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What is the Impact of E-banking on the Performance of Commercial Banks in Bangladesh? Evidence from Panel Data Analysis

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Abstract

This article investigates the impact of e-banking on the performance of commercial banks in Bangladesh using balanced panel data from 12 Bangladeshi commercial banks covering ten years from 2009 to 2018. The performance of banks is measured by banks' return on assets (ROA). We use ROA as a dependent variable and a proxy of e-banking, bank-specific variables, and macroeconomic variables as independent variables. Fixed effects model (FEM) and random effects model (REM) are applied to run regression based on the performance measure of ROA. The Hausman test is performed to select an appropriate model between FEM and REM, and REM is found appropriate. The generalised method of moments (GMM) is also applied to examine the relationship between e-banking and banks' performance to control heterogeneity effects. Results from both REM and GMM reveal that e-banking has a positive and significant impact on the banks' performance at 5% and 10% significance levels, respectively. Empirical findings indicate that the higher is the experience of e-banking, the greater extent and significance is the performance of the banks. The study suggests that the Government policymakers should take policies to introduce electronic banking in the banking industry and provide adequate knowledge

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and information about these technologies with appropriate use to employees and customers to improve the performance of the banking sector.

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1. Introduction

Nowadays, the banking sector is highly influenced by Information and Communication Technology (ICT), known as electronic banking (e-banking). In Bangladesh, the number of scheduled commercial banks is 57 (Bangladesh Bank, 2018). Generally, most private commercial banks (PCBs) are busy maximising their profit by serving attractive modern technologies to their clients. Information and technological revolution motivates banks to spend more on technology to maximise return and attract more customers who would not accept less than above-average services (Al-Smadi and Al-Wabel, 2011). Modern technologies have been accepted by both the banks and their clients in Bangladesh. We see that bank clients in Bangladesh are increasing, and transaction velocity is also increasing. E-banking has a higher potentiality, though the concept of e-banking is not so old in Bangladesh. (Ahmed et al., 2011). Many banks that use electronic banking now offer sophisticated tools, including rate alerts, account aggregation, stock quotes and portfolio managing programs to help manage all assets more effectively (Vila et al., 2013).

E-banking is a process that enables bank's customers to access accounts and general information on bank's products and services through electronic means like using web technology, telecommunications networks, other electronic devices, computers and cellular phones. A customer can carry out banking transactions electronically without physically entering a bank or financial institution (Simpson, 2002). It is a type of banking where assets are moved through a trade of electronic signals instead of through a trade of money, checks, or different sorts of paperdocuments.E-banking resembles traditional payment, inquiry, and data handling frameworks, varying in that it uses an alternate conveyance channel. Any choice to receive e-banking is regularly affected by various factors. This incorporate client care improvement and focus costs, all of which persuade banks to survey their electronic business strategies (Kondabagil, 2007). Banking through the internet has emerged as a strategic resource for achieving higher efficiency, control of operations, and cost reduction by replacing paper-based and labour-intensive methods with automated processes, thus leading to higher productivity and profitability (Malhotra and Singh, 2009).

In Bangladesh, foreign commercial banks (FCBs) play an innovative role in hosting e-banking with modern technology in retail banking. At the same time, the

state-owned commercial banks (SCBs) and the private commercial banks (PCBs) adopt e-banking services in the late 1990s. The performance of banks is that banks are significantly affected by adopting e-banking to the respective banks. Therefore, there is a crucial relationship (positive/negative) between the performance of banks and the adoption of e-banking. Many studies have been found considering the impact of e-banking and the performance of banks, but they have found different results and findings.

E-banking affects positively on the performance of banks in terms of return on equity (ROE), return on assets (ROA) and net interest margin (NIM) with a time lag of two years, while a negative impact is observed in the first year of adoption because of associating higher costs in the preliminary stage (Siddik et al., 2016, Oyewole et al., 2013). E-banking influences significantly and positively on the performance of banks (Sarker et al., 2015, Ngango et al., 2015, Aduda and Kingoo, 2012, Abdullai and Micheni, 2018). Yang et al. (2017) observe that e-banking improves the Chinese bank performance in terms of return on equity (ROE), return on assets (ROA) and operating margin (OM). On the contrary, Onay and Ozsoz (2011), Khrawish and Al-sa'di (2011), Malhotra and Singh (2009), and Abaenewe et al. (2013) report a negative impact of e-banking on the performance of banks. So, it is clear that there is mixed empirical evidence for the impact of e-banking on the performance of banks.

In addition, there is a relative dearth of empirical studies that provide quantitative evidence on the impact of e-banking on banks' performance in Bangladesh, although the rate of adoption of e-banking by Bangladeshi commercial banks is increasing. It is, therefore, relevant for supervisors, bankers, bank regulators and researchers to understand how the performance of commercial banks in Bangladesh is affected by e-banking. To provide a systematic analysis of the impact of e-banking on the performance of Bangladeshi banks is the primary purpose of this study, and this study uses a sample of 12 commercial banks of Bangladesh that have adopted e-banking.

2. Literature Review

2.1 Concept of E-Banking

Electronic banking is known as e-banking. The term e-banking can be explained differently from different perspectives, whereas researchers across the world have made extensive efforts to provide a precise and all-inclusive concept of e-banking (Siddik et al., 2016). E-banking is a system through which financial service providers, individuals, customers, and businesses can access their accounts, do

transactions and obtain the latest information on financial products and services from public or private networks, such as the internet. E-banking is a harmless, fast, proficient and straightforward electronic service to perform online banking services 24 hours a day and seven days a week. It is also a form of banking in which funds are transferred through an exchange of electronic signals instead of cash, checks, or other types of paper documents. The funds are transferred through electronic banking when someone takes cash from an automated teller machine (ATM) or pays for fares using a debit card.

E-banking is time-saving, fast and efficient than traditional banking. In modern busy days, people are finding it challenging to spend time on personal banking. There are different types of e-banking services that we can use for various bank transactions such as: PC banking includes internet banking and online banking, mobile banking (Bkash, Rocket, Ucash, among others, in Bangladesh), tele-banking, automated teller machines (ATMs), point of sale (POS), electronic funds transfer (EFT), TV banking, electronic clearing services (ECS), ATM cards and others. Internet banking is a boon for all such clients.

2.2 Previous Empirical Studies

Oyewole et al. (2013) observe the e-banking and banks performance in Nigeria using panel data of eight banks that have adopted e-banking from 2000 to 2010. The pooled OLS estimations indicate that e-banking influences banks' performance in terms of ROA and NIM with a time lag of two years, while a negative impact is observed in the first year of adoption. Hernando and Nieto (2007) explore the impact of internet banking on banks' financial performance. The study uses a sample of 72 commercial banks operating over the period 1994-2002. The results reveal an improvement in banks' profitability, which becomes significant after one and a half years in terms of ROA and after three years in terms of ROE.

Hossein (2013) examined the impact of e-banking on bank profitability in some selected Asian countries. The results indicate that internet banking starts contributing to banks' ROE with a time lag of three years while a negative impact is observed for one year lagged.

Baten and Kamil (2010) estimate the economic prospects of e-banking and explain the present scenario of banking sectors in Bangladesh. The study results show that e-banking supports several advantages to the Bangladeshi banking sector whereas, the Bangladeshi customers have not enough knowledge regarding e-banking which is understood by the banking sector in Bangladesh. Migdadi (2012) identifies the impact of adopting e-banking on branches operations strategy in developing economies from 1999 to 2008 using 15 local banks in

Jordan. The results reveal that branches are still the main channels of conducting banking transactions, and e-banking is parallel with branches.

Hassan et al. (2013) examine the impact of e-banking products on the performance of Nigerian deposit money banks using the listed twenty-one (21) Nigerian deposit money banks (DMBs) over the period from 2006 to 2011. The study results reveal that the adoption of electronic banking products (E-mobile and ATM transactions) has strongly and significantly impacted the performance of Nigerian banks. Khrawish and Al-sa'di (2011) investigate the impact of E-banking on bank profitability using primary data from 2000 to 2009 in Jordan. The study results indicate that there is no significant effect of E-banking services on the profitability of recent adopters' banks in terms of ROE and ROA, but it is significantly affected by E-banking services in case of interest margin.

Musa et al. (2015) explore the impact of online banking on the performance of the Nigerian banking sector. The study uses 21 commercial banks in Nigeria covering two specified periods: pre-consolidation (2000-2004) and post-consolidation (2005-2009). The study reveals that e-banking has revolutionised the banking industry by scaling borders and bringing about new opportunities. Al-Smadi and Al-Wabel (2011) analyse the impact of E-banking on the performance of Jordanian banks using panel data of 15 Jordanian banks for the period 2000-2010. The results show that the costs associated with adopting electronic banking are still higher than revenues from provision provided by electronic services.

Malhotra and Singh (2009) examine the impact of internet banking on bank performance and risk in India using panel data of 85 commercial banks from 1998 to 2006. The results show that internet banking has no significant impact on the profitability of banks. At the same time, there is a significant negative association with the risk profile of the banks in internet banking. Onay and Ozsoz (2011) evaluate the impact of internet banking on Brick and Mortar branches in Turkey using a panel of eighteen (18) retail banks that operate in Turkey from 1990-2008. The study results indicate that the adoption of internet banking has a negative impact on bank profitability after two years of adoption as internet banking increases competition and, therefore, lower interest income.

The earlier literature has some lacking which creates scope to conduct a further study for examining the impact of e-banking on the performance of banks. In most cases, the earlier studies are descriptive, considering the impact of e-banking on the performance of banks. To fill these gaps that are found in earlier studies, this study is an effort. Again, to estimate the relationship between e-banking and the performance of banks, the regression techniques such as, fixed effects model (FEM), random effects model (REM) along with generalised

method of moments (GMM) have not been used in earlier studies. Such crucial regression techniques (FEM or REM and GMM) to examine the impact of e-banking on the performance of commercial banks in Bangladesh are employed in our study. And this study is valued electronic banking in terms of the number of experience years of adopting e-banking by banks which have been not found in earlier studies. It is relevant to conduct a research to estimate the impact of e-banking considering the number of experience years by banks, since most of the banks in developed and developing countries like Bangladesh have already adopted e-banking technology.

3. Methodology

3.1 Research Design

The study uses panel data consisting of cross-sectional information, which captures individual variability, and time-series information, which captures dynamic adjustment. The study analyses the collected data statistically, and fixed effects model (FEM), random effects model (REM) and generalised method of moments (GMM) regression techniques are employed to examine the relationship between e-banking as well as other control variables and the performance of commercial banks.

3.2 Data Sources and Description

Twelve commercial banks were selected. Among them, 3 are the state-owned commercial banks (SCBs), and 9 are the private commercial banks (PCBs). We collect two types of data such as: primary data and secondary data. We collect primary data through personal visiting to the selected banks' branches at Rajshahi. Interviews are taken directly from the branch managers using questionnaire with respect to the first adopting year e-banking. We collect secondary data from the respective bank's Annual Reports covering the period from 2009 to 2018. Finally, macroeconomic data were collected from the 'World Data Atlas' website from 2009 to 2018.

3.3 Variables

3.3.1 Dependent variable

We take the banks' performance as the dependent variable. We use return on assets (ROA) as a proxy variable for the bank's performance. ROA is considered the primary measure of banks' profitability, and the net profits are expressed as a percentage of total assets. It illustrates the profits earned per taka of assets and

indicates how effectively the authority manages the bank's assets to generate revenues (Jahan, 2012; Golin, 2001). This measure is used by Dey (2014), Abaeenewe et al. (2013), Khrawish and Al-Sa'di (2011), Oyewole et al. (2013) and Siddik et al. (2016). To compute ROA, we calculate profit after taxations divided by total assets.

3.3.2 Independent Variable

This research is conducted to investigate the impact of e-banking on the performance of commercial banks in Bangladesh. Hence, e-banking is considered the sole independent variable. E-banking takes value from the number of experienced years of adopting e-banking by respective commercial banks. Mapharing and Basuhi (2017), Yang et al. (2018), Siddik et al. (2016) and Oyewole et al. (2013) point out that e-banking influences positively on banks' performance indicating the higher is the number of experience of adopting e-banking, the greater is the profitability of banks. We expect a positive sign for e-banking.

3.3.3 Control Variables

To control other variables, it is necessary to use them in the literature as possible determinants of banks' performance to isolate the effect of e-banking on banks' performance. Two sets of control variables are expected to influence banks' performance: the bank-specific and the macroeconomic determinants. The set of bank-specific variables are as follows:

Capital Adequacy: Capital adequacy (CAPTL) is a critical determinant of a bank's performance which plays a vital role in supporting the safety and soundness of banks (Flamini et al., 2009). A bank with a higher capital to assets ratio needs lower external financing, as external financing thereby reduces high cost, which provides higher profitability for banks (Naceur and Goaied, 2001). As a proxy of bank capital (CAPTL), we use the equity capital ratio to total assets and expect a positive sign for this variable.

Bank Size:The size (SZE) of the bank, as a control variable, is included to account for size-related economies and diseconomies of scale. According to Flamini et al. (2009), modern financial intermediation theory predicts the efficiency benefits of a bank's size, implying that larger banks may experience higher due to economies of scale. We compute the total assets in the Billion Taka of banks to measure the size.

Liquidity: How much a bank can meet the short term obligations is indicated by liquidity (LQDTY). A lower rate of return is observed in the case of liquid assets. High liquidity would negatively affect the bank's profitability (Guru et al.,

2000 and Siddik et al., 2016). On the other hand, Samad (2015) reports a significant positive impact of liquidity on the bank's profitability. We use the ratio of total loans to total deposits to measure liquidity (LQDTY).

Credit Risk:Another critical determinant of a bank's performance is Credit risk (CRRK). Bank profitability decreases if credit risk increases. Banks can improve their profitability by minimising the credit risk level through improving their appropriate lending policies (Al-Smadi and Al-Wabel, 2011, and Siddik et al., 2016). To measure credit risk (CRRK), we use the ratio of nonperforming loans to total loans, and a negative sign is expected for this variable.

Earnings per Share:An important determinant of bank performance is Earnings per share (EPS). Earnings per share are calculated as a bank's profit divided by the outstanding shares of its common stock. To measure earnings per share, we use the ratio of a bank's profit to the outstanding shares of its common stock. We expect a positive sign for this variable.

Operating Efficiency:Operating efficiency (OPE) is another significant determinant of banks' performance. Naifer (2010) finds that the bank with the higher operating efficiency, the lower the bank's profit. To measure operating efficiency (OPE), we use the ratio of total operating expenses to total operating income. A negative sign is expected for this variable. Besides the above bank-specific variables, two macroeconomic variables are used as control variables. The macroeconomic variables are as follows:

Economic Growth: As a control variable, economic growth (RGDP) impacts the bank's performance. During economic slowdowns, banks' lending could reduce and deteriorate credit quality, lowering the bank's performance (Athanasoglou et al., 2008). We measure economic growth by real GDP growth and expect a positive sign for this variable.

Inflation Rate: The relationship between inflation and the bank's performance relies on whether the inflation rate in the future is anticipated or not (Flamini et al., 2009). Trujillo-Ponce (2013) shows a positive relationship between inflation and banks' return on assets (ROA). To measure the inflation rate (INF), we use the current inflation rate of the country. We expect a positive sign for this variable. The calculating procedures and the explanations of these variables are summarised in Table 1.

Table 1: Summary of variables and their specification used in this study

Variables			Acronym	Measurement	Expected Sign
Dependent variable		Return on Asset	ROA	Net profit (after tax) / total assets	N/A
Independent variable		Electronic Banking	E-BANK	Number of experience years of adopting e-banking by banks	+
		Capital Adequacy	CAPTL	Equity capital / total assets	+
		Bank Size	SZE	Total assets	+ / -
		Liquidity	LQDTY	Total loans / total deposits	+ / -
Control variables	Bank-specific variables	Credit Risk	CRRK	Nonperforming loans / total loans	-
		Earnings per Share	EPS	(Net income-Preferred dividends) / Weighted average common shares outstanding	+
		Operating Efficiency	OPE	Total operating expenses / total operating incomes	-
	Macroeconomic variables	Economic Growth	RGDP	Real GDP growth rate	+
		Inflation Rate	INF	Current period inflation rate	+

3.4 Regression Techniques and Model Specification

Random effects model (REM) and fixed effects model (FEM), and generalised method of moments (GMM) is applied to determine the relative importance of independent and each control variable in influencing the banks' performance.

3.4.1 Fixed Effects Model (FEM)

A fixed-effects model is a statistical model whose parameters are fixed or non-random quantities in statistics. The fixed effect is because each bank's intercept does not vary over time, i.e., time-invariant though the intercept may differ across the selected banks. (Adeusi *et al.*, 2014). However, fixed effects models help with controlling for unobserved heterogeneity when this heterogeneity is constant over time. The individual-specific effects are correlated with the independent variables is an assumption of fixed effect. The basic equation for the fixed effects model (FEM) is:

$$Y_t = \alpha_i + \beta_1 X_t + \varepsilon_t \quad [For\ t = 1\ldots,T \text{ and } i = 1,\ldots,N] \tag{1}$$

Where, $Y_{\_it}$=the dependent variable observed for individual i and time t; $X_{\_it}$= the independent variable; β_1= the coefficient for independent variable;α_i = the unknown intercept for individual effect; ε_{it} = the error term.

3.4.2 Random Effects Model (REM)

A random-effects model, also known as the variance components model, is a statistical model where the model parameters are random. The random-effects model helps control unobserved heterogeneity when the heterogeneity is time-invariant and not correlated with independent variables. The constant variance of the individual-specific effect is also an assumption of the random-effects model. Random effects then are efficient and should be used (over fixed effects) if the assumptions are satisfied. The basic equation for the random-effects model (REM) is:

$$Y_t = \alpha_0 + \beta_1 X_t + \mu_i + \varepsilon_t \quad (2)$$

Where, Y_{it} = the dependent variable for individual i and time t; X_{it} = the explanatory variable for individuali and time t; β_1 = the coefficient of explanatory variable; μ_i = the individual time-invariant effect of i; ε_{it} = the error term; α_0 = the constant/intercept term. The random-effects model adds the term μ_i, but this term does not appear in the fixed-effects model.

3.4.3 Generalised Method of Moments (GMM)

Generally, Pooled OLS, Fixed Effects and/or Random Effects models are employed for panel data considering the banking literature. However, when a lagged dependent variable is important, particularly in a few periods and many observations, a difficulty arises with these models (Nickell, 1981). If there is a correlation between the independent variables and the lagged dependent variable to some degree, the coefficients may also be seriously biased (Heffernan and Fu, 2014). In this case, the dynamic panel data analysis based on the generalised method of moments (GMM) is mainly used to solve this problem. The solutions to the problems of endogeneity of the variables, simultaneity bias, reverse causality and omitted variables are provided by the GMM. System GMM estimator to combine the first difference in equations with equation at the level in which the variables are instrumented by their first differences is proposed by Blundell and Bond (1998). The basic equation for the system GMM approach is:

$$Y_t = \alpha_0 + \gamma_1 Y_{t-1} + \beta_1 X_t + \mu_i + \varepsilon_t \quad (3)$$

Where, Y_{it}= the dependent variable for individual i and time t; $Y_{(it-1)}$ = the lag dependent variable for individual i and time t; X_{it} = the explanatory variable for individual i and time t; γ_1= the lag coefficient; μ_i= unobserved individual time-invariant effect; ε_{it} = the error term; α_0= the constant term.

3.4.4 Empirical Model Specification

The fixed effects method (FEM) or random-effects method (REM) is taken after the Hausman test to estimate the relationship between the dependent and explanatory variables. To make the estimates more appropriate and relevant, the generalised method of moments (GMM) is also applied to establish the relationship between dependent and explanatory variables. The empirical Model 1, Model 2, and Model 3 are shown for FEM, REM and GMM, respectively, concerning our study.

$$Model\ 1: ROA_{it} = \alpha_i + \beta_1 EBANK_{it} + \beta_2 CAPTL_{it} + \beta_3 SZE_{it} + \beta_4 LQDTY_{it} + \beta_5 CRRK_{it} + \beta_6 EPS_{it} + \beta_7 OPE_{it} + \beta_8 RGDP_{it} + \beta_9 INF_{it} + \varepsilon_{it} \quad (4)$$

$$Model\ 2: ROA_{it} = \alpha_0 + \beta_1 EBANK_{it} + \beta_2 CAPTL_{it} + \beta_3 SZE_{it} + \beta_4 LQDTY_{it} + \beta_5 CRRK_{it} + \beta_6 EPS_{it} + \beta_7 OPE_{it} + \beta_8 RGDP_{it} + \beta_9 INF_{it} + \mu_i + \varepsilon_{it} \quad (5)$$

$$Model\ 3: ROA_{it} = \alpha_0 + \gamma_1 ROA_{it-1} + \beta_1 EBANK_{it} + \beta_2 CAPTL_{it} + \beta_3 SZE_{it} + \beta_4 LQDTY_{it} + \beta_5 CRRK_{it} + \beta_6 EPS_{it} + \beta_7 OPE_{it} + \beta_8 RGDP_{it} + \beta_9 INF_{it} + \mu_i + \varepsilon_{it} \quad (10)$$

Where, ROA_{it} = return on assets of bank i for year t; $EBANK_{it}$= number of experience years of adopting e-banking of bank i for year t; $CAPTL_{it}$ = capital adequacy ratio of Banki for year t; SZE_{it} = total asset size of bank i for year t; $LQDTY_{it}$= liquidity of bank i for year t; $CRRK_{it}$= credit risk of bank i for year t; EPS_{it} = earnings per share of bank i for year t; OPE_{it} = operating efficiency of bank i for year t; DPA_{it} = deposit to asset ratio of bank i for year t; RGD_{it} = GDP growth rate for year t; INF_{it}= inflation rate for year t; t = period (years); i= cross-sectional observations (Banks); $\beta_1, \ldots\ldots, \beta_9$= coefficients; $\varepsilon_{(it)}$= error term.

4. Empirical Results and Discussions

4.1 Correlation Analysis

A widely used statistical estimation technique to determine the degree of relationship between two explanatory variables is correlation analysis, shown in Table 2.

The correlation matrix (shown in Table 2) indicates the degree of relationship between the explanatory variables. It is seen from Table 3, the largest value of the correlation coefficient is 0.565 between earnings per share (EPS) and credit risk (CRRK). There is no multicollinearity problem if the correlation coefficient is low. Gujarati (2004) reports that multicollinearity may be a serious problem if a high pair-wise correlation coefficient exists between two explanatory variables,

Table 2: Matrix of Correlations between Independent Variables

Variables	EBANK	CAPTL	SZE	LQDTY	CRRK	EPS	OPE	RGDP	INF
EBANK	1.000								
CAPTL	-0.050	1.000							
SZE	-0.039	-0.260	1.000						
LQDTY	0.352	-0.115	-0.353	1.000					
CRRK	-0.185	0.002	0.178	-0.148	1.000				
EPS	-0.440	-0.052	0.120	-0.379	0.565	1.000			
OPE	-0.051	0.041	-0.009	-0.008	-0.034	0.017	1.000		
RGDP	0.448	0.087	0.436	0.270	0.048	-0.383	0.071	1.000	
INF	-0.220	-0.059	-0.199	-0.024	-0.087	0.046	-0.069	-0.223	1.000

say, over 0.8. However, in our analysis, the highest correlation coefficient is 0.565, which is lower than 0.8. So, the multicollinearity problem does not appear between explanatory variables.

4.2 Hausman's (1978) Specification Test

Hausman test is a crucial specification test that helps decide between random effects model (REM) and fixed effects model (FEM). The random-effects model is biased, and the fixed effects model is the appropriate estimation procedure if the Hausman test rejects the null hypothesis. However, if the Hausman test accepts the null hypothesis, the random-effects model is more appropriate than the fixed effects model. The hypotheses are as follows:

Null: Random effects is appropriate

Alternative: Fixed effects is appropriate

Table 3 shows the output of the Hausman test for one dependent variable, ROA. Here, the null hypothesis is accepted as the Probability>χ^2value is 0.0568which is greater than 5%. It indicates that the random-effects model (REM) is appropriate rather than the fixed effects model (FEM). So, it is relevant to estimate the Model 2: ROA rather than Model 1: ROA between the two models.

Table 3: Output of Hausman's Specification Test

Hausman Test	Model 1: ROA (FEM)	Model 2: ROA (REM)
χ^2		15.12
Probability> χ^2		0.0568

4.3 Regression Results

Table 4 shows the REM and GMM results for ROA, where R^2 indicates that the explanatory variables explain 28.73% variability in the dependent variable (Return on Assets). The Sargan test p-value is 0.8443, which accepts that the hypothesis of over-identifying restrictions is valid. ROA is also positively and

Table 4: REM and System GMM Regression Results for Model 2 and Model 3

Explanatory Variables	REM Results for Model 2: ROA			System GMM Results for Model 3: ROA		
	Coefficient	t-value	p-value	Coefficient	t-value	p-value
ROA (L1)				0.1517179*	1.83	0.067
EBANK	0.0007695**	2.00	0.046	0.0021237*	1.81	0.070
CAPTL	0.0320802*	1.83	0.067	0.0520488**	2.13	0.034
SZE	0.0000104	0.59	0.554	0.0000162	0.71	0.477
LQDTY	0.0248017	1.34	0.180	-0.0180384	-0.61	0.545
CRRK	-0.023955***	-4.43	0.000	-0.029188***	-4.69	0.000
EPS	0.0001166	1.45	0.147	0.0003322***	2.88	0.004
OPE	-0.0016404	-1.53	0.126	-0.0007874	-0.67	0.505
RGDP	-0.0051722	-1.31	0.189	0.0015587	0.28	0.783
INF	0.0031145***	3.47	0.001	0.0057674***	4.28	0.000
Constant	-0.0094543	-0.42	0.676	-0.0615263**	-2.12	0.034
Overall R^2		0.3400				
R^2 between		0.5345				
R^2 within		0.2873				
Wald χ^2		54.55			74.49	
Prob>χ^2		0.0000			0.0000	
Sargan test (p-value					33.7009 (0.8443)	

Note: *, ** and *** indicate 10, 5 and 1 percent significance levels respectively

significantly related to the lagged value of ROA proxied by ROA (L1), which reveals that banks with a high level of ROA in the previous year earn more ROA in the current year.

E-banking (EBANK) has a significant positive impact for both results (REM and GMM) on the performance of commercial banks in terms of return on assets (ROA). EBANK positively influences ROA at the significance levels 10% and 5% for Model 2 and Model 3, respectively. If the number of years of experience of adopting e-banking by commercial banks in Bangladesh increases, the banks' ROA improves, and thus, the profits of commercial banks in Bangladesh improve. This result is similar to the studies by Yang et al. (2018), Siddik et al. (2016), Oyewole et al. (2013), Akram and Allam (2010), Hernando and Nieto (2007), Mapharing and Basuhi (2017) and Ngango et al. (2015) who find that e-banking has a positive and significant effect on performance in terms of ROA for studied banks.

Capital adequacy has a significant positive impact on the performance of commercial banks in Bangladesh in terms of ROA for both models (Model 2 and Model 3). The result implies that the higher the equity to assets ratio, the higher the Bangladeshi commercial banks' profits in terms of return on assets. This result is consistent with studies by Rahman et al. (2015), Oyewole et al. (2013), Malhotra and Singh (2009), San and Heng (2013), and Tam et al. (2017), who find a significant positive relationship between capital adequacy and banks' ROA.

Both the REM and GMM results show a significant [at 1% significance level] negative relationship between banks' return on assets and credit risk. An increase in banks' credit risk is associated with a decline in the profitability of commercial banks in Bangladesh. This result is similar to the findings by Athanasoglou et al. (2008), Flamini et al. (2009), Al-Smadi and Al-wabel (2011), Siddik et al. (2016), Oyewole et al. (2013) and Tam et al. (2017).

The GMM results reveal that earning per share has had a significant [at 1% significance level] positive effect on the banks' ROA. Thus, an increase in earnings per share improves banks' performance, which is consistent with the finding by Saeed and Tahir (2015). Inflation has a significant [at 1% significance level] positive impact on the performance of commercial banks in Bangladesh for both results (REM and GMM). This result is similar to the finding of the studies by Goddard et al. (2004), Tam et al. (2017), Malhotra and Singh (2009) and Athanasoglou et al. (2008). Whereas bank size, liquidity, operating efficiency and GDP growth rate have insignificant effects with mixed direction on the performance of banks in terms of return on assets.

5. Conclusions and Recommendations

E-banking is one of the critical determinants to affect the performance of commercial banks in Bangladesh. Various other factors affect the banks' performance as well. The main objective of this research is to investigate the impact of e-banking technology on the performance of commercial banks in Bangladesh. Applying simple random sampling and based on data availability, this study selects 12 commercial banks covering the period from 2009 to 2018. The findings of the study are more comprehensive since this study employs two different regression techniques, namely random effects model (REM) and system generalised method of moments (GMM), to estimate the relationship between e-banking (electronic banking) and the performance of commercial banks in Bangladesh along with other bank-specific and macroeconomic factors.

Empirical results show that e-banking has a gradual significant positive impact on banks' performance being proxied by banks' return on assets (ROA). Results from REM and GMM further reveal that e-banking affects the performance of commercial banks in Bangladesh at the significance levels of 5% and 10%, respectively. The empirical results show that except for e-banking, control variables such as capital, credit risk, earnings per share, and inflation have had a significant impact on the banks' performance with a positive or negative direction. Though we find a significant positive impact of e-banking on the performance of commercial banks in Bangladesh measured by ROA, e-banking is valued by considering the first adopting year with any form of e-banking services by respective commercial banks in Bangladesh. It is recommended that banks should adopt all forms of e-banking services to improve their performance. Since all the commercial banks in Bangladesh have not yet ensured all sorts of e-banking services, this study suggests that banks management should invest more to setup comprehensive e-banking technologies in their banks as well as arrange to provide required knowledge about using e-banking to their employees and clients in order to receive higher profitability. We believe that future researchers would concentrate on confirming our findings by conducting more research on this issue.

References

Abaenewe, Z. C., Ogbulu, O. M., & Ndugbu, M. O. (2013). Electronic banking and bank performance in Nigeria. West African Journal of Industrial and Academic Research, 6(1): 171–187.

Abdullai, H. M., & Micheni, E. M. (2018). Effect of Internet Banking on Operational Performance of Commercial Banks in Nakuru County, Kenya. International Journal of Economics, Finance and Management Sciences, 6(2): 60-65.

Adeusi, S. O., Kolapo, F. T., & Aluko, A. O. (2014). Determinants of Commercial Banks' Profitability Panel Evidence from Nigeria. International Journal of Economics, Commerce and Management, 2(12): 1-18.

Aduda, J., & Kingoo, N. (2012). The relationship between electronic banking and financial performance among commercial banks in Kenya. Journal of Finance and Investment Analysis, 1(3): 99–118.

Ahmed, S. M. S., Rayhan, S. J., Islam, M. A., & Mahjabin, S. (2011). Problems and prospects of mobile banking in Bangladesh. Journal of Information Engineering and Applications, 1(6): 16-35.

Akram. J. K., & Allam, M. H. (2010). The Impact of Information Technology on improving Banking Performance Matrix: Jordanian Banks as Case Study. European Mediterranean and Middle Eastern Conference on Information System, April 12th –13th, Abu Dhabi, UAE.

Al-Smadi, M. O., & Al-Wabel, S. A. (2011). The impact of e-banking on the performance of Jordanian banks. Journal of Internet Banking and Commerce, 16(2): 1–10.

Athanasoglou, P. P., Brissimis, S. N., & Delis, M. D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. Journal of International Financial Markets, Institutions and Money, 18(2): 121–136.

Baten, M. A., & Kamil, A. A. (2010). E-banking of economic prospects in Bangladesh. Journal of Internet Banking and Commerce, 15(2): 1–10.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87(1): 115-143.

Dey, M. (2014). Profitability of commercial banks in Bangladesh: a multivariate analysis. IOSR Journal of Business and Management, 16(4): 92–95.

Flamini, V., Schumacher, L., & McDonald, C. A. (2009). The determinants of commercial bank profitability in Sub-Saharan Africa. IMF Working Paper No. 09/15. International Monetary Fund. Hall, M.; Weiss, L. 1967. Firm size and profitability. The Review of Economics and Statistics, 49(3): 319–331.

Goddard, J.A., Molyneux, P., &Wilson, J. (2004). The profitability of European banks: a cross-sectional and dynamic panel analysis. The Manchester School 72: 363–381.

Golin, J. (2001). The Bank Credit Analysis Handbook: A Guide for Analysts, Bankers and Investors. John Wiley & Sons (Asia) Pre Ltd.

Gujarati, D. N. (2004). Basic Econometrics, 4th Edition, Tata Mc-Graw-Hill Publishing Company Limited, New Delhi, India.

Hassan, S. U., Mamman, A., & Farouk, M. A. (2013). Electronic banking products and performance of Nigerian listed deposit money banks. American Journal of Computer Technology and Application, 1(10): 138-148.

Hefferman, S. A., &Fu, X. (2014). Determinants of financial performance in Chinese banking. Applied Financial Economics, 20(20): 1585-1600.

Hernando, I., &Nieto, M. J. (2007). Is the Internet delivery channel changing banks' performance? The case of Spanish banks. Journal of Banking & Finance, 31(4): 1083–1099.

Hossein, S. M. (2013). Consideration of the effect of E-Banking on Bank Profitability; Case Study Selected Asian Countries. Journal of Economics and Sustainable Development, 4(11): 112-117.

Hausman, J. A. (1978). Specification Tests in Econometrics. Econometrica, 46 (6): 1251–1271.

Jahan, N. (2012). Determinants of bank's profitability: evidence from Bangladesh. Indian Journal of Finance, 6(2): 32–38.

Khrawish, H. A., & Al-Sa'di, N. M. (2011). The impact of e-banking on bank profitability: evidence from Jordan. Middle Eastern Finance and Economics, 13: 142–158.

Kondabagil, J. (2007). Risk management in electronic banking: concepts and best practices. Singapore: John Wiley & Sons, 454: 75–90.

Malhotra, P., &Singh, B. (2009). The impact of internet banking on bank performance and risk: the Indian experience. Eurasian Journal of Business and Economics, 2(4): 43–62.

Mapharing, M., & Basuhi, E. (2017). Electronic Banking and Bank Performance: Botswana Context. Journal of Accounting, Business and Finance Research, 1(1): 84-93.

Migdadi, Y. K. A. A. (2012). The Developing Economies' Banks Branches Operational Strategy in the Era of E-Banking: The Case of Jordan. Journal of Emerging Technologies in Web Intelligence, 4(2): 189-197.

Musa, A., Kurfi, S. A., & Hassan, H. (2015). The Impact of Online Banking on the Performance of Nigerian Banking Sector. ICoEC 2015 (20-22 October), 63-68.

Naceur, S. B., & Goaied, M. (2001). The determinants of the Tunisian deposit banks' performance. Applied Financial Economics, 11(3): 317–319.

Naifer, N. (2010). The determinants of bank performance: an analysis of theory and practice in the case of an emerging market. International Journal of Business Environment, 3(4): 460-470.

Ngango, A., Mbabazize, D. M., & Shukla, D. J. (2015). E-Banking and Performance Of Commercial Banks In Rwanda A Case Of Bank Of Kigali. European Journal of Accounting Auditing and Finance Research, 3(4): 25-57.

Nickell, S. (1981). Biases in dynamic models with fixed effects. Econometrica, 49: 1417–1426.

Onay, C., & Ozsoz, E. (2013). The impact of internet banking on brick and mortar branches: the case of Turkey. Journal of Financial Services Research, 44(2): 187–204.

Oyewole, O. S., Abba, M., &El-maude, J. G. (2013). E-banking and bank performance: Evidence from Nigeria. International Journal of Scientific Engineering and Technology, 2(8): 766-771.

Rahman, M. M., Hamid, M. K., &Khan, M. A. M. (2015). Determinants of Bank Profitability: Empirical Evidence from Bangladesh. International Journal of Business and Management, 10(8): 135-150.

Saeed, J. T., &Tahir, J. H. (2015). Relationship between Earning Per Share and Bank Profitability. International Journal of Novel Research in Humanity and Social Sciences, 2(2): 4-13.

Samad, A. (2015). Determinants of bank profitability: Empirical evidence from
Bangladesh commercial banks. International Journal of Financial Research, 6(3): 173 - 179

San, O. T., & Heng, T. B. (2013). Factors affecting the profitability of Malaysian commercial banks. African Journal of Business Management, 7(8): 649-660.

Sargan, J. D. (1958). The Estimation of Economic Relationships Using Instrumental Variables. Econometrica. 26 (3): 393–415.

Sarker, M. N. I., Islam, M. S., & Rahman, M. M. (2015). Effects of electronic banking on performance of banks in Bangladesh. International Journal of Applied Research, 1(1): 28-34.

Siddik, M. N. A., Sun, G., Kabiraj, S., Shanmugan, J., & Yanjuan, C. (2016). Impacts of E-Banking on Performance of Banks in a Developing Economy: Empirical Evidence from Bangladesh. Journal of Business Economics and Management, 17(6): 1066-1080.

Simpson, J. (2002). The Impact of the Internet in Banking: Observations and Evidence from Developed and Emerging Markets. Telematics and Informatics, 19: 315-330.

Tam, L. T., Trang, P. X., & Hanh, L. N. (2017). Determinants of Bank Profitability: The Case of Commercial Banks Listed on Vietnam's Stock Exchange. Journal of Business Sciences (JBS), 1(2): 1-12.

Trujillo-Ponce, A. (2013). What determines the profitability of banks? Evidence from Spain. Accounting & Finance, 53(2): 561–586.

Vila, J. A., Serna-Olvera, J., Fernandez, L., Medina, M., & Sfakianakis, A. (2013). A professional view on E-banking authentication: Challenges and recommendations. 2013. 9th International Conference on Information Assurance and Security (IAS). doi:10.1109/isias.2013.6947731.

Yang, S., Li, Z., Ma, Y., & Chen, X. (2018). Does Electronic Banking Really Improve Bank Performance? Evidence in China. International Journal of Economics and Finance, 10(2): 82-94.