronic Payment and Bank Performance

The impact of technology on electronic payment is profound. Electronic payment increased efficiency and effectiveness of a nation's payment system by providing cost savings to the economy and stimulates economic growth (Wong et al., 2020). The adoption of electronic payment has affected bank's performance as it is the payment providers for a nation.

The technology-based products make banks more competitive by increase productivity, reduced transactions costs and improved customer service which in turn improved bank's performances. Study such as De Young et al. (2007) found that the adoption of internet banking has improved the U.S. bank's profitability in terms of ROA and return on equity (ROE). This is supported by study of Gündoğdu and Taşkın (2017) and Onay and Ozsoz (2013) who examined that the electronic payment had positive impact on ROA, ROE and NIM of banks in Turkey. To provide electronic banking services, banks spend huge capital to develop the system by invest in technology equipment, hire information technology experts, and provide training to employees to deal with electronic banking. This has increased sharply bank's operating costs, particularly during the initial stage of electronic banking implementation. Despite the high expenditure on the information technology investment, banks are able to generate comparatively income to overcome high expenses. Hernando and Nieto (2007) demonstrated that Spanish banks realised profit after three years adopted internet banking. The bank's ROA and ROE has obviously increase compared to banks who do not provide internet banking service. The consistent findings also documented by Ardizizi et al. (2019) for Italian Banks.

On the other hand, the consistent results can be found in studies in some developing countries. Itah and Emmanuel (2014) and Akara and Asekome (2018) examined the impact of electronic banking in Nigeria. They found that electronic banking improved ROA and ROE of commercial bank in long run after the system of electronic banking is well-developed with the improvement of service delivery (Adewoye, 2013), cost effectiveness and wider coverage of electronic payment channels (Mustapha, 2018). Besides that, Rauf and Qiang (2014) and Kamboh and Leghari (2016) also showed that electronic payment such as mobile banking has significantly improved the ROA and ROE of banks in Pakistan. Alber (2011) also found consistent results for Saudi banks. The expenditure of banks offering these electronic banking goes down with increasing revenue that improved the bank's performance in Kenya (Aduda & Kingoo, 2012) and Lebanese (El-Chaarani & El Abiad, 2018). Yang et al. (2018) indicated that the electronic banking generated better profitability and efficiency performance in the developed stage compared to developing stage of electronic banking in China.

Despite the perceived benefits of information technology application on payment system, the developing countries are still lag behind developed countries. Simpson (2002) examined that the internet banking generates higher revenue to banks in the U.S. compared to banking organisation in developing countries due to the strong information technology framework in the U.S. The transaction cost performed at the bank branch reduced when the same transaction performed

through web (Akhisar et. al., 2015). Dinh et al. (2015) found that although the adoption of digital channel reduces operating costs, however, the income generated is relatively small. Meanwhile, Hosein (2013) and Gutu (2014) revealed that the high cost of the electronic payment infrastructure and limited number of customers has adversely affected bank's performance in developing countries. This is consistent with study of Khrawish and Al-Sa'di (2011) that showed contradict results in Jordan. They explained that due to the high cost associated with electronic banking services, the adaptation does not have impact on bank's profitability. Malhotra and Singh (2009) also showed that internet banking has no significant impact on Indian bank's profitability, but it has negative impact of bank's risk profile. Yang et al. (2009) indicated bank facing new challenges, the issues such as competition and risk management are the limitations of the electronic banking adoption. Chen et al. (2019) described that the development of non-bank institutions such as Alibaba Ant Financial and Tencent, the internet finance giant in China, that offered similar financial products particularly third-party payment has negatively affect bank's profitability. This ecosystem has created more risks to bank.

Hypotheses Development

Although studies such as De Young et al. (2007), Hernando and Nieto (2007), Onay and Ozsoz (2013) and Gündoğdu and Taşkın (2017) showed evidence that electronic banking services improved the performance of banks in developed countries, some studies (Khrawish & Al-Sa'di, 2011; Hosein, 2013; Gutu, 2014; Chen et al., 2019) showed contradictory findings in developing countries. But, Itah and Emmanuel (2014) and Akara and Asekome (2018) argue that the improvement of ROE can realised after the systems are well-developed in developing countries. Based on the research gap, we expect that electronic payments could enhance a bank's ROE. Therefore, we hypothesised that:

> H1: E-money, credit and charge card, debit card, internet and mobile banking are positively related to the banks' ROE.

Simpson (2002), Aduda and Kingoo (2012) and El-Chaarani and El Abiad (2018) found that electronic payments can enhance a bank's revenue, but these studies were conducted on non-Asian bank sample. Based on the research gap, we expect that electronic payments could enhance a bank's revenue growth. Therefore, we hypothesised that:

> H2: E-money, credit and charge card, debit card, internet and mobile banking are positively related to the banks' revenue growth.

Hobe and Alas (2016), Abualloush et al. (2017), Kołodziej (2017) and Kinyanzui et al. (2018) argued that technology innovation can enhance operational efficiency of a firm, however, there is a scarcity of banking studies that demonstrate how electronic payments can improve a bank's operational efficiency. Based on the research gap, we expect that electronic payments could enhance a bank's operating income. Therefore, we hypothesised that:

H3: E-money, credit and charge card, debit card, internet and mobile banking are positively related to the banks' operating income.

RESEARCH METHODOLOGY

Data Sources

The sample banks of this study are the local banks in Malaysia, Singapore and Thailand consists as shown in Table 1. Banks plays dominant role in payment services in Malaysia, Singapore and Thailand (S&P Global Market Intelligence, 2021). The banks' financial data are obtained from Datastream, including their net income, total assets, total equity, total interest income, total operating costs, total operating revenue, provision of loan losses and total loan. The data are collected for the period between 2010 to 2020. The data for the statistics of total transaction value of electronic payments are gathered from the central bank of Malaysia, Singapore and Thailand.

The study has excluded the Philippines and Indonesia due to non-banks have overtaken banks as primary payment providers in these countries (S&P Global Market Intelligence, 2021). While the reason for not including Cambodia in the study was due to limited of the data for analysis.

Table 1
List of local banks in Malaysia, Singapore and Thailand with their market capitalisation in local currency

Country	Banks	Market capitalisation
Malaysia	Malayan Banking Berhad	RM17,200,000
	Public Bank Berhad	RM13,000,000
	CIMB Group Holding Berhad	RM10,300,000
	RHB Bank Berhad	RM225,913
	Affin Bank Berhad	RM977,606
	AMMB Holdings Berhad	RM3,248,478
	BIMB Holdings Berhad	RM906,944
	Hong Leong Bank Berhad	RM4,831,559
	Alliance Bank Malaysia Berhad	RM1,174,738
Singapore	Oversea-Chinese Banking Corporation, Limited	SGD21,400,000
	United Overseas Bank	SGD20,600,000
	DBS Group Holdings	SGD26,100,000
Thailand	Kasikornbank PCL	THB8,084,552
	Siam Commercial Bank	THB8,820,212
	Bangkok Bank PCL	THB7,245,436
	Bank of Ayudhya PCL	THB4,372,377
	Krung Thai Bank PCL	THB5,137,673
	CIMB Thai Bank PCL	THB765,689
	Kiatnakin Phatra Bank PCL	THB807,031
	Thanachart Capital PCL	THB990,135
	TMB Bank PCL	THB2,176,892

Control Variables

$BankSize_{it}$ indicates bank size that is measured by the natural logarithm of total assets of bank *i* at year *t* in this study. According to the past studies, for example, Athanasoglous et al. (2005) revealed that the impact of bank's expanding size on profitability has been shown positive, but Aladwan (2015) revealed that the effect of bank size on profitability is negative. Hence, we expect bank size has a significant effect on ROE but the direction of the effect is undetermined.

NPL-to-Loans$_{it}$ indicates credit risk that is measured by total non-performing-loans divided by total loans of bank *i* at year *t* in this study. As increasing credit risk reduces bank profitability (Lepetit et al., 2008; Abdul Rahman, 2011; Samad, 2015), we expect the effect of *NPL-to-Loans*$_{it}$ is significantly negative.

Debt-to-Capital$_{it}$ indicates capital structure that is measured by total debt divided by total capital of bank *i* at year *t* in this study. Higher the debt-to-capital ratio, bank expose to higher risk as the bank is funded by debt more than equity. Pratheepkanth (2011) found negative relationship between capital structure and bank performance. However, Birru (2016) presented that debt-to-capital has direct positive impact on firm performance. We expect *Debt-to-Capital*$_{it}$ has a significant effect on ROE, but the direction of the effect is undetermined.

Loans-to-Assets$_{it}$ indicates liquidity risk that is measured by total loans divided by total assets bank *i* at year *t* in this study. The higher the ratio indicates a bank is loaned up and lower liquidity. Mikhan and Jain (2007) showed that higher loans-to-assets ratio, the riskier is the bank due to higher probability of defaults. Hence, we expect the effect of *Loans-to-Assets*$_{it}$ has a significant positive effect on ROE.

ForeignStrategic$_{it}$ indicates foreign strategic shareholdings (at least 5% shareholdings) of bank *i* at year *t*. Ownership structure is shown has an effect on bank performance (Beck et al., 2013; Dietrich & Wanzenried, 2011). Micco et al. (2007) and Hapsari and Rokhim (2017) found that bank with foreign ownership is associated with an increase in the performance of bank. Bank with foreign ownership enhances human capital, invest heavily in technology and product innovation improves bank's profitability and efficiency. However, Mamatzakis et al. (2017) showed that foreign ownership is negatively related to bank performance. Hence, we expect *ForeignStrategic*$_{it}$ has a significant positive effect on ROE but the direction of the effect is undetermined.

GovStrategic$_{it}$ indicates government strategic shareholdings (at least 5% shareholdings of bank *i* at year *t*. The previous study by Lin and Zhang (2009) and Ashraf (2017) found that bank with government ownership exhibits poorer performance due to weak managerial. However, Faccio et al (2006) found that government ownership bank is performed better as they beneficial of either implicit or explicit regulatory support from authority. Hence, we expect *GovStrategic*$_{it}$ has a significant positive effect on ROE but the direction of the effect is undetermined.

Model Specification

Equation 1 examines the impact of the four electronic payments' transaction value on the banks' ROE, by controlling the banks' fundamental variables and ownership structure. Equation 1 is to examine hypothesis 1 of the study.

$$ROE_{it} = \alpha + Xs_{it} + D_{it} + \varepsilon_{it} \quad (1)$$

where Xs_{it} are the control variables including bank size ($BankSize_{it}$), NPL-to-total loans ($NPL\text{-}to\text{-}Loans_{it}$), debt-to-capital ($Debt\text{-}to\text{-}Capital_{it}$), loans-to-assets ($Loans\text{-}to\text{-}Assets_{it}$), foreign strategic shareholdings ($ForeignStrategic_{it}$) and government strategic shareholdings ($GovStrategic_{it}$,), year and firm dummy variables. D_{it} includes the independent variables, which are $EMoney_{it}$, $CreditCharge_{it}$, $DebitCard_{it}$, and $InternetMobile_{it}$, which represent the total national transaction value for respective electronic payments, i.e., e-money, credit and charge card, debit card, internet and mobile banking. These variables are country aggregate data. The total transaction value of these electronic payments is transformed to natural logarithm of bank *i* at year *t* in this study. E-money is defined as the monetary value instrument that the user has paid in advance to use for the purchase of goods and services. Credit and charge card is a type of payment card that allows card holder to use the credit with the credit line given and the amount will be settled in future or by the due date. Debit card is a type of payment card that the transaction amount is linked to the holder's bank account. Internet and mobile banking is the monetary value instrument that allows users to performed banking transactions through a web browser (internet banking) and mobile phone (mobile banking).

We further construct Equations 2 and 3 to examine the respective H2 and H3. For Equation 2, the dependent variable is $RevGrowth_{it}$, which is measured by 1-year revenue growth of bank *i* at year *t*. For Equation 3, the dependent variable is $OperatingIncome_{it}$, which is measured by revenue minus operating expenses, indicates operating income of bank *i* at year *t*, downloaded from Datastream. Xs_{it} is the control variables including $BankSize_{it}$, $NPL\text{-}to\text{-}Loans_{it}$. $Debt\text{-}to\text{-}Capital_{it}$, $Loans\text{-}to\text{-}Assets_{it}$, $ForeignStrategic_{it}$, $GovStrategic_{it}$, year dummies and cross-sectional dummy variables. In Equation 3, the dependent variable is $OperatingIncome_{it}$, which is measured by taking natural logarithm of the operating income of bank *i* at year *t*. Xs_{it} is the control variables including $BankSize_{it}$, $NPL\text{-}to\text{-}Loans_{it}$. $Debt\text{-}to\text{-}Capital_{it}$, $Loans\text{-}to\text{-}Assets_{it}$, $ForeignStrategic_{it}$, $GovStrategic_{it}$, year dummies and cross-sectional dummy variables.

$$RevGrowth_{it} = \alpha + Xs_{it} + \varepsilon_{it} \quad (2)$$

$$OperatingIncome_{it} = \alpha + Xs_{it} + \varepsilon_{it} \quad (3)$$

RESULTS AND DISCUSSIONS

Descriptive Statistics

Table 2 presents the descriptive statistics of all variables used in this study. The mean of ROE_{it} is –0.0138, and the range of the variable falls between –9.9348 and 0.5181. The statistics indicate that the average bank performance is not satisfied. The mean of $BankSize_{it}$ is 15.2223, with the standard deviation of 1.2490, with the total assets of Malaysian banks in average is RM44.7 million (equivalent to USD10.7 million), SGD209 million (equivalent to USD154.7 million) for Singapore banks, THB33.1 million (equivalent to USD0.99 million) for Thailand banks (equivalent to USD The mean of $NPL\text{-}to\text{-}Loans_{it}$ is 5.5467, and its' minimum and maximum value is 5.1860 and 22.8000, where the average non-performing loans for Malaysian banks is RM95.6 million (equivalent to USD22.9 million), USD223 million (equivalent to USD165 million) for Singapore banks and THB129 million (equivalent to USD3.9 million) for Thailand banks, while the average total loans is RM30.8 million (equivalent to USD7.4 million), SGD138 million (equivalent to USD102.1 million) for Singapore banks and THB27 million (equivalent to USD0.81 million) for Thailand banks. The mean of the $Loans\text{-}to\text{-}Assets_{it}$ is 75.4803, and range of the variable is 87.2291. The mean of $Debt\text{-}to\text{-}Capital_{it}$ is 54.3563, with the standard deviation of 16.0077. The average total debt is RM5.6 million (equivalent to USD1.35 million) for Malaysian banks, SGD25.7 million (equivalent to USD19 million) for Singapore banks and THB3.65 million (equivalent to USD0.11 million) for Thailand banks. Instead, the average total capital is RM6.05 million (equivalent to USD1.45 million) for Malaysian banks, SGD27.6 million (equivalent to USD20.4 million) for Singapore banks and THB4.89 million (equivalent to USD0.15 million) for Thailand banks. The mean of the $RevGrowth_{it}$ is 0.0934 and the mean of the $OperatingProfit_{it}$ is 12.6272. The average operating income is approximately RM0.66 million (equivalent to USD0.16 million) for Malaysian banks, SGD19.8 million (USD14.7 million) for Singapore banks and THB0.53 million (equivalent to USD0.02 million) for Thailand banks. Among the sample, the mean of $ForeignStrategic_{it}$ is 0.2802 and the mean of the $GovStrategic_{it}$ is 0.6204, which indicate that government strategic holdings in the Asian banks are more prevalence than foreign strategic holdings. Over the four electronic payment channels, the mean of the transaction values of $EMoney_{it}$, $CreditCharge_{it}$, $DebitCard_{it}$ and $InternetMobile_{it}$, are 2.9153 billion, 3.6319 billion, 1.6524 billion, 6.7111 billion, respectively.

Table 3 presents the correlations of the variables. $BankSize_{it}$ and $OperatingIncome_{it}$ are correlated at 0.4913, which indicates that larger banks earn higher operating income. However, $BankSize_{it}$ is negatively correlated with

$RevGrowth_{it}$, and this is logic because of meeting saturated market shares. We observe that the four electronic payments are negatively correlated with ROE_{it}, i.e., –0.4474, –0.2714, –0.2597 and –0.2284.

Table 2
Descriptive statistics of the variables

Variable	Obs	Mean	S.D.	Min	Max
ROE_{it}	274	–0.0138	1.0916	–9.9348	0.5181
$BankSize_{it}$	274	15.2223	1.2490	12.1290	17.7866
$NPL\text{-}to\text{-}Loans_{it}$	274	5.5467	5.1860	0.0100	22.8000
$Debt\text{-}to\text{-}Capital_{it}$	274	54.3563	16.0077	0.0300	89.9300
$Loans\text{-}to\text{-}Assets_{it}$	274	75.4803	9.9309	35.3900	97.1600
$ForeignStrategic_{it}$	274	0.2802	0.1355	0.0000	0.9500
$GovStrategic_{it}$	274	0.6204	0.1475	0.0000	0.7900
$RevGrowth_{it}$	274	0.0934	0.1921	–0.7736	1.1928
$OperatingIncome_{it}$	274	12.6272	1.2892	7.9889	15.2390
$EMoney_{it}$	274	2.9153	2.5805	0.0000	9.5812
$CreditCharge_{it}$	274	3.6319	0.2178	3.1657	4.0734
$DebitCard_{it}$	274	1.6524	0.7976	–0.0756	3.3869
$InternetMobile_{it}$	274	6.7111	0.8181	3.3320	7.6810

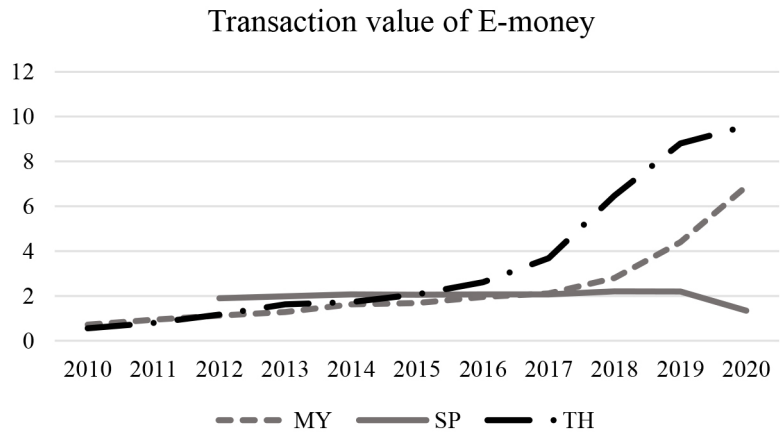

Figure 1: Transaction value of e-money for Malaysia, Singapore and Thailand
Sources: Bank Negara Malaysia, Monetary of Singapore and Bank of Thailand

Table 3
Correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. ROE_{it}	1.0000												
2. $BankSize_{it}$	0.0254	1.0000											
3. $NPL\text{-}to\text{-}Loans_{it}$	–0.3617	–0.1063	1.0000										
4. $Debt\text{-}to\text{-}Capital_{it}$	0.1551	–0.3287	0.1904	1.0000									
5. $Loans\text{-}to\text{-}Assets_{it}$	0.0625	–0.0234	0.1471	0.2916	1.0000								
6. $ForeignStrategic_{it}$	–0.3075	–0.2570	0.0249	0.1749	0.0329	1.0000							
7. $GovStrategic_{it}$	0.0687	–0.0323	–0.1432	–0.1037	–0.5775	–0.0589	1.0000						
8. $RevGrowth_{it}$	0.2589	–0.1560	0.0938	0.2945	0.033	0.0352	0.0264	1.0000					
9. Operating $Income_{it}$	0.3422	0.4913	–0.1551	–0.3430	–0.0269	–0.4073	0.0788	–0.0439	1.0000				
10. $EMoney_{it}$	–0.4474	0.1885	0.0740	–0.3307	0.1743	0.0996	–0.1443	–0.3073	0.0553	1.0000			
11. $CreditCharge_{it}$	–0.2714	0.1625	0.0166	–0.2638	0.2395	0.1057	–0.2199	–0.3582	0.0774	0.7256	1.0000		
12. $DebitCard_{it}$	–0.2597	0.2611	–0.2316	–0.3036	–0.0798	0.0249	0.0442	–0.3676	0.1569	0.4801	0.4582	1.0000	
13. $InternetMobile_{it}$	–0.2284	0.2645	–0.3154	–0.354	–0.2115	–0.0186	0.1691	–0.4560	0.1717	0.6590	0.5400	0.4120	1.0000

Figure 1 shows the transaction values of e-money for Malaysia, Singapore and Thailand. For Thailand, prior to 2016, the transaction values of e-money increase gradually over the years. In the period between 2016 and 2019, the transaction values rise exponentially, from USD2.61 billion to USD9.58 billion. In 2020, the increment shows the sign of slowing down. However, for Malaysia, prior to 2017, the transaction values of e-money rise slowly. Until thereafter, the value increases exponentially, from USD 2.11 billion to USD 6.88 billion. Instead, for Singapore, the transaction values of e-money do not show a clear pattern over the sample period. Even, while Thailand and Malaysia exhibit increasing e-money transaction value, Singapore shows a relatively plausible decrease in the transaction value. Thailand has the highest record in the transaction value, followed by Malaysia and Singapore. According to the study of S&P Global Market Intelligence (2021), the developing of modernised instant interbank payment scheme tends to hurt e-money. The interbank transfer support retail payments with Quick-Response codes and instant transfer allows it to compete with e-money. This makes e-money growth slowing in Thailand and stagnation in Singapore. In Malaysia, e-money remained unaffected, part of the reason is because government using e-money to disburse stimulus package to support economic vulnerable groups that affected by COVID-19 pandemic.

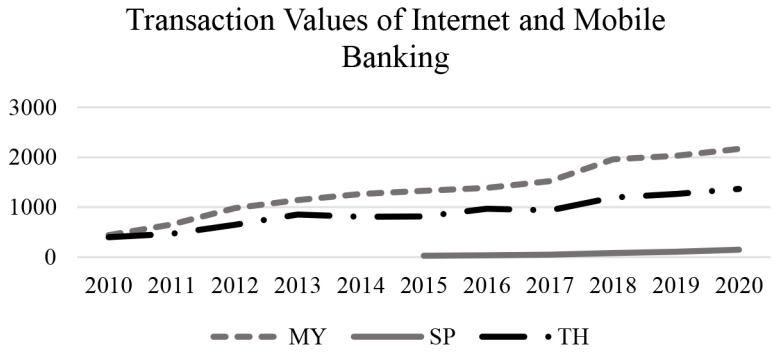

Figure 2: Transaction value of internet and mobile banking for Malaysia, Singapore and Thailand

Sources: Bank Negara Malaysia, Monetary of Singapore and Bank of Thailand

Figure 2 shows the transaction values of internet and mobile banking for Malaysia, Singapore and Thailand. Malaysia and Thailand exhibit a plausible incremental trend over the sample period. The transaction values of both countries start to deviate since 2010, where Malaysian transaction values (maximum is approximately USD2,166 billion) go beyond Thailand (maximum is approximately USD1,366 billion). Instead, Singapore's transaction values of internet and mobile banking are merely approximately USD149 billion at the maximum, far behind Malaysia

and Thailand. Although Singapore has highest banked population, access to smartphone and wireless broadband rates in Southeast Asia, but the utilisation of Internet and mobile banking remains relatively low. The possible reason may be due to the preference of Singaporean in using contactless card as it is convenience, speed and wide acceptance as showed in survey by KPMG (2016).

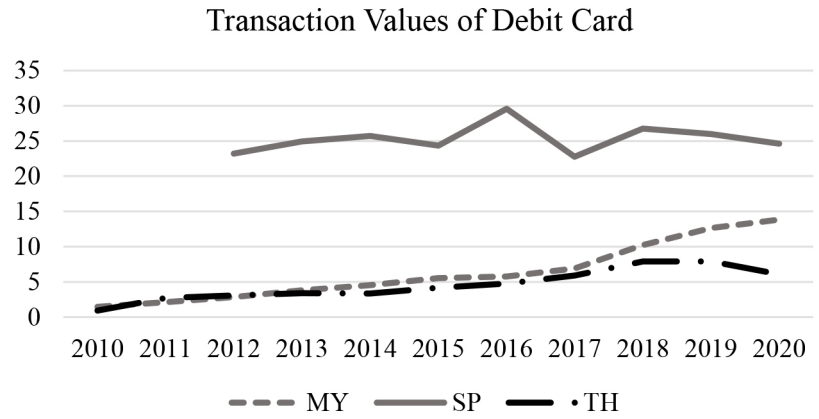

Figure 3: Transaction value of debit card for Malaysia, Singapore and Thailand
Sources: Bank Negara Malaysia, Monetary of Singapore and Bank of Thailand

Figure 3 shows the transaction values of debit card for Malaysia, Singapore and Thailand. Interestingly, Singapore shows the highest transaction values of debit card compared to Malaysia and Thailand, of which the values of Singapore range between USD23 billion to USD29 billion, whereas the highest values of Malaysia and Thailand are only USD13 billion and USD7.9 billion. Nonetheless, the transaction values of debit card for Singapore do not show a clear pattern over the sample period. Comparatively, Malaysia and Thailand show slow incremental trends over the sample period, particularly Malaysia that exhibits a significant increment since 2017. This probably due to Bank Negara Malaysia (BNM) required bank to replaced ATM card as debit card to allow cardholder to make purchases at POS terminal in 2017 (BNM, 2016).

Figure 4 shows the transaction values of credit and charge card for Malaysia, Singapore and Thailand. The transaction values of credit and charge card over the sample period display incremental trends for Singapore, Malaysia and Thailand, of which the trends are consistent across the three countries. There is a noticeable decrement in transaction values in 2019 that is not found in the previous years. This gives an important information that credit and charge card usage may have been replaced by the other currently prevalent electronic payment channels such as e-money and internet and mobile banking transaction. These two payment

channels offer transactions with little to no fees are expected to grow faster than card payment in the region (S&P Global Market Intelligence, 2021). Thailand however shows the highest transaction value, followed by Singapore and Malaysia.

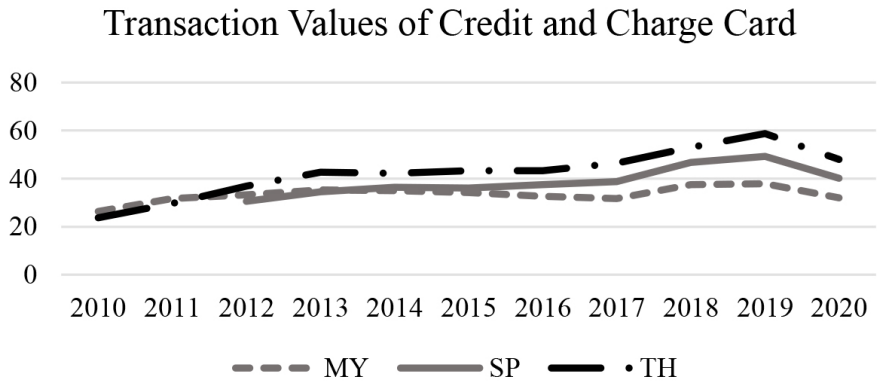

Figure 4. Transaction value of credit and charge card for Malaysia, Singapore and Thailand

Sources: Bank Negara Malaysia, Monetary of Singapore and Bank of Thailand

Regression Results

Table 4 shows the regression results highlighting the effect of the four electronic payment channels on bank performance. We run the analysis in two different specifications, including pooled OLS with year fixed effect (column 1a) and bank-specific fixed effect (column 1b). We also use additional econometric techniques to validate the results of the pooled OLS, which are two-way clustering ("cluster2" of Stata syntax, column 1c) and system GMM ("xtabond2" of Stata syntax, column 1d). In overall, we find that $NPL\text{-}to\text{-}Loans_{it}$, $Debt\text{-}to\text{-}Capital_{it}$ and $ForeignStrategic_{it}$ are shown significantly related to ROE_{it}, where the estimated coefficients of $NPL\text{-}to\text{-}Loans_{it}$ and $ForeignStrategic_{it}$ are negative (coeff = –0.0122, p-value = 0.0000; coeff = –0.0003; p-value = 0.0736), and the estimated coefficients of $Debt\text{-}to\text{-}Capital_{it}$ is positive (coeff = 0.0006; p-value = 0.0021). The other control variables are not statistically significant. However, for GMM's results, only $NPL\text{-}to\text{-}Loans_{it}$ is significantly related to ROE_{it} and the sign of the estimated coefficient is remained negative. The negative effect of non-performing loans is within our expectation. Only we are surprised by the negative effect of foreign strategic shareholdings on ROE, but many literatures show evidence of the disadvantages of foreign shareholdings on firm performance (e.g., Gurbuz & Aybars, 2010; Duong et al., 2021). Besides, we highlight that the impact of $BankSize_{it}$ is not significant, which opposes the view of larger banks gain more market shares and enjoy competitive advantage (Liu, 2021). We argue that banking system is becoming transparent with well-regulated standardised operations which leads to reducing advantage of bank size. Apart from that, smaller banks might

outsource technology operations and leverage the latest system to the cloud-based infrastructure and Backend-as-a-Service (BaaS) providers in order to compete with larger banks (Feyen et al., 2021). This helps smaller bank stay competitive in offering electronic payment services. Thus, bank size does not have impact on bank's profitability. This is supported by studies such as Anarfi et al. (2016) and Tharu and Shrestha (2019) where they found no relationship between bank size and bank's profitability.

The estimated coefficients of $EMoney_{it}$ and $DebitCard_{it}$ are only significantly shown in pooled OLS with country-year fixed effect (coeff = –0.0010; p-value = 0.0692) and two-way clustering method. The negative coefficients of $EMoney_{it}$ and $DebitCard_{it}$ indicate unfavourable effect on bank performance. Instead, the estimated coefficient of $CreditCharge_{it}$ is consistently positive across all specifications, and the estimates are fallen within 0.0350 to 0.0440 with pooled OLS and two-way clustering specification. The estimated coefficient of $CreditCharge_{it}$ in GMM result is far higher, which is 0.9773 (p-value = 0.0357). However, we find that the estimated coefficient of $InternetMobile_{it}$ is not statistically significant, which opposes to studies such as Alber (2011), Rauf and Qiang (2014) and Kamboh and Leghari (2016) where they find that mobile banking improves ROE of banks in the non-Asian hemisphere. We justify the insignificance of internet and mobile banking on banks' ROE in Asia which is due to intense competition (Frost et al., 2021) with many non-banks' mobile payment services such as ShopeePay, GrabPay, LazadaPay, etc. The aggressiveness of market penetration of these non-bank electronic payment services may be a significant threat to the conventional banks.

As we observe that the adjusted R^2 of the country-year fixed effect specification is the highest among columns 1 to 3, hence, we rely on the result of pooled OLS with country-year fixed effect for further analysis. We do not tend to rely on GMM as our small sized observations may not perfectly suit to the properties of GMM that uses lag effect of the independent variables as the instrumental tools to reduce endogeneity. In fact, the panel data are useful for applying fixed effect model to examine the events across time and cross-sectional units in providing the meaningful regression analysis (Brüderl & Ludwig, 2015).

Table 4
Regression results of the impacts of transaction values of the four electronic payments on bank performance

	Pooled OLS (1a)	Pooled OLS (1b)	Two-way Clustering (1c)	GMM (1d)
Control variables				
$BankSize_{it}$	0.0017	0.0012	0.0021	0.0259
	(0.7103)	(0.8002)	(0.7239)	(0.2707)
$NPL\text{-}to\text{-}Loans_{it}$	–0.0122***	–0.0121***	–0.0138***	–0.0196**
	(0.0000)	(0.0000)	(0.0000)	(0.0429)
$Debt\text{-}to\text{-}Capital_{it}$	0.0006***	0.0006***	0.0005*	0.0050
	(0.0021)	(0.0022)	(0.0905)	(0.2425)
$Loans\text{-}to\text{-}Assets_{it}$	0.0001	0.0001	0.0006	0.0002
	(0.7396)	(0.7302)	(0.3455)	(0.8940)
$ForeignStrategic_{it}$	–0.0003*	–0.0003*	–0.0007***	0.0003
	(0.0736)	(0.0773)	(0.0000)	(0.7312)
$GovStrategic_{it}$	0.0001	0.0001	0.0002	0.0030
	(0.6938)	(0.7433)	(0.2196)	(0.2635)
Electronic payment transaction values				
$EMoney_{it}$	–0.0014	–0.0010*	–0.0050***	–0.0434
	(0.4299)	(0.0692)	(0.0006)	(0.1700)
$CreditCharge_{it}$	0.0363*	0.0350***	0.0440**	0.9773**
	(0.0740)	(0.0063)	(0.0352)	(0.0357)
$DebitCard_{it}$	–0.0008	–0.0046*	–0.0221***	0.2953
	(0.9644)	(0.0093)	(0.0085)	(0.1361)
$InternetMobile_{it}$	0.0106	0.0350	0.0388	0.1672
	(0.2558)	(0.2658)	(0.1863)	(0.1533)
Constant	–0.0665	–0.2099	–0.0763	0.0001
	(0.6909)	(0.3876)	(0.4407)	(0.4582)
Firm Dummies	No	Yes	-	Yes
Year Dummies	Yes	Yes	-	Yes
SE clustered by	-	-	Country, Year	-
Obs	247	247	247	247
Adjusted R^2	0.4621	0.4643	0.4590	-
AR(1)				0.0730
AR(2)				0.3010
Hansen Test				0.9839

Notes: SE represents standard errors. OLS represents ordinary least square. 2-way clustering method is performed using Stata syntax "cluster2". Dependent variable is ROE (ROE_{it}). The GMM is the system GMM. *, ** and *** indicate the levels of significance at 10%, 5% and 1%, respectively. The figure in parentheses is *p*-value.

Table 5 presents the results for H2 and H3. In columns 2 and 3 of Table 5, we find that, among the control variables, only the estimated coefficient of the *Debt-to-Capital*$_{it}$ and *ForeignStrategic*$_{it}$ are statistically significant (coeff = 0.0045; *p*-value = 0.0971; coeff = 0.0030; *p*-value = 0.0123). The sign of the estimated coefficient of *ForeignStrategic*$_{it}$ turns into positive as compared to the result in Table 4, and we justify that increasing foreign strategic shareholdings is beneficial to the operational performance of the banks rather than firm performance, which can be explained by resource-based view where the involvement of foreign institutional shareholders may bring more resources to the banks for the significance benefit of revenue growth and operating profit.

The findings shows that neither of the electronic payment transaction values are significantly related to *RevGrowth*$_{it}$. This is opposes to the findings of the previous studies by El-Chaarani and El Abiad (2018) and Aduda and Kingoo (2012), however, those findings are based on non-Asian bank sample. Simpson (2002) justified that electronic payment generate higher revenue for banks in countries with strong information technology framework. This is supported by Yang et al. (2018) where electronic payment improved performance of bank only after the system is well-developed. According to Deloitte and INCLUSION Fintech Conference report (2020), although there has been rapid increase in electronic payment adoption, but the trend in Southeast Asia is still in initial stage, except Singapore. Electronic payment would generate better performance only after the electronic payment models become mature.

Meanwhile, the impacts of the four electronic payment transaction values on *OperatingIncome*$_{it}$, only the estimate coefficient of *CreditCharge*$_{it}$ is statistically significantly. This is supported by studies of Akhisar et al. (2015) and Gündoğdu and Taşkın (2017) where they demonstrate that payment cards enhance the profitability of banks. Yet, e-money, debit card, internet and mobile banking are found no relationship to bank's operating income. This is because these electronic payments generate low non-interest income to bank. While credit and charge card generates interest-based income to bank based on the outstanding balance of the card. Interest income and noninterest income are two main sources of bank's operating income. Sun et al. (2017) explained that as the marginal cost of developing noninterest income rising and the marginal income of noninterest income is decreasing, this would increase the operating costs which in turn decrease bank's net income. This is supported by study of DeYoung and Roland (2001) where noninterest income activities increase volatility of bank's income.

Table 5
Regression results of the impacts of transaction values of the four electronic payments on operating income and revenue growth

	$RevGrowth_{it}$ (2)	$OperatingIncome_{it}$ (3)
Control variables		
$BankSize_{it}$	0.0001	0.0128
	(0.9974)	(0.9088)
NPL_{it}	–0.0010	0.0097
	(0.9247)	(0.7234)
$Debt\text{-}to\text{-}Capital_{it}$	0.0026**	0.0045*
	(0.0122)	(0.0971)
$Loans\text{-}to\text{-}Assets_{it}$	0.0004	0.0062
	(0.8017)	(0.1553)
$ForeignStrategic_{it}$	0.0030**	0.0061**
	(0.0123)	(0.0458)
$GovStrategic_{it}$	–0.0026	–0.0028
	(0.3073)	(0.6657)
Electronic payment transaction values		
$EMoney_{it}$	0.0100	0.0343
	(0.4672)	(0.4147)
$CreditCharge_{it}$	–0.0987	1.4855**
	(0.4652)	(0.0105)
$DebitCard_{it}$	0.0235	0.2276
	(0.7496)	(0.2695)
$InternetMobile_{it}$	0.0456	0.9190
	(0.7167)	(0.1571)
Constant	0.0771	1.4360
	(0.9435)	(0.7944)
Firm dummies	Yes	Yes
Year dummies	Yes	Yes
Obs.	274	274
Adjusted R^2	0.4659	0.4705

Notes: *, ** and *** indicate significant that the observed mean is significantly different from zero at 10%, 5% and 1% level, respectively. The figure in parentheses is *p*-value.

Additional Analyses

Table 6 is the additional analysis to wrap-up the effect of electronic payment transaction values channeling through operating income towards improving the overall bank performance. In fact, the intention of the additional analysis is to

observe how the previous findings in Table 5 are contributing to the overall bank performance. Hence, we highlight the interaction effect of the electronic payment transaction with operating income (the significant variable in Table 5) on the bank performance (return on equity).

Therefore, Table 6 shows the regression results of the impacts of interaction between the transaction values of each electronic payments with operating income ($OperatingIncome_{it}$) on ROE_{it}. The results show that the estimated coefficients of $EMoney_{it}$ x $OperatingProfit_{it}$, $DebitCard_{it}$ x $OperatingProfit_{it}$ and $InternetMobile_{it}$ x $OperatingProfit_{it}$ are statistically significant, and the effects are positive (coeff = 0.0023, *p*-value = 0.0000; coeff = 0.0084, *p*-value = 0.0000; coeff = 0.0117, *p*-value = 0.0000), except for the interaction term of $CreditCharge_{it}$ × $OperatingProfit_{it}$ is not statistically significant. However, the estimate of $OperatingIncome_{it}$ is significantly positive in all regressions. This indicates that increasing transaction value of e-money, debit card, internet and mobile banking significantly reduces the positive impact of operating income on ROE betterment. Instead, increasing transaction value of credit and charge card does not significantly affect the impact of operating income on ROE.

Table 6
Regression results of the interacting impacts of electronic payment transaction values with operating income on bank performance

	Electronic payment			
	$Emoney_{it}$	$CreditCharge_{it}$	$DebitCard_{it}$	$InternetMobile_{it}$
[Payment]	0.0297***	0.0901	0.1209***	0.1859***
	(0.0000)	(0.2005)	(0.0000)	(0.0001)
$OperatingIncome_{it}$	0.0562***	0.0792***	0.0636***	0.1305***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
[Payment] × $OperatingIncome_{it}$	–0.0023***	–0.0074	–0.0084***	–0.0117***
	(0.0000)	(0.1374)	(0.0000)	(0.0000)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Obs.	274	274	274	274
R^2	0.562	0.4205	0.4636	0.4614
Adjusted R^2	0.7696	0.7182	0.7440	0.7421

Notes: *, ** and *** indicate significant that the observed mean is significantly different from zero at 10%, 5% and 1% level, respectively. The figure in parentheses is *p*-value.

CONCLUSIONS AND IMPLICATIONS

The liberalisation of financial sector has allowed greater competition in banking system. Bank faced intense competition from non-bank institutions in their core services that threaten their profitability. This study aims to examine the impact of electronic payments on bank performance. Our findings show that, of the four electronic payment channels (e-money, credit and charge card, debit card, internet and mobile banking), only the credit and charge card show the most prominent positive effect on the banks' ROE across different econometric specifications. The nexus between credit and charge and the banks' ROE may be driven by its contribution towards the banks' operating income. Instead, increasing the transaction values of the four electronic payment services is not significantly related to revenue growth of the banks. Instead, by increasing the transaction value of credit and charge card, we find the banks' operating income is significantly increased. This leads us to conclude that the electronic payment services are irrelevant to revenue growth, but it is able to reduce the operating cost of the banks particularly for the credit and charge card that generates additional interest charge on the card holders for late repayment. For e-money, debit card, internet and mobile banking which receive lesser additional income by offering the services, it is seen as a burden for shareholders as the investments neither create any value to the operating income.

This study provides valuable empirical evidence of the relationship between electronic payment channels and bank's performance. The implications are derived from the findings of this study. The findings shows that electronic payment such as e-money, debit card, internet and mobile banking negatively influencing the relationship between banks' operating income and ROE. Bank offering these services to stay competitive in competitive market. Providing these services requires technology and financial resources that rapidly changing. This increase bank's operational expenses. Banks need to reinvent their operating model such as partnership with fintech companies. The rapid technological evolutions such as Internet of Things (IoT), Artificial Intelligence (AI) and blockchain forced bank to invest in cutting-edge technology. Partnership with technology expert company not only ensure that a bank stay at the forefront of technology but also reduces bank's operating expenses on the technology research and development. Besides that, government should provide incentives and support for the banking sector's digital transformation. This may include financial and tax incentives for services that entails digital transformation and provide training for technology applications. This could help banks achieve cost optimisation in offering electronic payment services.

LIMITATION OF THE STUDY

The limitation of this study is that the financial data of our sample are taken based on the group consolidated accounts. The consolidate data might be embedded with noises where some of the financial information might not be related to the electronic payment transactions of the banks. Yet, Mustapha (2018) showing that electronic payment technologies have changed the business models of banks in Nigeria, and that has also caused to a transitional increase of the cost of operation. Based on these points, we argue that electronic payment technologies do exert several effects on the consolidated financial data of the banks in indirect ways. In the addition, we argue that the electronic payment technologies can create synergy with the other operating activities of the banks. Yet, the indirect effects of electronic transaction values on the consolidated data explain the weak significance results as shown in this study.

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