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Empirical analysis of internet and mobile banking in Malaysia

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ABSTRACT

Internet and mobile banking deliver banking services through various cashless payment tools, such as debit and credit cards, direct transfers and electronic wallets. The usage of internet and mobile banking in Malaysia has increased, but it is uncertain if they facilitate retail consumption. If internet and mobile banking are the preferred banking services, their usage could stimulate retail consumption; otherwise, their usage will be short-lived and more work must be done to develop the internet and mobile banking sector. This study aims to determine the influence of internet and mobile banking on retail consumption in Malaysia. The diffusion of innovation theory is applied by examining how technologically aids cashless payment systems and how internet and mobile banking might facilitate retail consumption. The short-run and long-run influences of internet banking and mobile banking are analyzed based on the autoregressive distributed lag (ARDL) unrestricted error correction model. The ARDL unrestricted error correction model was estimated for retail consumption, represented by the monthly retail trade index, and internet banking and mobile banking are represented by the number of monthly internet and mobile transactions. The results suggest a bi-directional causal relationship between retail consumption and internet banking in the short run. In the long run, the internet and mobile banking transactions were found to significantly facilitate household retail consumption, but not vice versa.

Contribution/Originality: This study contributes to the body of knowledge in two ways. First, actual internet and mobile banking transactions were used to examine their impact on retail consumption, and second, it was found that internet and mobile banking affect retail consumption in the long run and not vice versa. Thus, financial technology innovation could encourage retail consumption.

1. INTRODUCTION

Internet and mobile banking usage in Malaysia has increased for two reasons—the convenience of the delivery channels, and it is a directive from the central bank. First, the advantages of utilizing internet and mobile banking include 24/7 accessibility (Jebarajakirthy & Shankar, 2021) and fast transfers. The convenience of internet and mobile banking comprises the convenience of accessing cashless banking services (Lin, Lin, & Ding, 2020) without having to be physically present at the bank (Shankar & Rishi, 2020). It allow users to make online purchases and pay via internet and mobile banking (Teng & Khong, 2021). Except for occasional downtime for maintenance, internet and mobile banking services are available almost 24/7, every day of the year.

Making cashless interbank transfers online is also favored due to the safety features (e.g., secret PIN access and facial or fingerprint recognition) and the ability to track expenses (Świecka, Terefenko, & Paprotny, 2021). It is an option for contactless banking where users can avoid crowded banking halls and be able to transfer funds from the comfort of their homes. In Central Asia, young adults' perception of online security positively influences their trust in mobile banking (Ivanova & Kim, 2022).

Second, the Central Bank of Malaysia is migrating from paper-based to cashless payments. The central bank's Financial System Blueprint 2011–2020 stressed the importance of a digitalized financial system by encouraging cashless payments and discouraging cheque payments (Bank Negara Malaysia, 2011). Since January 2, 2015, users have been advised against cheque payments due to the high cost of stamp duty of Malaysian ringgit (RM) of 0.15 and a processing fee of RM 0.50 for each cheque issued.

Unlike cheques, online payments and transfers are free of charge in Malaysia. In addition to cost savings, going cashless through internet and mobile banking are innovations to develop a digitalized economy (Ng, Kauffman, Griffin, & Hedman, 2021). The digitalization of financial services is further emphasized in the central bank's latest Financial System Blueprint 2022–2026 through upgraded digital infrastructure, digital financial services, financial security and supervision (Bank Negara Malaysia, 2022).

The monthly value of internet and mobile transactions in Malaysia supports the notion that its usage has increased steadily from January 2016 to January 2022. Its use spiked in March 2021 and continued to rise until January 2022. See Figure 1 for details.

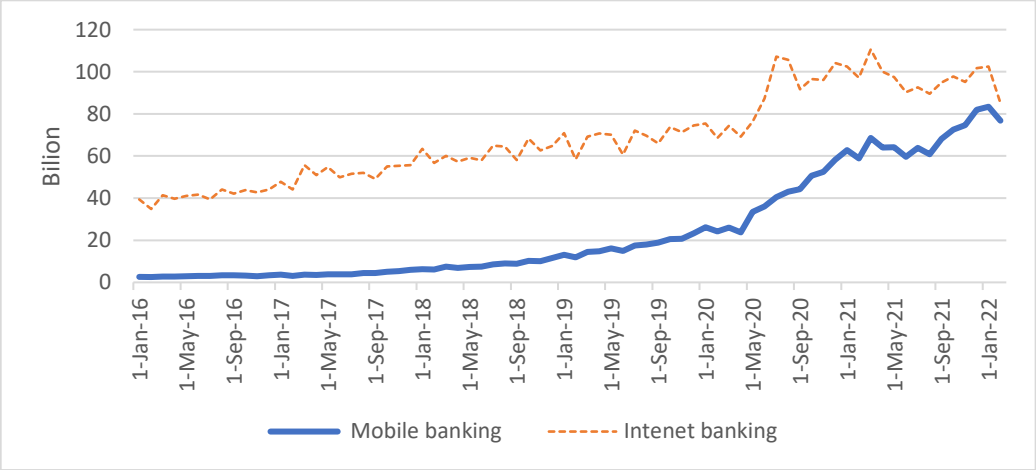


Figure 1. Internet and mobile banking use.

Source: The Central Bank of Malaysia's payment channel statistics.

The usage of the internet and mobile banking has increased but it is uncertain if it is the preferred payment method. Internet and mobile banking usage increased during the Covid-19 pandemic due to its contactless feature, but it is uncertain if its usage will continue.

This study examines two aspects of internet and mobile banking in financing retail consumption in Malaysia. First, the dynamic short-run causal impact of internet and mobile banking on retail consumption is examined, and vice versa by applying the Granger causality test. Second, a bounds test of the long-run sustainable effect of retail consumption, internet banking, and mobile banking is carried out. The bounds test is analyzed based on the autoregressive distributed lag (ARDL) unrestricted error correction model of retail consumption, internet banking, and mobile banking.

The next section of this study discusses literature related to internet and mobile banking, the pattern of retail consumption and the diffusion of innovations (DOI) theory. Next, the research framework, methodology, and findings are presented. The paper ends with a discussion and concluding remarks.

2. LITERATURE REVIEW

Internet and mobile banking services are contactless and cashless banking services. Internet banking allows users to manage their banking transactions and access banking services online. Banks use internet banking to deliver electronic banking services, attract savings and interact with their customers. Mobile banking provides similar online banking services through mobile devices. They both deliver various services through payment tools, such as debit cards, credit cards, direct transfers and electronic wallets (e-wallets).

2.1. Internet and Mobile Banking

Both internet and mobile banking are online banking services offered by commercial banks. In Malaysia, online banking services were introduced in the late 1990s for selected premier customers through an intranet network connected by a telephone line. The first internet banking service that opened to the public was launched by Maybank in June 2000, which still relies on telephone lines for dial-up internet connection. Back then, the first-mover advantage was given to local commercial banks to offer internet banking services (Bank Negara Malaysia, 2000). Foreign-owned commercial banks were allowed to provide internet banking two years later, in 2002.

With improved high-speed 5G broadband connections, commercial banks can now offer more sophisticated online banking services. Almost all banking services can be done online, except cash transactions.

The convenience of accessing and transacting online reduces transaction time. Convenience is essential to encourage the usage of the internet and mobile banking (Lin et al., 2020; Shankar & Rishi, 2020; Van et al., 2021). Recent studies highlight security, usefulness and ease of use as crucial elements to encourage the utilization of internet and mobile banking services. Security against cybercrime and data protection are the most significant technological elements associated with mobile banking (Bolt & Mester, 2017; Wirani, Hidayanto, & Shihab, 2020). A secure banking interface will be more effective in encouraging mobile payment usage than incentive handouts.

In addition to banking security, users' attitudes and demographic properties also significantly affect the acceptance of mobile banking usage (Van et al., 2021). Users' trust in the banks' ability to promptly process their financial instructions online is positively and significantly related to the intention to use mobile banking. Users' lifestyles and satisfaction with mobile banking services are highly linked to their mobile banking usage (Siadat, Najjar, & Nezafati, 2019).

The extent of the use of internet and mobile banking services positively relates to users' financial illiteracy. Financially literate consumers are more confident in their digital and financial skills (Andreou & Anyfantaki, 2021) and are more likely to pay for their shopping electronically. However, online or mobile buyers are multi-device consumers. They can shop online and offline, using physical cash, e-wallets, internet or mobile banking (Groß, 2020) to pay for their purchases. Consumers may not always use the internet or mobile payment to pay for online purchases. Online purchasers can opt for cash payment when the goods are delivered, commonly known as cash on delivery (COD).

To leverage online sales, retailers selling reputable brands will also sell via their mobile applications (Murugan & Jacob, 2019). Online or mobile retailers accept payment through e-wallets, internet or mobile banking. Therefore, online retailers' acceptance of cashless payments is one of the determining factors in the usage of internet and mobile payments. Thus, the pattern of retail trade will be able to exhibit consumers' retail consumption and their association with internet and mobile payments.

2.2. Retail Consumption

Consumers' retail consumption is related to the economy's gross domestic product (GDP). During the movement control enforced during the Covid-19 pandemic, all economic activities were almost at a standstill. Only vendors selling essential goods were allowed to open for business. Based on 2015 prices, Malaysia's real GDP experienced the worst plunge of 15.9% in Q2 2020. A similar pattern was noted for household consumption, where the retail trade

index fell from 138.6 in Q1 2020 to 107.6 in Q2 2020. Household consumption was also on a downward trend in 2021, before picking up in Q4 of 2021. See Figure 2 for details.

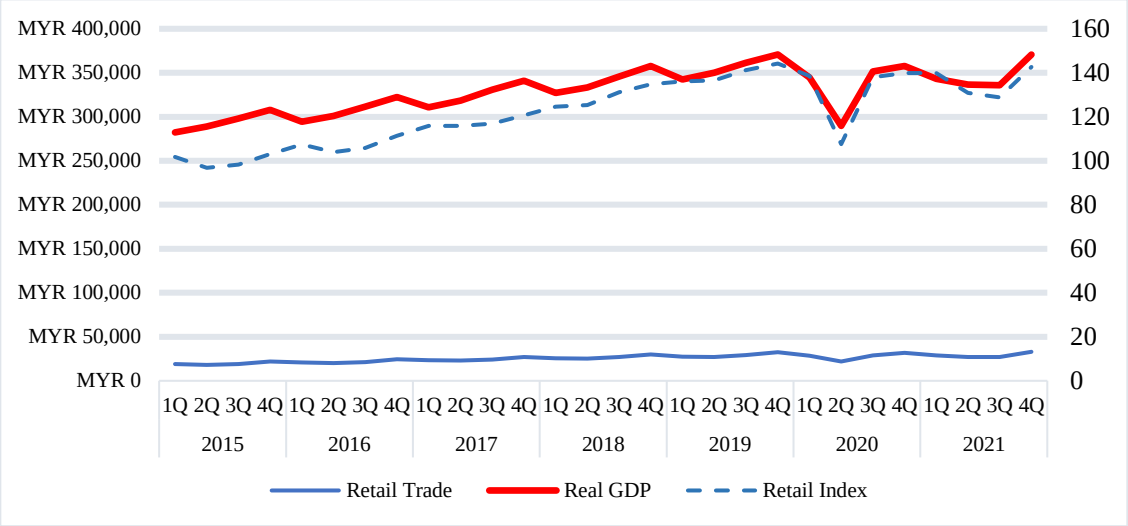


Figure 2. Retail trade, real GDP and retail trade index.

Source: Central Bank of Malaysia.

The retail trade index in Malaysia is pro-cyclical, moving along with the changes in real GDP. Although retail consumption plunged in April 2020, internet and mobile banking usage showed a rising trend for the same period (refer to Figure 1). During the Covid-19 pandemic, internet and mobile banking were the ideal contactless payment options for retail consumption. This study aims to determine whether internet and mobile banking affect retail consumption and vice versa by using the diffusion of innovations concept.

2.3. Diffusion of Innovations (DOI)

The theoretical background of this study is the diffusion of innovations concept introduced by Rogers (1962). The DOI theory explains that technologically-aided innovation facilitates transformation and promotes economic growth (Perilla, 2020). DOI has been theorized in recent studies that examined the intention and adoption of technologically-aided financial services (Kaur, Dhir, Bodhi, Singh, & Almotairi, 2020; Perilla, 2020; Zhu, Lyu, Long, & Wachenheim, 2022).

The DOI concept explains how consumers might adopt an innovative payment method that benefits them (Świecka et al., 2021). It is also an appropriate theoretical context to conduct a semi-structured survey to analyze a new accounting reporting standard (Ilias, Ghani, & Azhar, 2021). This study applies the DOI theory by examining how technologically-aided cashless payment systems, such as internet and mobile banking, might facilitate retail consumption.

3. METHODOLOGY

Based on the DOI concept, how cashless payments, such as internet and mobile banking, could facilitate retail consumption is examined. Equation 1 examines whether internet and mobile banking usage facilitates retail consumption. Equations 2 and 3 cross-examine the effect of retail consumption and mobile banking on internet banking, and retail consumption and internet banking on mobile banking, respectively.

$$Retail = f(IB, MB) \quad (1)$$

$$IB = f(Retail, MB) \quad (2)$$

$$MB = f(Retail, IB) \quad (3)$$

Retail represents the monthly retail trade index, and *IB* and *MB* are the respective values of the monthly internet and mobile transactions. The frequency of the data is monthly and the sampling period from January 2016 to January

2022 was selected based on data availability. All data were obtained from the Central Bank of Malaysia payment statistics.

The estimation model for Equation 1 was determined based on the stationarity of the variables used in the model. The ARDL model can be employed for time series with mixed stationarity (Alshubiri, Tawfik, & Jamil, 2020; Atmaca & Karadaş, 2020; Scott-Joseph & Turner, 2019). The long-run and short-run relationships of the variables were analyzed following the ARDL bounds test (Elhassan & Braima, 2020; Pesaran, Shin, & Smith, 2001). The ARDL unrestricted error correction model (ECM) was estimated for Retail, IB, and MB, as stipulated in Equations 4, 5, and 6, respectively.

$$\Delta Retail_t = \alpha_0 + \alpha_1 Retail_{t-1} + \alpha_2 IB_{t-1} + \alpha_3 MB_{t-1} + \sum_{i=1}^{\rho} \alpha_{4i} \Delta Retail_{t-i} + \sum_{i=1}^{q} \alpha_{5i} \Delta IB_{t-i} + \sum_{i=1}^{r} \alpha_{6i} \Delta MB_{t-i} + \varepsilon_t \quad (4)$$

$$\Delta IB_t = b_0 + b_1 Retail_{t-1} + b_2 IB_{t-1} + b_3 MB_{t-1} + \sum_{i=1}^{\rho} b_{4i} \Delta Retail_{t-i} + \sum_{i=1}^{q} b_{5i} \Delta IB_{t-i} + \sum_{i=1}^{r} b_{6i} \Delta MB_{t-i} + e_t \quad (5)$$

$$\Delta MB_t = c_0 + c_1 Retail_{t-1} + c_2 IB_{t-1} + c_3 MB_{t-1} + \sum_{i=1}^{\rho} c_{4i} \Delta Retail_{t-i} + \sum_{i=1}^{q} c_{5i} \Delta IB_{t-i} + \sum_{i=1}^{r} c_{6i} \Delta MB_{t-i} + E_t \quad (6)$$

The short-run correction of the ARDL unrestricted ECM is combined with the long-run equilibrium information. The F-statistics are estimated from the ordinary least squares estimations in Equations 4, 5, and 6 to find the presence of cointegration. The null hypothesis of no long-run cointegration is rejected when the F-statistic is higher than the critical value of the upper bound test of I(1). After the significance of the long-run cointegration bound test is determined, the reduced forms of the vector ECM are specified as follows:

$$\Delta Retail_t = C + \sum_{i=1}^{\rho} \alpha_{4i} \Delta Retail_{t-i} + \sum_{i=1}^{q} \alpha_{5i} \Delta IB_{t-i} + \sum_{i=1}^{r} \alpha_{6i} \Delta MB_{t-i} + \gamma ECT_{r_{t-1}} + \vartheta_t \quad (7)$$

$$\Delta IB_t = g + \sum_{i=1}^{\rho} b_{4i} \Delta Retail_{t-i} + \sum_{i=1}^{q} b_{5i} \Delta IB_{t-i} + \sum_{i=1}^{r} b_{6i} \Delta MB_{t-i} + bECT_{ib_{t-1}} + \partial_t \quad (8)$$

$$\Delta MB_t = h + \sum_{i=1}^{\rho} c_{4i} \Delta Retail_{t-i} + \sum_{i=1}^{q} c_{5i} \Delta IB_{t-i} + \sum_{i=1}^{r} c_{6i} \Delta MB_{t-i} + cECT_{mb_{t-1}} + \mu_t \quad (9)$$

The coefficients of the ARDL reduced ECM estimation measure the short-run dynamics of the model. The lag of the error correction term's coefficient determines the adjustment speed in the long-run equilibrium. The Wald test was applied to determine the short-run relationships of retail consumption, internet and mobile banking in Equations 7, 8, and 9.

4. RESULTS

The augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests examined whether the time series had a unit root problem. The null hypothesis of both tests probed for non-stationarity and the alternative hypothesis of stationarity. Both the ADF and PP tests indicated that Retail and IB at constant were I(1) and with trend were I(0). MB was I(1) for both tests at a 1% significance level. See Table 1 for details.

Since the time series were mixed stationarity, the F-statistics of the ARDL bounds test were applied to determine the long-run cointegrating relationship among Retail, IB, and MB. When the critical value of the bounds test F-statistic was higher than the upper bound limit, it indicates rejection of the null hypothesis of no cointegration. The null hypothesis of no cointegration of the bounds test was rejected at a 1% significance level, indicating a long-run cointegration for retail consumption, denoted by *Retail*. At 10% and 5% significance levels, there were long-run cointegrating relationships for internet banking (IB) and mobile banking (MB), respectively. See Table 2 for details.

Table 1. Unit root tests.

ADF test variable	At Constant (t_μ)	Levels Trend (t_τ)	First Constant (t_μ)	Difference Trend (t_τ)
Retail	-2.545	-4.412***	-7.869***	-7.812***
IB	-0.826	-4.432***	-12.243***	-12.152***
MB	2.333	-0.338	-3.829***	-4.992***
PP test				
Retail	-2.276	-3.536**	-12.330***	-12.283***
IB	-0.662	-4.465***	-14.360***	-14.232***
MB	3.420	-0.185	-10.080***	-11.599***

Note: *** and ** denote rejection of the null hypothesis at the 5% and 10% levels, respectively.

Table 2. Long-run bounds test.

Model	F-statistics	
Retail (2, 2, 2)	5.537***	
IB (2, 4, 4)	3.371*	
MB (3, 4, 2)	4.271**	
Significance level	Lower bound I(0)	Upper bound I(1)
10%	2.63	3.35
5%	3.10	3.87
2.5%	3.55	4.38
1%	4.13	5.00

Note: '**, ** and * denote rejection of the null hypothesis at the 1%, 5% and 10% levels of significance, respectively.

Based on the Hannan–Quinn information criterion, the optimum lags for Equations 7, 8, and 9 were lag 2. The Wald test was conducted to determine the short-run Granger causal relationship among Retail, IB, and MB. At a 10% significance level, there was a bi-directional Granger causal relationship between retail consumption (Retail) and internet banking (IB) in the short run. There was unidirectional Granger causality from mobile banking (MB) to internet banking (IB) at a 10% significance level in the short run. See Table 3 for details.

Table 3. Short-run coefficient Wald test.

Dependent variable	Retail	IB	MB
Chi-square			
ΔRetail	-	5.294*	1.814
ΔIB	4.903*	-	0.741
ΔMB	0.148	5.815*	-

Note: * denotes a 1% level of significance.

The negative coefficients of the lag of the error correction term establish the speed of the adjustment process in the long run. Still, only the mobile banking (MB) error correction terms were significant. Thus, at a 5% level of significance, approximately 0.56% of mobile banking could return to long-run equilibrium after a shock. It is uncertain whether the speed of adjustment process for retail consumption and internet banking return to long-run equilibrium after a shock. See Table 4 for details.

Table 4. Error correction term.

ΔECM_{t-1}	Retail	IB	MB
Coefficient	-0.492	-0.530	-0.556
T-statistic	-1.371	-1.111	-2.096**

Note: ** denotes a 5% level of significance.

The results in the long run can be summarized in two ways. Firstly, internet and mobile banking significantly affect retail consumption at 5% and 10% significance levels, respectively. A 1% increase in internet banking would increase retail consumption by 0.72% in the long run, and a 1% increase in mobile banking would decrease retail consumption by 0.50% in the long run. Secondly, there was no evidence of retail consumption affecting internet and

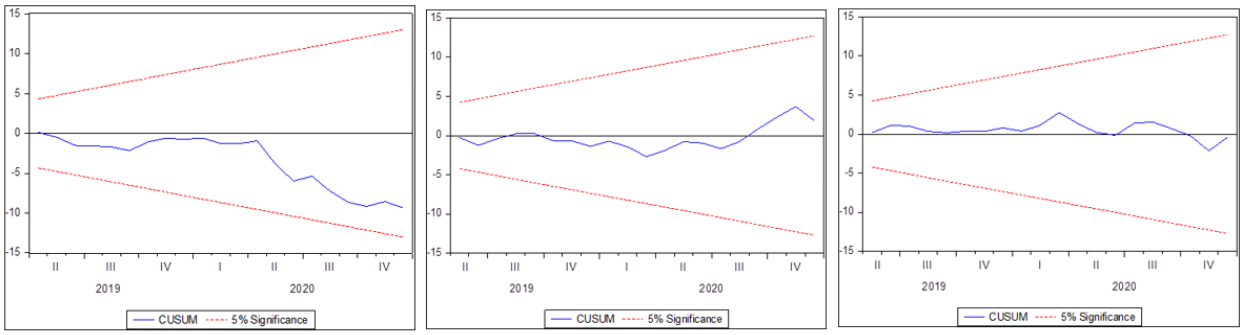
mobile banking in the long run. Thus, internet and mobile banking usage will significantly affect retail consumption in the long run but not vice versa. See Table 5 for details.

Table 5. Long-run coefficient estimates.

Retail	Coefficient	Std. error	t-statistic
IB	0.719**	0.307	2.342
MB	-0.496*	0.252	-1.971
C	84.447***	15.674	5.388
Diagnostic tests			F-statistic
Breusch–Godfrey LM test			0.439
Breusch–Pagan–Godfrey heteroskedasticity test			1.116
Jarque–Bera normality test			524.872
IB	Coefficient	Std. error	t-statistic
Retail	0.251	0.262	0.957
MB	0.268	0.206	1.305
C	24.226	32.414	0.747
Diagnostic tests			F-statistic
Breusch–Godfrey LM test			3.050**
Breusch–Pagan–Godfrey heteroskedasticity test			1.152
Jarque–Bera normality test			0.892
MB	Coefficient	Std. error	t-statistic
IB	0.528	6.751	0.078
Retail	-8.421	48.241	-0.175
C	377.529	1974.437	0.191
Diagnostic tests			F-statistic
Breusch–Godfrey LM test			0.819
Breusch–Pagan–Godfrey heteroskedasticity test			3.626***
Jarque–Bera normality test			3.123

Note: ***, ** and * denote rejection of the null hypothesis at the 1%, 5%, and 10% levels, respectively.

The cumulative sum (CUSUM) test plots the cumulative sums of the deviations of the sample values from a target value. The CUSUM tests for all models showed that the coefficients were stable at a 5% level. See Figure 3 for details.



3(a) Retail 3(b) MB 3(c) IB

Figure 3. CUSUM test.

5. DISCUSSION

This study concludes that a bi-directional causal relationship exists between retail consumption and internet banking in the short run. In the short run, there is also significant unidirectional causality from mobile banking to internet banking. In the long run, internet and mobile banking facilitate retail consumption. There is no evidence of retail consumption influencing internet and mobile banking in the long run. Therefore, more retailers should be encouraged to accept internet and mobile payments to promote more retail trade activities. Increased internet and mobile banking through financial process exchange (FPX) transfers, top-ups, and e-wallet payments will boost retail consumption.

FPX connects users to their cards and deposit accounts to allow instant online payment. In addition to providing an alternative mode of payment, the current FPX that waives internet and mobile banking transaction fees must be maintained to ensure continued internet and mobile banking usage.

Internet and mobile banking are a way forward to a digital economy and support the Central Bank of Malaysia's effort to drive the digitalization of Malaysia's financial system. Internet banking could establish financial inclusion for young and technologically savvy consumers (Dandapani, Lawrence, & Rodriguez, 2018) and boost economic growth through access to banking facilities, saving deposits and remittances (Vo, Nguyen, & Van, 2021).

Mobile banking is an upgraded version of internet banking where banking is at your fingertips. With innovations in financial technology and support from the central bank, more consumers can be encouraged to migrate to internet and mobile banking to pay for their daily purchases. Banks have been limiting the number of face-to-face transactions in branches since the outbreak of the Covid-19 pandemic. Several bank branches had to operate with fewer bank tellers and officers when their staff contracted Covid-19. Hence, internet and mobile banking services are the most effective means to access banking services and practice social distancing.

6. CONCLUSION

The value of the internet and mobile transactions in Malaysia has increased since 2016. Consumers turned to internet and mobile banking services to conduct contactless banking and ensure social distancing. In addition, past literature also found that the convenience, cost-effective benefits and advances in financial technology innovations had heightened internet and mobile banking usage.

This study analyzed how actual internet and mobile banking transactions might facilitate retail consumption and vice versa. The results suggest a bi-directional causal relationship between retail consumption and internet banking in the short run. Internet and mobile banking transactions will facilitate retail consumption significantly in the long run. Thus, more retailers should accept cashless payments to increase mobile banking usage.

This study is limited to internet and mobile banking services available to Malaysian consumers. Future studies may explore the use of internet and mobile banking in Southeast Asia to compare the development and the impact of digital banking in the region. Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses.

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