

## **The Effect of Financial Innovation on Bank Performance: Evidence from Commercial Banks of Sri Lanka**

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### **Abstract**

This study investigates the impact of financial innovation on bank performance in the context of commercial banks in Sri Lanka. Automated Teller Machines (ATM), mobile banking, internet banking, and debit cards are used as proxies to measure financial innovation while bank performance is measured by ROA and ROE. Pooled OLS regressions are estimated using data for a balanced panel of 11 commercial banks over 10 years from 2010 to 2019. All the proxies for financial innovation have significant effects on bank performance. However, the effects are not uniform across the performance measures. The results show that the financial innovations proxies of ATMs, internet banking, and debit cards have a significantly positive impact on ROA, while mobile banking has a negative impact. Internet banking has a significant positive impact on ROE, while ATMs and mobile banking are negatively related to ROE. These findings underscore the important role played by financial innovation in bank performance.

*JEL classification:* G2, G21

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## 1. Introduction

The rising importance of the financial sector in modern economies and the rapid rate of innovation have aroused curiosity for research in financial innovation. As stated by Tufano (2003), “The activity of financial innovation is large, but the literature on the topic is relatively sparse and spread out broadly among a number of fields” (2003; 331). Although the practical interest in financial innovation is high, the sources of financial innovations and their impact on performance are not well known, mainly due to the absence of sufficient empirical evidence (Frame & White, 2004). Financial innovations are used by banks as powerful strategic variables to outperform competition and have become an essential means for banks to enhance their performance and maintain the effectiveness and productivity of the market (Batiz-Lazo & Woldeesenbet, 2006).

Even though financial innovation is considered interesting, very little is known about the relationship between financial innovation and bank performance in the Sri Lankan context. To address this empirical gap, this study aims to explore the impact of financial innovation on bank performance, taking Sri Lanka as an illustrative example of a developing country where banks play a major role in the financial system. In doing so, this paper addresses two research questions: (a) To what extent financial innovation is embedded in the banking business of Sri Lanka? and (b) What is the impact of financial innovation on bank performance?

Employing the pooled ordinary least squares technique, this study examines the impact of financial innovation on bank performance for a sample of 11 commercial banks in Sri Lanka over the period of 2010-2019. We study the impact of innovation on bank performance through four main indicators of innovation, namely the usage of ATMs, mobile banking, internet banking, and debit cards. Bank performance is captured through return on equity and return on assets. Besides, bank size and GDP growth are employed as control variables.

The findings suggest a statistically significant effect of all the considered innovation variables on bank performance. Regression findings reveal that ATMs, internet banking, and debit cards have a significant and positive impact on ROA, while mobile banking is negatively related with ROA. Further, internet banking has a significant positive impact on ROE, while ATMs and mobile banking show a negative relationship. Taking Sri Lanka as an illustrative example of emerging markets, this study adds value to the under-researched area in the banking industry. The findings suggest that bank practitioners and policymakers should identify the value of financial innovation to the financial performance of banks and invest in such strategies for the benefit of stakeholders.

The remainder of the paper is organized as follows. Section two reviews the extant literature with the theoretical foundation of the study. Section three discusses the research methodology including hypothesis development and the regression model. Section four discusses the results including descriptive statistics and regressions. Finally, the paper concludes with a summary of the findings and policy considerations.

## 2. Literature Review

Financial innovation as a new and contemporary concept has been narrowly and broadly defined in the literature. In a narrow sense, financial innovation means the introduction of new financial instruments (Ndirangu & Nyamongo, 2015). A broader view of financial innovation tends to incorporate more elements of the financial system. For example, Tufano (2003) defines financial innovation as the “*act of creating and popularizing new financial instruments as well as*

*new financial technologies, institutions, and markets*” (2003; 310). The importance of financial innovation naturally arises from the centrality of finance in an economy and its importance for economic growth (Frame & White, 2004). The real sector and financial sectors of an economy are highly interconnected, and financial innovation is an important component of the financial sector (Festre & Nasica, 2009; Akdere & Benli, 2018). The literature on financial innovation suggests that financial innovation can be categorized based on technological updates to various spheres of the financial system such as organizational innovations, process innovations, and product innovations (Akdere & Benli, 2018; Beck, Senbet & Simbanegavi, 2015; Lee, Wang & Ho, 2019).

According to the diffusion of innovations (DOI) theory, innovation is an idea, practice, or object that is perceived as new by an individual or group and should be considered desirable to adopt (Rogers, 1995). Innovations are of two types such as product innovations and process innovations (Tushman & Nadler, 1986). Product innovation is considered as changes in products or services, and process innovation is the change in the way products or services are delivered. Branchless banking models represent both types of innovations. For instance, ATMs and internet banking are process innovations while mobile banking and debit cards are considered product innovations.

### *2.1 Innovations in the banking industry*

A specific definition for financial innovation is hardly found for the banking industry given its unique features compared to non-banking institutions (Arnaboldi & Rossignoli, 2015). Frame and White (2004) defined financial innovation as product and organizational innovations which allow for cost reduction for banks, or an improvement of services for the financial system as a whole. According to Ross (1989), the major motives that make the demand for financial innovations are agency considerations and institutional preferences. He claimed that agency concerns, explicit contracts, and regulations, make the process of borrowing expensive or restricted to individuals. Alalwan, Dwivedi, and Rana (2017) stated that among many businesses, banks are genuinely interested in innovation to better serve their customers and enhance their efficiency and effectiveness. In the past, the banking industry has traditionally had a tight bureaucratic structure with high levels of centralization, standardization, and limited flexibility. However, the current banking sector is facing a highly competitive atmosphere requiring rapid external changes due to global competition, technical evolution, and regulatory system (Axel & Harborne, 1985; Uz Kurt, Kumar, Kimzan & Eminoglu, 2013).

Niehans (1983) has categorized the financial innovation of banks into two types—adaptive innovations and technological innovations. Adaptive innovations occur as a reaction to changing market conditions while technological innovations are characterized by the electronic revolution. The common denominator of technological innovation is the reduction in transaction costs (Niehans, 1983). Considering this technological breakthrough aiming for cost reduction in the storage, retrieval, and transmission of information in bank transactions, our paper focuses on the technological improvements in the banking industry in four main areas. These are the use of ATMs, mobile banking, internet banking, and debit cards in Sri Lankan banks. ATMs are designed to perform the most important functions of banks such as deposits, withdrawals, the printing of mini statements, and settlements of bills. The ATM is a highly accepted innovation that reduced the operational costs of bank branches (Akhisar, Tunay & Tunay, 2015). Mobile banking has often been discussed as a strategic change in retail banking and identified as an application that enables

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customers to access bank accounts through mobile devices such as mobile phones, or tablets to conduct financial or non-financial transactions (Shaikh & Karjaluo, 2015). Internet banking is defined as the internet portals that could facilitate customers to a variety of banking services ranging from bill payment to investments (Pikkarainen, Pikkarainen, Karjaluo & Pahnla, 2004). Debit cards are characterized as essentially pay-now instruments linked to checking accounts which facilitate customers to engage in banking transactions via online or offline methods (Frame & White, 2004). The role of debit cards in terms of acceptance, security, portability, time costs, and payment attributes plays a similar role as credit cards (Zinman, 2008).

### *2.2 Innovation and bank performance*

The resource-based view (RBV) sees the unique resources that the firm controls as key to superior firm performance and value creation. Fundamentally, according to this theory, the firm creates value by combining resources that are valuable, rare, imitable, and non-substitutable (Barney, 1991). Differences may occur in the form of strategic resources such as expert human capital, proprietary technology, superior information, computer, and technology (ICT), infrastructure, and patents. According to Barney (1991), the RBV assumes that the firm's resources, skills, and capabilities are heterogeneous, and resources are immobile, making them difficult to move freely from organization to organization, at least over the short term. Having unique resources and controlling them may not lead to superior firm performance. However, superior firm performance can be achieved by exploiting those unique resources to gain a competitive advantage (Salwani, Marthandan, Norzaidi & Chong, 2009). Thus, the RBV was developed to explain how firms gain sustainable competitive advantage (Caldeira & Ward, 2003). A firm is said to have a competitive advantage when competitors are unable to simultaneously implement a strategy that the firm currently implements (Barney, 1991).

Consistent with the RBV framework, ICT infrastructure is considered a unique capability that can create value for the firm (Zhu, 2004). Zhu and Kraemer (2005) investigated the relationship between e-business and firm performance using the RBV framework. They concluded that the adoption and usage of e-business could lead to significant firm financial performance. Based on the RBV theory, this study considers financial innovation as a valuable resource that banks can use to enhance their financial performance.

There is an ambiguity regarding the economic impact of financial innovation on performance. Initially, in the 1970s and 1980s, concerns were raised as to whether financial innovation had any significant effect on economic output. However, over the last couple of decades, evidence has shown that financial innovation provides sizable economic returns to both organizations and the economy (Beck, Chen, Lin & Song, 2016; Bernier & Plouffe, 2019). More recent cross-country studies also found notable evidence of the impact of financial innovation on bank performance. For example, Beck et al. (2016) examined the innovation-growth and innovation-fragility views in 32 countries, arguing that banks in countries with higher levels of financial innovation are experiencing faster growth, but also higher fragility and worse bank performance during crisis periods. By focusing on crisis periods, they found strong evidence, while others focus on performance in normal times. Based on an analysis of 40 countries from 1989 to 2011, Lee et al. (2019) uncovered evidence of better growth in assets, loans, and profits in banks located in countries with a higher level of financial innovation. While several other studies have reported similar conclusions (Zarutskie, 2013), the magnitude of the effect varies significantly between

countries. Financial innovations are the result of increasing e-based platforms (Tule & Oduh, 2016). Studies have revealed a positive and significant correlation between the adoption of financial innovation and bank performance. Using a large sample of 29 countries in Europe and America, Scott, Reenen, and Zachariadis (2017) found a positive relationship between digital innovation, especially the adoption of SWIFT (Society for Worldwide Interbank Financial Telecommunication), and bank performance. In addition, they found that the adoption of SWIFT has a greater impact on profitability in the long run and that the effect on profitability is greater for large banks than for small banks.

Using 23 developed and developing countries, Akhisar et al. (2015) investigated the effect of electronic bank products on performance. Their results, using a dynamic panel data method, demonstrated that both the number of issued bank cards and the ratio of ATMs to the number of branches impact profitability positively while the number of point-of-sale (POS) terminals and the number of customers using internet banking services impact profitability negatively. Such findings are particularly useful in order to understand the effect of financial innovation on profitability but are hard to generalize due to different banking infrastructures and socio-cultural characteristics of customer behavior in different countries.

There are only a few research studies in the area of financial innovations in the Sri Lankan banking sector. Several studies focused on financial innovations in the insurance industry (Rajapathirana & Hui, 2018), digital transformation in the banking sector (Habeeb & Wickramasingha, 2019), and trends in financial innovations in terms of online banking, etc. Although financial innovations in the banking sector are considered a hot topic in the literature, there is very little empirical evidence in the Sri Lankan context. For example, Rathnasiri (2010) investigated the impact of financial innovation on the development of commercial banks in Sri Lanka and found that the financial sector fostered financial innovation and led to the improvement of the efficiency of the banking system. Ariyasena and Jayarathne (2019) examined the effect of e-banking adoption on the financial performance of 12 domestic commercial banks in Sri Lanka and found that e-banking has a significant positive impact on financial performance. However, this study examined only e-banking in terms of financial innovation. Premarathne and Gunatilake (2016) examined the consumer adaptation to internet banking in Sri Lanka and found that the availability of internet facilities, consumer awareness, cost, web design, etc. are the main determinants of the usage of internet banking. Similar evidence was reported by Jayasiri and Kariyawasam (2016).

A review of relevant literature shows that although there has been some research in the area of financial innovations, studies on the impact of innovation on bank performance are limited. Many studies have omitted some of the more important variables in terms of technological innovations, such as the usage of credit and debit cards, POS terminals, online banking, mobile banking, and agency banking. Hence, the main objective of the study is to fill this gap with a systematic and comprehensive analysis of the effect of financial innovation on bank performance in the emerging market of Sri Lanka.

### *2.3 Hypothesis*

The association between ATMs and bank performance has been investigated in several previous studies, and much of the previous evidence confirmed that ATMs are significant for bank performance. Akhisar et al. (2015) and Shihadeh, Hannon, Guan, Haq & Wang (2018) observed a

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significant positive relationship between ATMs and bank performance. Authors argued that lower operational costs lead to higher profitability. However, Victor, Ebuka & Echekeba (2017) observed a negative relationship in the Nigerian banking industry. In the Sri Lankan context, Ariyasena and Jayarathne (2019) observed a significant positive relationship. Therefore, we hypothesize that ATMs have a positive effect on the performance of commercial banks in Sri Lanka.

*H1: ATMs have a positive effect on the performance of commercial banks in Sri Lanka.*

Previous evidence also confirmed that mobile banking is significantly positively related with bank performance. Kamau and Oluoch (2016) observed a positive relationship between the number of mobile banking users and bank performance. Chipeta and Muthinja (2018) stated that mobile banking significantly affects bank performance. Consistent with this literature, we expect a positive relation between mobile banking and bank performance.

*H2: Mobile banking has a positive effect on the performance of commercial banks in Sri Lanka.*

Previous empirical evidence showed that internet banking enhances bank performance. Chipeta and Muthinja (2018) and Muiruri and Ngari (2014) reported a significant positive relationship between the number of internet banking users and bank performance. The authors stated that banks use internet banking to improve accuracy and efficiency as well as the speed and reliability of the banking system. In contrast, Akhisar et al. (2015) found a negative relationship and stated that it is due to the high infrastructure costs and high advertising expenses. Consistent with the majority of the literature, we expect to find a positive relation between internet banking and the performance of commercial banks in Sri Lanka.

*H3: Internet banking has a positive effect on the performance of commercial banks in Sri Lanka.*

Aduda and Kingoo (2012) and Akhisar et al. (2015) found a significantly positive relationship between the number of debit cards issued to customers and bank performance. Kamau and Oluoch (2016) concluded that the successful adoption of credit and debit cards among users of commercial bank services has a positive impact on profits. Thus, in line with these empirical studies, we expect a positive relationship between the use of debit cards and the performance of commercial banks.

*H4: The use of debit cards has a positive effect on the performance of commercial banks in Sri Lanka.*

### **3. Data and Methodology**

#### *3.1 The sample*

At the end of 2020, the Sri Lankan banking sector comprised 26 licensed commercial banks, of which 13 were domestic commercial banks while the rest was foreign banks. We excluded two domestic banks due to data unavailability. We also excluded the foreign banks due to the differences in the operation strategy and the unavailability of data. As a result, the final sample

consists of 13 domestic commercial banks. Findings are based on the annual data collected from published annual reports, banks' websites, and central bank annual reports for the 10 years from 2010 to 2019.

### 3.2 *The variables*

The test variables of the study are proxies for financial innovation. They include the number of ATMs (Akhisar et al., 2015; Shihadeh et al., 2018), the number of mobile banking users (Kamau & Oluoch 2016; Chipeta & Muthinja 2018), the number of internet banking users (Chipeta & Muthinja, 2018; Muiruri & Ngari, 2014), and the number of debit cards issued (Kamau & Oluoch, 2016; Akhisar et al., 2015).

Bank performance is the dependent variable, and the study uses two proxy variables that have been used in many previous studies to measure firm performance in terms of profitability (Akhisar et al., 2015; Menicucci & Paolucci, 2015; Siddik, Sun, Kabiraj, Shanmugan & Yanjuan, 2016). A commonly used measure of firm performance is the return on assets (ROA) (Aduda & Kingoo, 2012; Akhisar et al., 2015; Kamau & Oluoch, 2016; Shihadeh et al., 2018; Victor et al., 2017). ROA measures the profitability of the firm relative to its total assets. It explains how efficiently assets are being used to generate earnings by banks. Higher ROA reflects better performance. We also use return on equity (ROE), which measures the operating profit relative to shareholders' equity. Akhisar et al. (2015), Siddik et al. (2016) and Victor et al. (2017) have used ROE as a measure of firm performance in their studies. A higher ratio indicates better performance.

We also control for bank size and economic conditions. Evidence of a positive relationship between the size and profitability of banks has been found in Sri Lanka (Weersainghe & Perera, 2013; Sufian, 2012; Swarnapali, 2014). Sufian (2013) and Weerasingha and Perera (2013) argue that economies of scale lead larger banks to be more profitable than smaller banks. However, Siddik et al., (2016) found a significant negative effect of bank size on performance in the context of Bangladesh. Athanasoglou, Brissimis, and Delis (2008) argued that during economic slowdowns, banks experience lower profitability due to the reduction of lending. On the other hand, Siddik et al., (2016) stated that, during economic booms where all sectors of an economy perform well, loan demand could increase and lead to higher interest margins for banks. There are several studies supporting that GDP growth has a positive effect on firm performance in the Sri Lankan context (Sufian, 2013; Weerasaingha & Perera, 2013). In our study, the bank size is measured by the logarithm of the total assets of a bank, and the annual real GDP growth of Sri Lanka proxies for economic conditions.

### 3.3 *The empirical models*

To test the relationship between financial innovations and firm performance, the study uses a linear regression model. Most of the previous studies, such as Aduda and Kingoo (2012), Shihadeh et al. (2018), and Siddik et al. (2016), also used linear regression models to assess the effect of financial innovations on bank performance. We specific the regression models as follows:

$$ROE_{it} = \beta_0 + \beta_1 ATMB_{it} + \beta_2 NMB_{it} + \beta_3 NIB_{it} + \beta_4 NDC_{it} + \beta_5 BS + \beta_6 RGDP + \varepsilon_{it} \quad (1)$$

$$ROA_{it} = \beta_0 + \beta_1 ATMB_{it} + \beta_2 NMB_{it} + \beta_3 NIB_{it} + \beta_4 NDC_{it} + \beta_5 BS + \beta_6 RGDP + \varepsilon_{it} \quad (2)$$



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Where  $i$  refers to the bank and  $t$  represents the year.  $\beta_0$  is the intercept, ATMB is the number of ATMs per branch, NMB is the natural logarithm of the number of mobile banking users, NIB is the natural logarithm of the number of internet banking users, NDC is the natural logarithm of the number of debit cards issued in each year, BS is the natural logarithm of bank size measured by the logarithm of total assets and RGDP is the real GDP growth rate.  $\hat{\epsilon}_{it}$  is the regression error term.

### 4. Results and Discussion

#### 4.1 Descriptive Statistics

Table 1 shows the descriptive statistics of the dependent, test, and control variables used in both empirical models. On average, the Sri Lankan banks included in the sample exhibit an ROE of 21.7 percent over the sample period. It ranges from 0.4 percent to 57.8 percent with a standard deviation of 10.5 percent, suggesting a large variation in the performance of banks. The reason for such variability is the differences in the amount of debt in their capital structures. However, the banks in the sample display a ROA of 1.8 percent with a standard deviation of 0.7 percent, indicating much lower variation across firms.

The test variables show wide variations as well, particularly mobile banking and debit cards. Although mobile banking was in operation for the last decade, most of the banks in the sample have not witnessed much issuance of debit cards during the sample period. Consequently, the minimum value for these variables is 0. In addition, the minimum value of ATMB (ATM/branch) is less than one, indicating that some branches do not have ATMs. The variability of mobile banking, Internet banking, and debit cards is also very large. Among the control variables, the standard deviation of bank size is also large, which indicates that the scale of assets of Sri Lankan commercial banks varies greatly, especially among the six systemically important banks. The average GDP growth is 5.25% with a standard deviation of 2.3%.

**Table 1**

#### *Descriptive Statistics*

Variable	Mean	Std. Dev.	Minimum	Maximum
ROE	0.217	0.105	0.004	0.578
ROA	0.018	0.007	0.001	0.436
ATMB	1.346	0.577	0.486	3.095
NMB	7.266	5.497	0.000	13.736
NIB	10.287	1.530	6.691	12.889
NDC	10.509	3.982	0.000	13.812
BS	26.480	1.123	23.649	28.513
RGDP	0.0526	0.0230	0.023	0.0915

Note: ROE is the return on equity, ROA is the return on assets, ATMB is automated teller machines per branch, NMB is the number of mobile banking users, NIB is the number of internet banking users, NDC is the number of debit cards, BS is the bank size and RGDP is the Gross Domestic Product growth rate.



## 3.2 The correlation matrix

Table 2 shows the correlation matrix for all variables used in the study. The correlation between ROE and ROA is 0.41 indicative of a moderate relationship. This is because although the two ratios measure firm performance, the components of each of the ratios are different.

**Table 2***Correlation Matrix*

Variables	ROE	ROA	ATMB	NMB	NIB	NDC	BS	RGDP
ROA	0.408*** (4.648)							
ATMB	-0.109 (-1.142)	0.089 (0.932)						
NMB	0.085 (0.886)	-0.256*** (-2.749)	0.452*** (5.272)					
NIB	0.459*** (5.372)	0.172* (1.815)	0.377*** (4.229)	0.7416*** (11.488)				
NDC	0.242** (2.597)	0.011 (0.112)	0.248*** (2.661)	0.6121*** (8.0438)	0.688*** (9.855)			
BS	0.451**** (5.249)	-0.069 (-0.713)	0.316*** (3.464)	0.7111*** (10.5103)	0.916*** (23.782)	0.760*** (12.155)		
RGDP	0.302*** (3.295)	0.400*** (4.5368)	-0.205** (-2.180)	0.5444*** (-6.7441)	-0.364*** (-4.057)	-0.345*** (-3.824)	0.375*** (-4.200)	

Note: ROE is the return on equity, ROA is the return on assets, ATMB is automated teller machines per branch, NMB is the number of mobile banking users, NIB is the number of internet banking users, NDC is the number of debit cards, BS is the bank size and RGDP is the Gross Domestic Product growth rate. *Standard errors are in parentheses.* \* significant at 10%, \*\* significant at 5%, and \*\*\* significant at 1%.

The correlations show that internet banking (NIB) and debit cards (NDB) are positively correlated with ROE while NIB is also significantly positively correlated with ROA. However, mobile banking (NMB) is significantly negatively related with ROA and insignificantly positively correlated with ROE. The firm size is also significantly positively correlated with ROE. The RGDP also shows a moderate and significant positive relationship with both ROE and ROA. The presence of multicollinearity may lead to spurious correlations between variables and the Variance Inflation

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Factors (VIF) show no evidence of multicollinearity problems. Further, normality tests confirm that both ROE and ROA are normally distributed.

### 3.3 Regression Results

Table 4 reports the regression results for the two models. Overall, most of the test and control variables have a statically significant relationship with firm performance measures. Based on the adjusted  $R^2$ , model 1 explains 54% of the variation in ROE while model 2 explains 28% of the variation in ROA. The F-statistics reported in both models are significant at the 1% level of significance, confirming the validity of the models used in the study.

**Table 4**

#### *Regression Results*

Variable	ROE				ROA			
	Coefficien t	Std. Error	t-Stat	Prob.	Coefficien t	Std. Error	t-Stat	Prob.
Constant	-0.000	0.065	-0.000	1.000	-0.000	0.082	-0.000	1.000
ATMB	-0.242	0.073	-3.291	0.001***	0.283	0.092	3.065	0.003***
NMB	-0.194	0.114	-1.676	0.097*	-0.251	0.143	-1.754	0.082*
NIB	0.579	0.174	3.335	0.001***	0.634	0.218	2.903	0.005***
DB	-0.122	0.101	-1.205	0.231	0.229	0.128	1.791	0.076*
BS	0.400	0.182	2.203	0.030**	0.571	0.229	2.499	0.014**
RGDP	0.467	0.078	6.016	0.000***	0.384	0.098	3.929	0.000***
Adj R-sq		0.543			0.276			
		22.57						
F-statistic		3			7.914			
Prob (F-statistic)		0.000			0.000			

Note: ROE is the return on equity, ROA is the return on assets, ATMB is automated teller machines per branch, NMB is the number of mobile banking users, NIB is the number of internet banking users, NDC is the number of debit cards, BS is the bank size and RGDP is the Gross Domestic Product growth rate. *Standard errors are in parentheses.* \* significant at 10%, \*\* significant at 5%, and \*\*\* significant at 1%.

#### *3.3.1 ATMs and bank performance*

The findings of the relationship between ATMs and bank performance show mixed results between ROE and ROA. ATMs are positively related with ROA at the 1% level of significance. This result is consistent with Akhisar et al. (2015), which reported that an increase in the number of ATMs leads to higher ROA by reducing the operational expenses of banks. Furthermore, Chipeta and Muthinja (2018), Shihadeh et al. (2018), and Ariyasena and Jayarathne (2019) also found a significant positive relationship between ATMs and firm performance. The findings reveal that ATMs have the potential to generate profits for banks.

However, ATMs and ROE are negatively related. A possible explanation for the negative relationship is the large investment and operational expenses such as technology, rent, security, and maintenance cost associated with ATMs. The installation of machines increases overall capital expenditure. Consequently, the higher capital expenditure may lead to lower ROE. It should be noted that to manage higher costs, most small banks in Sri Lanka have moved to a shared ATM platform with other banks and all the banks have linked their customers to a shared network referred to as Lanka Pay.

### *3.3.2 Mobile banking and bank performance*

The hypothesis that mobile banking has a positive impact on bank performance is rejected in this study. As results show, the usage of mobile banking has a significant negative impact on both ROE and ROA. However, most prior research found that mobile banking has a positive effect on bank profitability. For instance, Chipeta and Muthinja (2018) reported that mobile banking significantly positively affects firm performance in terms of both ROA and ROE confirming the dominance of mobile banking in Kenya. Similarly, Kamau and Oluoch (2016) observed a positive relationship between the number of mobile banking users and bank performance. However, the adoption of mobile payments varies across countries and depends on the level of economic growth and financial literacy of the country.

Banks in the sample have not witnessed much use of mobile banking during the entire sample period of ten years, and mobile banking is a relatively new concept in Sri Lanka. The implication is that the impact of mobile banking is likely to be felt more in the future and, it is too early to see an impact on firm performance in these results.

### *3.3.3 Internet banking and bank performance*

The regression results indicate a significant positive relationship between internet banking and both measures of bank performance at the 1% level of significance. Consistent with our hypothesis, these results suggest that commercial banks with a higher number of internet banking users are more profitable than commercial banks with a lower number of internet banking users in Sri Lanka. The results relating to internet banking and firm performance are supported by prior research. Chipeta and Muthinja (2018) observed a positive relationship between the number of internet banking users and bank performance. Similarly, Stoica et al. (2015) showed that the use of internet banking has led to an increase in the performance of some banks in their sample.

### *3.3.4 Debit cards and bank performance*

We find mixed results relating to the hypothesis that the usage of debit cards is positively related with bank performance. The results show a significant positive relationship with ROA at the 10% level of significance. These results are consistent with Akhisar et al. (2015) who reported that increases in the use of debit cards positively impact profitability. Aduda and Kingoo (2012) also reported a positive relationship between the number of debit cards issued to customers and the firm's performance in terms of ROA. Furthermore, Kamau and Oluoch (2016) found that the successful adoption of debit cards among users of commercial bank services has

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a positive effect on their returns. However, the relationship between debit cards and ROE is negative and not statistically significant.

Both control variables—firm size and economic growth—are significantly positively related with both measures of bank performance. Consistent with the expectations, larger banks are more profitable and higher economic growth leads to higher profitability for banks.

### **4. Conclusions and Recommendations**

The main purpose of this study is to examine the effect of financial innovations on bank performance in the context of commercial banks in Sri Lanka using a sample of 11 commercial banks for the 10 years from 2010 to 2019. The bank performance is measured by ROE and ROA, and financial innovations are proxied by the number of ATMs per branch, and the number of users of mobile banking, internet banking, and debit cards.

The empirical results suggest that all financial innovation variables have statistically significant effects on bank performance. However, the influence is not uniform across ROE and ROA. The results indicate that the number of ATMs is positively related with ROA and negatively related with ROE. The use of mobile banking has a significant negative effect on both ROE and ROA. We find that internet banking has a significant positive impact on both ROA and ROE. Internet banking is found to have the highest impact on both ROA and ROE among other innovation variables. The use of debt cards has a significant positive impact on ROA and an insignificant negative effect on ROE.

With regards to the level of adaption of financial innovation in Sri Lanka, ATMs, internet banking and debit cards seem to be widely used by all banks in Sri Lanka, but not mobile banking. Especially, most of the banks in Sri Lanka have not witnessed the use of mobile banking during the period under study. The implication is that the impact of mobile banking is likely to be felt positively more in the future.

Based on the findings, the study suggests several key points for policy consideration. Firstly, policymakers should encourage banking institutions to invest in financial innovations for their products and services which will enhance bank performance in terms of profitability. It was observed that although commercial banks have adopted new products and services, many such products have not been brought to the public attention. In addition, bank management needs to identify innovation in general and financial innovation in particular that creates financial value addition to the banking institutions.

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