GREEN BANKING PRACTICES: THE IMPACT OF INTERNET BANKING ON BANK PROFITABILITY IN EGYPT

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Abstract

This is the first study to use a quantitative approach in examining the impact of internet banking implementation as a green banking practice on bank profitability in Egypt. Moreover, it is the first global study to differentiate the impact between basic and advanced transactional internet banking on bank profitability. A total of 20 banks operating in Egypt were sampled over two time periods: 2009–2018 and 2014–2018. Random effects generalized least squares (GLS) regression analysis and nonparametric analysis were used. Findings indicate that advanced transactional internet banking, as a green banking practice that contributes to the Egyptian sustainable development strategy (SDS), significantly impacts bank profitability after three or more years of implementation. This study's results are consistent with the findings of other comparable research conducted in developed markets. The findings of this study provide practical implications for managers and policymakers.

Keywords: Green Banking, Sustainability, E-Banking, Internet Banking, Bank Profitability, Egyptian Banks

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1. INTRODUCTION

Internet banking has become a common feature provided by most banks worldwide. It can open various opportunities for banks, ranging from cost savings to increased access to a large customer base. Furthermore, being a crucial green banking practice, internet banking has been described by Roy, Sarker, and Parvez (2015), and Lalon (2015) as a concept that contributes to the reduction of a bank's carbon footprint by decreasing waste from traditional processes and energy from maintaining traditional branches.

The sustainable development goals (SDGs) are a global call to end poverty, protect the earth's environment, and ensure that people worldwide can enjoy peace and prosperity. The United Nations and its partners in Egypt are working toward achieving the 17 SDGs. Internet banking is among the most important sustainable practices in the financial sector. Thus, implementing internet banking in Egypt provides a new opportunity to contribute to

the Egyptian sustainable development strategy (SDS), an integral part of Egypt's 2030 vision representing a roadmap to economic growth by developing sustainable practices. By adopting internet banking, the Egyptian banking sector can be reshaped to be more sustainable.

Internet banking was introduced in Egypt in 2014, a time when applications of transactional internet banking systems were limited. In advanced internet banking systems, customers conduct financial transactions, such as transferring money and paying bills. Egypt's revolutionary developments in information communications technology and the continuation of the Egyptian SDS progress will propel the banking and financial industry toward adopting internet banking. Most banks will be required to implement sustainable practices, the first of which is transactional internet banking. Additionally, health and safety concerns raised owing to the recent COVID-19 pandemic are expected to positively change the delivery and usage of internet banking in Egypt.

Surprisingly, to our knowledge, no research to date has quantitatively examined the impact of adopting internet banking on bank profitability in Egypt. Therefore, bank managers and policymakers in this country might be reluctant to implement or improve internet banking shortly, as its effects on bank profitability have not been quantitatively examined yet. Therefore, the present study quantitatively investigates the impact of internet banking implementation on bank profitability in Egypt and provides recommendations for bank managers and government officials. We believe this is a significant step in analysing the future impact of internet banking implementation on the banking industry.

Previous studies have stated that banks have high costs and low usage rates during the first year of implementing what is deemed transactional internet banking systems. Thus, transactional internet banking initially negatively affects bank profitability and gradually becomes positive as time passes (Rega, 2017). Accordingly, the present study examines the effect of internet banking implementation time on bank profitability by conducting an analysis.

Moreover, similar to studies in the developed markets, previous studies examining the impact of internet banking on bank profitability in developing markets did not consider the complexity of internet banking services provided. This might be the reason for the insignificant impact of internet banking on bank profitability in developing markets where the scope of transactional internet banking is limited. Banks operating in developing countries most commonly provide basic non-transactional internet banking services, such as balance inquiries and downloading bank statements. Basic "information-only" bank services do not offer direct interest income or non-interest income (fees and commissions on internet transactional services) to the bank. Thus, the impact of implementing the basic internet banking service on bank profitability is likely to be indistinguishable. Consequently, studies investigating the impact of internet banking on bank profitability in Egypt should resort to transactional internet banking, which is expected to positively affect bank

profitability. The latter leads to questions that this study aims to answer:

RQ1: Does internet banking, basic or advanced, have an impact on bank profitability in Egypt?

RQ2: Does the time of implementing internet banking, basic or advanced, have an impact on bank profitability in Egypt?

In conclusion, studies differentiating between transactional and basic internet banking features regarding the impact of internet banking on bank profitability in developing markets are lacking. Therefore, this study is the first attempt to distinctly examine this impact in the context of Egypt, a developing market. Additionally, this is the first study to quantitatively examine the impact of implementing internet banking on bank profitability in Egypt. Moreover, this study considers the previous findings regarding the difference in the impact of internet banking implementation on bank profitability in developed and developing markets as time progresses. Therefore, the impact of the internet banking implementation period is examined using the study sample.

The remainder of this paper is structured as follows. Section 2 presents the relevant review of literature, identification of research gaps, statement of the study objectives, and development of research hypotheses. Section 3 describes the research methodology and data collection. Section 4 presents the empirical tests with a summary of the results, data analysis, and findings. Finally, Section 5 concludes the paper.

2. LITERATURE REVIEW

2.1. The impact of internet banking implementation on bank profitability in developed and emerging markets

The increased worldwide acceptance of the Internet as a delivery channel for banking products and services offers new profit-making opportunities for banks. Internet banking can allow banks to realize economies of scale due to increased usage rates and reduced costs. Additionally, internet banking acts as a high convenience delivery channel, which can incite some customers to pay a premium to use it. Moreover, internet banking allows banks to personalize and diversify their product offerings for their customers, which increases the potential for profit (DeYoung, Lang, & Nolle, 2007). Meanwhile, Marinč (2013) suggested that the standardization of processes from transactional internet banking can reduce costs and marketing benefits, such as access to more customers through the Internet and the ability to conduct precise market research using trends and online user data.

A significant number of studies have explored the effect of electronic banking adoption on banks' financial performance, especially in developed markets. Most recent studies conducted on internet banking in developed markets examined countries in Europe. Studies across various European countries have shown that banks using advanced internet banking experience gained some benefits such as decreased costs (Cocco, Pinna, & Marchesi, 2017) and access to more users (Angelakopoulos & Mihiotis, 2011).

Meanwhile, other studies on multiple European

banks posited that the significant positive impact of internet banking on bank profitability is evident after some time of implementation (Rega, 2017). The adoption of transactional internet banking involves a gradual reduction in overhead expenses (e.g., staff and marketing expenses). Nevertheless, the impact of transactional internet banking adoption on banks' financial performance takes time to appear. Therefore, internet banking harms bank profitability during its first year of implementation. For example, using a sample of 72 commercial banks operating in Spain over the 1994–2002 period, Hernando and Nieto (2007) demonstrated that the significant cost reduction translates into an increase in banks' profitability after one and a half years in terms of return on assets and after three years in terms of return on equity (*ROE*).

These findings in European countries confirm DeYoung et al.'s (2007) rationale of how traditional US banks using internet banking as a complement to their services can face higher costs initially. The main cause is the substantial increase in wages for skilled labour needed to run a more sophisticated delivery system. Thus, DeYoung et al. (2007) demonstrated that the positive impact of internet banking adoption on banks' financial performance is expressed gradually and has become significant two to three years after the first wave of US banks to adopt transactional banking websites in the late 1990s. Furthermore, the study of Yang, Li, Ma, and Chen (2018) in the Chinese context supports previous findings in developed markets, stating that the relationship between e-banking and bank profitability is positive in the long term.

Alternatively, the findings of studies that examined the impact of internet banking implementation on banks' profitability in developing markets were ambiguous. For instance, Angelakopoulos and Mihiotis (2011) surveyed 17 Greek banks, where a questionnaire was sent to bank employees and customers. Bank managers stated that internet banking has allowed their banks to attract more customers at previously unreachable locations, whereas customers expressed that internet banking was appealing due to its convenience and its constant availability of services (Angelakopoulos & Mihiotis, 2011). In addition, using a sample of 20 banks in Vietnam, Dinh, Le, and Le (2015) mentioned that internet banking has a low positive impact on bank profitability with a lag time of more than 3 years. They also demonstrated that this lag might be caused by a drop in profits due to the high initial investment cost for the new delivery system.

Nevertheless, other studies conducted in developing countries, such as India (Malhotra & Singh, 2009), Jordan (Khrawish & Al-Sa'di, 2011), Turkey (Onay & Ozsoz, 2013), and other Asian countries (Hosein, 2013), stated that internet banking has no significant impact on bank profitability. Additionally, in Romania, Gutu (2014) showed that the impact of electronic banking on banks' profitability is negative. These findings can be attributed to low usage rates and customers having concerns over the security of their information (Gutu, 2014; Khrawish & Al-Sa'di, 2011). Malhotra and Singh (2009) also stated that implementing and maintaining internet banking resulted in high costs, using Indian banks as their study sample. Additionally, Dinh et al. (2015) and Gutu (2014) argued that the positive impact of internet banking adoption on bank profitability is clearer in developed countries than in developing ones due to the weaker source of data, level of technology, and high internet infrastructure costs in developing countries.

This paper proposes another rationale that would explain the insignificant positive impact of internet banking implementation on bank profitability in developing markets. This rationale is attributed to the low usage of transactional versus basic internet banking in developing countries.

Internet banking adoption in developed countries can be traced as far back as the late 1990s in the US, with the continuous development of information and communication technology (Furst, Lang, & Nolle, 2002). Meanwhile, developing countries have a relatively low level of information and communication technology infrastructure, somewhat late development of electronic banking, and low usage rates by customers of transactional internet banking services (Dinh et al., 2015; Yadav, Chauhan, & Pathak, 2015).

Thus, to date, banks in developed markets, especially in Europe and the US have adopted transactional internet banking in addition to traditional delivery channels. Moreover, developed markets have "internet-only" banks that offer their customers transactional services solely through the internet. However, most emerging countries are still in the early stages of internet banking development, especially transactional e-banking (Yadav et al., 2015). Banks in developing markets offer their customers more basic "information-only" websites compared to transactional internet banking services on their websites. Thus, transactional internet banking is not widely implemented in emerging markets compared to developed markets.

Offering internet banking services that do not include transactional internet banking features (e.g., balance transfers and deposit and loan control facilities) is not expected to positively impact bank profitability. In contrast, adopting transactional internet banking services allows banks to charge higher monthly service fees and cross-sell additional transactional fee-based services over their website. DeYoung et al. (2007), who examined the impact of adopting transactional e-banking on bank profitability of 424 US banks, stated that "the added convenience of transactional internet banking led some bank depositors to purchase additional fee-based services and to willingly pay extra for the services they previously purchased at bank branches" (p. 1035). Thus, offering transactional internet banking is the main driver for the positive increase in banks' profitability.

Therefore, this paper proposes that the methodology applied by previous studies on developing markets could be one of the main reasons for the contradicting results of the impact of internet banking implementation on bank profitability. Little effort was made to distinguish between the adoption of transactional and basic internet banking when examining the impact of internet banking adoption on bank profitability in emerging markets.

Similarly, internet banking was first implemented in Egypt in around 2014; thus, banks operating in Egypt have not been allowed simultaneous implementation of advanced internet banking, as in developed nations. Accordingly, basic internet banking, as opposed to advanced transactional e-banking, is the most commonly applied system in Egypt. Therefore, e-banking

complexity (the impact of basic vs. transactional e-banking) should be considered when examining the impact of internet banking implementation on bank profitability in developing markets, such as Egypt.

Additionally, as far as the researchers' knowledge, there is a dearth of empirical studies providing a quantitative analysis of the impact of internet banking adoption on banks' financial performance in Egypt. Using a quantitative approach on this topic conforms to several previous related studies in other countries and allows the time of implementing e-banking to be considered an independent variable. The time of internet banking implementation has shown a robust impact on bank profitability in similar studies conducted in developed and emerging economies (Dinh et al., 2015).

The combination of the lack of quantitative studies conducted on the topic in Egypt, not classifying internet banking by the complexity of features, and not considering the time of implementing internet banking identify the gaps that this study fills.

2.2. Hypotheses development

Based on previous literature on developing markets, basic internet banking is expected to have no significant impact on bank profitability in Egypt, as Egypt is likely to face similar economic and market conditions. This is similar to results found in other studies conducted in developing markets such as India and Jordan (Malhotra & Singh, 2009; Khrawish & Al-Sa'di, 2011).

In contrast, transactional internet banking features are expected to impact bank profitability because these features offer banks a direct source of revenue. Thus, based on the previous rationale, this study developed the first hypothesis:

H1: Advanced transactional (vs. basic) internet banking features impact bank profitability in Egypt.

Based on an examination of previous empirical studies in subsection 2.1, the time of implementation of internet banking is expected to significantly impact bank profitability. This is presented in the studies by Hernando and Nieto (2007), Gutu (2014), and Rega (2017) due to variations in cost and usage rates in the initial years of implementation. Accordingly, the second hypothesis is developed:

H2: The time of implementing advanced transactional internet banking impacts bank profitability in Egypt.

3. RESEARCH METHODOLOGY

3.1. Sample and data

The population of the study comprises the 38 banks operating in Egypt (Central Bank of Egypt, n.d.). The sample used in the study includes 20 commercial banks, including state-owned and foreign subsidiaries, and conventional and Islamic banks as presented in Table 1. Convenience sampling was used, as banks were selected for the sample based on the availability of financial data and internet banking information.

The period of the study spans from 2009 to 2018. The 10-year sample period is chosen to consider the bank's performance before and after implementing internet banking as employed in

previous studies (Gutu, 2014). Additionally, this period featured the most available financial information for banks used in the sample.

The second sample period from 2014–2018 is also used. This sample period is limited to the years that internet banking was implemented in Egypt, an approach used by Onay, Ozsoz, and Helvacıoğlu (2008), and Khrawish and AlSa'di (2011).

Banks' financial data are collected from BankScope, Thompson Reuters, and each bank's respective annual reports published on banks' websites. Moreover, macroeconomic indicators were collected from the World Bank DataBank, and information regarding internet banking was collected from each bank's website and annual reports.

Table 1. Banks used in the sample

Bank name	Ownership	Type
Abu Dhabi Islamic Bank, Egypt	Islamic	Foreign
Arab African International Bank	Conventional	Private
Ahli Bank of Kuwait, Egypt	Conventional	Public
Ahli United Bank	Conventional	Foreign
Arab Banking Corporation	Conventional	Foreign
Attijariwafa Bank	Conventional	Foreign
Bank Audi	Conventional	Foreign
Bank of Alexandria	Conventional	Foreign
Banque du Caire	Conventional	State-owned
Banque Misr	Conventional	State-owned
Blom Bank	Conventional	Foreign
Commercial International Bank	Conventional	Public
Credit Agricole	Conventional	Public
Egyptian Gulf Bank	Conventional	Public
HSBC	Conventional	Foreign
National Bank of Kuwait, Egypt	Conventional	Foreign
National Bank of Egypt	Conventional	State-owned
Qatar National Bank, Egypt	Conventional	Public
Société Arabe Internationale de Banque	Conventional	Public
Suez Canal Bank	Conventional	Public

3.2. Identification and measurement of the study variables

The study uses a set of independent and control variables and bank profitability as a dependent variable. The independent and control variables consist of financial ratios specific to the banking industry, one macroeconomic variable, and a set of dummy variables.

3.2.1. Dependent variable: Return on equity

The dependent variable used to measure bank profitability is *ROE*, which represents the income earned by investors. From another perspective, it displays the effectiveness of the bank's management in using equity to create profits (Rose & Hudgen, 2008). The *ROE* is a common indicator of bank probability in Egyptian studies (Abobakr, 2018). Additionally, international studies (Al-Harbi, 2019) have examined determinants of bank profitability. *ROE* is also a commonly used dependent variable found in related studies on internet banking (Gutu, 2014).

3.2.2. The independent variables

Table 2 summarizes control variables that significantly impact bank profitability in various studies over different markets. Meanwhile, the independent variables examined are bank-specific financial ratios, internal measures, and economic indicators. According to Le and Ngo (2020), differences in determinants are due to different economic and financial market conditions.

Table 2. Previously examined variables as determinants of bank profitability

Explanatory	Authors	Markets variable
Bank size	Abobakr (2018), Kassem and Sakr (2018), Al-Harbi (2019), Onay et al. (2008), Gutu (2004)	Egypt, various Organisation of Islamic Cooperation (OIC) countries, Turkey, Romania
Operating income ratio	El-Ansary and Megahed (2016), Abobakr (2018), Ramlall (2009)	Egypt, Taiwan
Net non-interest income ratio	Wahdan and El Leithy (2017), Sufian (2012)	Egypt, Bangladesh, Sri Lanka, Pakistan
Loan loss provision ratio	Kassem and Sakr (2018), Al-Harbi (2019), Staikouras and Wood (2004)	Egypt, various OIC countries, the UK, France, Greece, Spain
Capital adequacy	Wahdan and El Leithy (2017), Kassem and Sakr (2018), Al-Harbi (2019), Hoffman (2011)	Egypt, various OIC countries, the United States
Liquidity risk	Abobakr (2018), Sufian (2012)	Egypt, Bangladesh, Sri Lanka, Pakistan
Credit risk	El-Ansary and Megahed (2016), Sufian (2012)	Egypt, Bangladesh, Sri Lanka, Pakistan
Market capitalization	Sufian (2012)	Bangladesh, Sri Lanka, Pakistan
Overhead costs	Sufian (2012)	Bangladesh, Sri Lanka, Pakistan
GDP growth rate	Wahdan and El Leithy (2017), Abobakr (2018), Al-Harbi (2019), Staikouras and Wood (2004)	Egypt, various OIC countries, various EU countries

The bank-specific measures and financial ratios used in this study include the natural log of total assets (*LnTA*), loan loss provisions to total loans (*LLP*), operating income to total assets (*OIA*), net non-interest income to total assets (*NNIA*), and the cost to income ratio (*CTI*) (calculated by dividing operating income by operating expenses). The selected bank-specific measures and financial ratios in this study have significant effects on bank profitability in Egypt, as demonstrated by El-Ansary and Megahed (2016), Kassem and Sakr (2018), and Abobakr (2018). A macroeconomic variable, the growth rate of the gross domestic product (*GDPgr*), was also used; it significantly affects the profitability of banks operating in Egypt (Abobakr, 2018). Additionally, two dummy variables were used to control for bank size (*Large*) similar to that of Onay et al. (2008) and banks listed on the Egyptian Stock Exchange (*Listed*), which is consistent with that of Hernando and Nieto (2007).

Previous studies have used dummy variables to account for internet banking features. For example, Onay et al. (2008) distinguished banks offering internet features from those that do not, by implementing a dummy variable taking the value of 1 if the bank offered internet features, and 0 otherwise. Other studies implemented dummy variables that are based on the year of implementation for internet banking to account for time (Gutu, 2014; Hernando & Nieto, 2007; Onay et al., 2008).

Similarly, a dummy variable for Internet features (*Internet*) is used in this study. Additionally, as discussed in subsection 2.1, the time of internet banking implementation is important because its effects can vary based on its implementation period due to potential costs and low adoption rates by customers. To account for this, this study introduced a matrix of three dummy variables considering the year of implementation (*Int*), consisting of three dummy variables (Hernando & Nieto, 2007; Onay et al., 2008; Gutu, 2014).

Moreover, a dummy variable for advanced transactional features (*Adv*) is introduced, which is needed as internet banking in Egypt is considered basic when compared with banks operating in developed countries, where their advanced internet features show a significant effect on bank profitability as demonstrated by Hernando and Nieto (2007), Gutu (2014) and Rega (2017).

Similar to the *Internet* variable, the *Adv* variable is presented in a set of three dummy variables to differentiate the time of implementing advanced internet banking features.

Table 3 shows the names, notations, descriptions, and measurements of bank-specific and macroeconomic variables based on previous studies in Egypt and other markets.

Table 3. Bank-specific and macroeconomic determinants of bank profitability employed in this study

Name	Notation	Description	Measurement
Return on equity	*ROE*	The measure of bank profitability, dependent variable	Net income divided by total equity (Abobakr, 2018)
Natural log of assets	*LnTA*	The measure of bank size, independent variable	Natural log of total assets (Abobakr, 2018)
Loan loss provisions	*LLP*	The measure of risk, independent variable	Loan loss provisions divided by total loans (El-Ansary & Megahed, 2016)
Operating income to total assets	*OIA*	The measure of income, independent variable	Operating income divided by total assets (El-Ansary & Megahed, 2016)
Net non-interest income to total assets	*NNIA*	The measure of income, independent variable	Net non-interest income divided by total assets (Al-Harbi, 2019)
Cost-to-income ratio	*CTI*	The measure of cost, independent variable	Interest and non-interest income are divided by interest and non-interest expense (Kassem & Sakr, 2018)
GDP growth rate	*GDPgr*	Economic indicator, independent variable	The growth rate of Egyptian GDP (Abobakr, 2018)

Table 4 presents the names, notations, and measurements of dummy control variables under study.

Table 4. Dummy control variables

Name/ Notation	Description	Measurement
Listed	Distinguishes between banks listed on the Egyptian Stock Exchange and those that do not	Dummy variable, assigned 1 for listed banks and 0 otherwise
Large	Classifies large banks by the natural log of total assets	Dummy variable assigned 1 for banks with a natural log of total assets in the 4th quartile in the sample and 0 otherwise

Table 5 displays names, notations, descriptions, and measurements of internet banking-specific dummy variables examined in this study, in addition to time-specific internet banking dummy variables that were previously used in similar studies in foreign markets (Hernando & Nieto, 2007; Gutu, 2014; Rega, 2017).

Table 5. Internet banking-specific dummy variables

Name/ Notation	Description	Measurement
Internet	Distinguishes banks that offer internet banking	Dummy variable, assigned 1 bank applying basic internet banking features and 0 otherwise.
Int	Time-specific implementation of internet banking	Dummy variable. Variables are assigned depending on the time of implementation of internet features.
Adv	Time-specific implementation of advanced features	Dummy variable. Variables assigned depending on time of implementation of advanced features.

3.3. Empirical model and data analysis techniques

Previous studies on the same topic have used regression models to examine the impact of internet banking implementation on bank profitability (Gutu, 2014; Khrawish & Al-Sa'di, 2011). Others used a standard statistical technique to test the significance of the difference in means for a sample performance pre- and post-adoption of e-banking (Abaenewe, Ogbulu, & Ndugbu, 2013; Yang et al., 2018; Islam, Kabir, Dovash, Safa-E-Nafee, & Saha, 2019). Both methods are employed in this study to examine the effect of internet banking on bank profitability and test the hypotheses developed in this study.

Panel regression analysis is conducted using the following estimating equation:

$$y_{it} = a_0 + \beta_i MACRO_t + \beta_{it} CTRL_{it} + \sum_{i=1}^{n} \beta_{it} X_{it} + \beta_{it} Internet_{it} + \varepsilon_{it} \quad (1)$$

$$y_{it} = a_0 + \beta_i MACRO_t + \beta_{it} CTRL_{it} + \sum_{i=1}^{n} \beta_{it} X_{it} + \beta_{it} Int_{it}^j + \varepsilon_{it} \quad (2)$$

$$y_{it} = a_0 + \beta_i MACRO_t + \beta_{it} CTRL_{it} + \sum_{i=1}^{n} \beta_{it} X_{it} + \beta_{it} Adv_{it}^j + \varepsilon_{it} \quad (3)$$

where *MACRO* represents GDP growth rate, *CTRL* represents *Listed* and *Large* dummy variables.

X represents bank-specific financial ratios. The *Internet* represents the application of internet banking features per bank. *Int^j* represents the dummy variable matrix containing *Int1*, *Int2* and *Int3*. Similarly, *Adv^j* represents the dummy variable matrix *Adv1*, *Adv2* and *Adv3* (the application of internet banking features per bank).

All coefficients *β* are estimated for bank *i* at time *t*. a_0 represents the constant term and ε_{it} represents the error term.

The data show no multicollinearity issues, and outliers were winsorized at 95% as usually done in similar studies (Bikker & Verliet, 2018; Nisar, Peng, Wang, & Ashraf, 2018). Additionally, the data do not comply with ordinary least squares (OLS) regression assumptions. Moreover, based on the presence of endogeneity in the dataset, the generalized method of moments (GMM) regression was considered to be employed in this study.

Nevertheless, the large N (20) and small T (10) of the sample used in this study were determined to be invalid, following Roodman (2009), who pointed out that small sample size may lead to an overstated estimator and unrealistically high p-values, reaching up to 1, for the Hansen test. The Hansen statistic is used for testing the over-identification of instruments, which is computed through the residuals of instrumental variables. Roodman (2009) stated that in GMM, correcting a Hansen test p-value of 1 enforces the use of too many instrumental variables and overall produce weak results. Consecutively, a generalized least squares (GLS) regression seems more appropriate for this dataset, and random effects are used according to Hausman's (1978) test results. Finally, in addition to random effects GLS regression, Mann-Whitney and Wilcoxon nonparametric tests are also conducted.

4. RESULTS AND DISCUSSION

4.1. Descriptive analysis

Table 6 displays the descriptive statistics for the full sample.

Table 6. Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
ROE	150	0.209	0.121	-0.138	0.996
LnTA	150	17.73	1.18	15.40	21.15
LLP	150	0.058	0.032	0.009	0.161
OIA	150	0.026	0.013	-0.008	0.094
NNIA	150	0.008	0.002	0.004	0.015
CTI	150	0.466	0.272	0.119	1.71
GDPgr	150	0.036	0.012	0.018	0.053

The descriptive statistics for the 151 observations examined in this study show the average financial ratios for all banks used in the full sample. The banks averaged 20.9% *ROE*, 2.6% operating income to total assets, and 0.8% net non-interest income to total assets from 2009–2018. Most ratios display high standard deviations, which can be attributed to the diversity of the sample, including banks of different sizes, listed and unlisted banks, state-owned banks, and foreign subsidies banks.

4.2. Regression analysis

Table 7 displays the regression results for the sample spanning 2009–2018, using the equation (1).

Table 7. Regression analysis results for *Internet* (2009–2018)

Variable	Coef.	St. err.	p-value
LnTA	-0.021	0.013	0.104
LLP	-0.391	0.138	0.005***
OIA	8.518	0.355	0***
NNIA	-14.956	2.461	0***
CTI	-0.034	0.022	0.123
GDPgr	0.111	0.511	0.828
Listed	0.07	0.035	0.045**
Large	0.035	0.032	0.27
Internet	0.03	0.028	0.281
Constant	0.465	0.215	0.031**
Overall r-squared		0.794	
Chi-square		838.607	
Number of obs.		150	
Prob > chi2		0	

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1.*

The *Internet* variable is positive but not significant, indicating no significant impact of implementing internet banking on bank profitability.

Regression analysis was conducted again, where the same model was applied to the same banks, but only using a shorter sample period from 2014–2018. This only covers the period when transactional internet features were widely offered by banks in Egypt. The regression results are presented in Table 8.

Table 8. Regression analysis results for *Internet* (2014–2018)

Variable	Coef.	St. err.	p-value
LnTA	-0.016	0.014	0.243
LLP	-0.829	0.245	0.001***
OIA	9.494	0.449	0.000***
NNIA	-16.296	3.314	0.000***
CTI	-0.062	0.045	0.172
GDPgr	-1.473	0.686	0.032**
Listed	0.091	0.041	0.026**
Large	0.036	0.037	0.328
Internet	0.014	0.035	0.684
Constant	0.48	0.245	0.050*
Overall r-squared		0.811	

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1.*

Results are similar to those when using the full sample, with the coefficient for the *Internet* remaining positive and insignificant.

Table 9 presents the results for the regression model measuring the impact of the time of internet banking implementation, using the *Int1*, *Int2*, and *Int3* dummy variables seen in equation (2).

Table 9. Regression analysis results for *Int* (2009–2018)

Variable	Coef.	St. err.	p-value
LnTA	-0.025	0.013	0.048**
LLP	-0.39	0.137	0.004***
OIA	8.485	0.353	0.000***
NNIA	-15.439	2.438	0.000***
CTI	-0.038	0.022	0.075*
GDPgr	0.236	0.502	0.638
Listed	0.067	0.034	0.046**
Large	0.043	0.031	0.162
Int1	-0.039	0.033	0.249
Int2	0.034	0.032	0.289
Int3	0.019	0.028	0.613
Constant	0.552	0.216	0.011**
Overall r-squared		0.833	

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1.*

Results indicate an insignificant negative relationship when implementing internet features for 1 year and an insignificant positive relationship for 2 years and 3 years or more. Table 10 presents the results for the same test using the 2014–2018 sample.

Table 10. Regression analysis results for *Int* (2014–2018)

Variable	Coef.	St. err.	p-value
LnTA	-0.023	0.015	0.14
LLP	-0.801	0.246	0.001***
OIA	9.351	0.45	0***
NNIA	-17.986	3.415	0
CTI	-0.067	0.044	0.129
GDPgr	-1.352	0.702	0.054
Listed	0.078	0.036	0.03**
Large	0.036	0.034	0.29
Int1	-0.04	0.034	0.237
Int2	0.039	0.033	0.244
Int3	0.009	0.04	0.819
Constant	0.609	0.273	0.14
Overall r-squared		0.856	
Chi-square		750.776	
Number of obs.		98	
Prob > chi2		0	

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1.*

When using the 2014–2018 sample, this study obtained the same results in terms of direction; the results remain insignificant for internet banking implementation variables.

A regression analysis was conducted for the sample implementing advanced transactional features for the period 2014–2018. The model mostly remains the same, with changes including removing the dummy variable for banks with the natural log of assets in the fourth quartile (large banks; *Large*) (because all banks in this sample satisfy this criterion) and replacing *Int* dummy variables with *Adv* dummy variables (equation (3)). Table 11 presents the results.

Table 11. Regression analysis results for *Adv* (2014–2018)

Variable	Coef.	St. err.	p-value
LnTA	-0.076	0.029	0.009***
LLP	-0.271	0.349	0.437
OIA	4.672	1.831	0.011**
NNIA	-13.762	6.043	0.023**
CTI	-0.929	0.221	0***
GDPgr	-0.519	1.246	0.677
Listed	-0.011	0.05	0.824
Large	-0.02	0.042	0.633
Adv1	0.066	0.042	0.117
Adv2	0.107	0.027	0***
Adv3	2.016	0.605	0.001***
Constant	-0.076	0.029	0.009***
Overall r-squared		0.905	
Chi-square		181.649	
Number of obs.		30	
Prob > chi2		0	

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1.*

Results reveal an insignificant negative impact of implementing advanced internet banking features for 1 year on bank profitability, an insignificant positive relationship for 2 years, and a significant positive relationship for 3 years or more at a 1% significant level. The significant relationship for a form of internet banking is seen only for advanced transactional internet banking.

4.3. Non-parametric analysis

In addition to the regression analysis, nonparametric tests were conducted on the data. A parametric t-test for the difference in means was used in a similar study, that is, Abaenewe et al.'s (2013) study on Nigerian banks before and after adopting internet banking, Yang et al.'s (2018) study on China, and Islam et al.'s (2019) study in India. Nevertheless, the same test cannot be applied due to non-compliance with the t-test assumptions in the samples used in this study. The data used are not normally distributed. Additionally, the sample size of 151 observations does not meet the 200 observations, which is suggested by Fagerland (2012) as the minimum sample size to be exempted from using the t-test, even if the data were not normally distributed. Nonparametric tests are distribution-free tests that target the differences in medians rather than the differences in means. Macdonald (1999) conducted a study testing the power and error rates of the parametric Student's t-test and the nonparametric Wilcoxon sign test on various population distributions and sample size pairings. The results indicate that when the populations were not normally distributed, the Wilcoxon rank-sum test displayed a consistent advantage in statistical power, fewer correct null hypothesis rejections for the wrong reasons (type III errors), and proportionally fewer wrong hypothesis rejections compared with the parametric Student's t-test (Macdonald, 1999).

Accordingly, one of the non-parametric tests used in this study is the Wilcoxon (1945) sign rank test which tests for the significance of the difference in medians of paired (dependent) samples (pre- and posttranslational internet banking adoption). Another nonparametric test, the Mann-Whitney (1947) test, is used to test for the significance of the difference in medians of independent samples (banks adopting transactional internet banking versus others using basic internet banking).

Table 12 displays the summary of the non-parametric test results.

Table 12. Non-parametric test results

Test	*Sample type*	*Test*	*Z-value*	*P-value*
Test 1 (Advanced vs. non-advanced)	Independent	Mann-Whitney (rank-sum)	3.747	0.0005***
Test 2 (Before and after advanced)	Dependent	Wilcoxon (sign-rank)	2.841	0.0045***
Test 3 (Before and after internet)	Dependent	Wilcoxon (sign-rank)	4.679	0.0000***

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1.*

To test for the difference in medians of *ROE* in banks that apply advanced feature internet banking and those that do not, a Mann-Whitney rank-sum test result indicates a significant difference in medians of *ROE* between banks that use advanced feature internet banking and those that do not at z = 3.474, p = 0.0005.

Next, a Wilcoxon sign test 2 is conducted to determine the significance of the difference in medians for bank profitability before and after applying advanced internet banking. The test indicates that the median *ROE* after applying advanced internet banking was statistically significantly higher than *ROE* before applying advanced internet banking at z = 2.841, p = 0.0045.

Finally, Wilcoxon sign test 3 to examine the difference in medians of *ROE* for banks before and after applying internet banking indicates a significant difference in the median of *ROE* after applying basic internet banking at z = 4.679, p = 0.000.

4.4. Discussion of findings

The results of the regression analysis on the *Internet* variable show an insignificant positive relationship for Egyptian banks adopting basic internet banking over the 2009–2018 sample period. This is similar to the findings of Malhotra and Singh (2009), Khrawish and Al-Sa'di (2011), and Onay et al. (2008) in developing markets. Egypt is also a developing market; hence, the results of this study were expected to be similar. The results are repeated when the 2014–2018 sample is analysed, which is limited to the period when internet banking was commonly applied in the banks under study. This indicates that internet banking has no significant impact on bank performance before and after implementing internet banking. Moreover, nonparametric test results indicate a significant difference in medians of *ROE* for banks after applying internet banking; however, this finding is unsupported by regression analysis.

When considering the implementation time, regression results show an insignificant negative relationship between banks adopting internet banking for 1 year and an insignificant positive relationship between banks adopting internet banking for two years and three or more years. This is similar to the findings of Malhotra and Singh (2009) in India, Onay et al. (2008) in Turkey, and Khrawish and AlSa'di (2011) in Jordan.

Testing using the 2014–2018 sample shows the same results. The insignificant effects of internet banking on bank profitability were seen in previous studies, especially in developing countries, such as Turkey (Onay et al., 2008), India (Malhotra & Singh, 2009), and Jordan (Khrawish & Al-Sa'di, 2011).

The insignificant relationships between basic internet banking and bank profitability in both longer (2008–2019) and shorter (2014–2018) samples observed in Egypt could be due to several factors. Since the implementation of internet banking in all Egyptian banks started at most in 2014, the impact of internet banking may not have manifested during this short period. Most studies showing positive, significant relationships were performed on banks in developed markets (Hernando & Nieto, 2007), where internet banking was implemented as far back as 1997.

Moreover, Khrawish and Al-Sa'di (2011), who studied the Jordan context, suggested that low usage rates among the bank's customers are a reason for the insignificant relationship between internet banking implementation and bank profitability. Similarly, previous studies in Egypt have stated that the Egyptian market also suffers from low usage rates of internet banking.

For example, Hussein and Saad (2016) conducted a study on Egyptian bank customers showing that the low usage rate of internet banking was negatively impacted by the perceived usefulness of internet banking, noting that the result was significant. Moreover, Abd El. Aziz, ElBadrawy, and Hussein (2014) conducted a similar study; they determined that the level of education and previous experience using digital banking services impacted the low usage rate of internet banking in Egypt. Accordingly, these findings may be especially relevant to the present study's findings since internet banking was adopted recently in Egypt, leading to a shortage of user experience and low usage rates of internet banking features. This in turn results in the insignificant effect of internet banking on bank profitability.

Another possible reason is that most internet banking features in Egypt are basic and are not implemented in transactions that offer direct revenue to the bank, as discussed in detail in subsection 2.1. In addition, most banks in Egypt offer internet banking with no fee or commission charged to the customer using it.

Moreover, most banks' basic internet banking features cannot replace services offered at physical branches. Therefore, implementing basic internet banking does not result in cost reduction, as reflected in studies conducted in other markets. Thus, this could justify the insignificant effects of basic internet banking on bank profitability in Egypt.

Accordingly, the regression analysis for advanced transactional features provides different results. An insignificant negative relationship exists for the first year of implementation, followed by an insignificant positive relationship in the second year, and a significant positive relationship in the third year. Similarly, non-parametric test results indicate that the median *ROE* for banks using advanced feature internet banking is higher than banks that do not use advanced features. Furthermore, when testing the banks' *ROE* before and after applying advanced features of internet banking, this study determines a significant difference in medians in *ROE* after applying advanced features. The nonparametric results are consistent with the findings of Abaenewe et al. (2013) in Nigeria.

The combined regression and nonparametric test results support *H1*; that is, bank profitability is likely to be significantly and positively impacted by advanced transactional internet banking as opposed to basic internet banking.

Advanced internet banking features in this study include features that allow users to control deposit facilities, loan facilities, inter-bank transfers, and money market transactions. A common feature among the previous features is that they all offer a direct revenue stream for the bank. Deposits and loans naturally allow the bank to earn a spread, and inter-bank transfers and money market transactions normally have a fee or commission attached that is earned by the bank. Thus, from a theoretical standpoint, advanced internet banking features are more likely to significantly impact bank profitability. Hernando and Nieto (2007) illustrated this in their study of banks providing online brokerage services, stating that online brokerage's significant relationship with bank profitability could be due to

the collection of fees associated with the service.

Reflecting on the importance of examining the time of implementation, this study's regression results support *H2*, showing that the implementation period of advanced internet banking impacts bank profitability in Egypt. Advanced transactional internet banking has a significant impact on bank profitability after some years of implementation. This finding is consistent with other studies and follows the rationale that banks have high costs and low usage rates during the first year of implementing advanced internet banking systems (Hernando & Nieto, 2007).

5. CONCLUSION

The findings of this paper provide several theoretical and empirical contributions to the finance literature. It is the first of its kind to quantitatively examine the impact of basic and advanced e-banking on bank profitability in Egypt. In addition, differentiating between basic and advanced transactional features in regression analysis was not employed in international markets, especially in developing countries where advanced transactional internet banking is not widely implemented. The empirical findings of this study indicate that advanced transactional e-banking significantly impacts bank profitability in Egypt after three or more years of implementation. Moreover, basic e-banking had no significant impact, regardless of the time of implementation. Consequently, the results prove that differentiating between basic and advanced e-banking is essential when examining a developing market, such as Egypt, where advanced e-banking is not common.

Moreover, the findings of this paper provide recommendations for both bank managers and policymakers to implement advanced transactional internet banking and pursue upgrading of the internet banking technology to include more features. Consequently, the findings of this study provide important practical contributions to the Egyptian market. First, this study recommends that bank managers should implement advanced internet banking to benefit from a potential increase in profits. Second, policymakers in Egypt are incentivized to push for standardized transactional internet banking among all banks because it is core to green banking and, ultimately, to Egypt's SDS. In addition, expansion in the delivery and usage of transactional internet banking in Egypt is essential after the COVID-19 pandemic health and safety concerns. Thus, advanced transactional internet banking is likely to benefit the bank customers, banks, the Egyptian government and the economy.

The sample size examined in this study could be considered a limitation; nevertheless, this sample represents around 50% of the Egyptian banking industry, including all the large public, private, and Islamic banks. In addition, the sample remains the same throughout the analysed period, which leads to a relevant output. Moreover, generally, the number of banks operating in emerging markets is lower than in developed countries, especially when it comes to banks utilizing internet banking. Thus, previous studies investigating this topic in emerging markets have used small sample sizes, for example, 20 banks in Vietnam, four banks in Nigeria,

18 banks in Turkey, 17 banks in Greece, and 15 banks in Jordan (Dinh et al., 2015; Abaenwe et al., 2013; Onay & Ozsoz, 2013; Angelakopoulos & Mihiotis, 2011; Khrawish & Al-Sa'di, 2011). Moreover, the low number of banks applying transactional advanced internet banking features in Egypt is even common in studies conducted in developed markets when examining "internet-only banks". For example, DeYoung (2001), DeYoung (2005), and Delgado, Hernando, and Nieto (2007) conducted their study on six US banks, 12 US banks, and 15 EU banks, respectively.

The recent COVID-19 health and safety concerns occurring in the coming years are expected to significantly positively change the delivery and usage of internet banking in Egypt. Thus, future research on the topic is recommended to address the previous limitations and include future years in the study.

REFERENCES

1. Abaenewe, Z. C., Ogbulu, O. M., & Ndugbu, M. O. (2013). Electronic banking and bank performance in Nigeria. *West African Journal of Industrial & Academic Research*, *6*(1), 131–187. Retrieved from https://www.ajol.info/index.php/wajiar/article/view/87447
2. Abd El. Aziz, R., ElBadrawy, R., & Hussein, M. I. (2014). ATM, internet banking and mobile banking services in a digital environment: The Egyptian banking industry. *International Journal of Computer Applications*, *90*(8), 45–52. https://doi.org/10.5120/15598-4408
3. Abobakr, M. G. (2018). Bank specific, industry concentration, and macroeconomic determinants of Egyptian banks' profitability. *International Journal of Accounting and Financial Reporting*, *8*(1), 380–397. https://doi.org/10.5296/ijafr.v8i1.12882
4. Al-Harbi, A. (2019). The determinants of conventional banks profitability in developing and underdeveloped OIC countries. *Journal of Economics, Finance and Administrative Science*, *24*(47), 4–28. https://doi.org/10.1108/JEFAS-05-2018-0043
5. Angelakopoulos, G., & Mihiotis, A. (2011). E-banking: Challenges and opportunities in the Greek banking sector. *Electronic Commerce Research*, *11*, 297–319. https://doi.org/10.1007/s10660-011-9076-2
6. Bikker, J. A., & Vervliet, T. M. (2018). Bank profitability and risk-taking under low interest rates. *International Journal of Finance & Economics*, *23*(1), 3–18. https://doi.org/10.1002/ijfe.1595
7. Central Bank of Egypt. (n.d.). *License lists*. Retrieved from https://www.cbe.org.eg/en /BankingSupervision/Pages/LicenseLists.aspx
8. Cocco, L., Pinna, A., & Marchesi, M. (2017). Banking on blockchain: Cost savings thanks to the blockchain technology. *Future Internet*, *9*(3), 25. https://doi.org/10.3390/fi9030025
9. Delgado, J., Hernando, I. & Nieto, M. J. (2007). Do European primarily internet banks show scale and experience efficiencies? *European Financial Management*, *13*(4), 643–671. https://doi.org/10.1111/j.1468-036X.2007.00377.x
10. DeYoung, R. (2001). The financial performance of pure play internet banks. *Economic Perspectives*, *25*(1), 60–75 Retrieved from https://www.chicagofed.org/digital_assets/publications/economic_perspectives/2001/1qepart4.pdf
11. DeYoung, R. (2005). The performance of internet-based business models: Evidence from the banking industry. *Journal of Business*, *78*(3), 893–947. https://doi.org/10.1086/429648
12. DeYoung, R., Lang, W. W., & Nolle, D. L. (2007). How the internet affects output and performance at community banks? *Journal of Banking & Finance*, *31*(4), 1033–1060. https://doi.org/10.1016/j.jbankfin.2006.10.003
13. Dinh, V., Le, U., & Le, P. (2015). Measuring the impacts of internet banking to bank performance: Evidence from Vietnam. *Journal of Internet Banking and Commerce*, *20*(2), 1–14. https://doi.org/10.4172/1204-5357.1000103
14. El-Ansary, O., & Megahed, M. I. (2016). Determinants of Egyptian banks profitability before and after financial crisis. *Corporate Ownership & Control*, *14*(1–2), 360–372. https://doi.org/10.22495/cocv14i1c2p8
15. Fagerland, M. W. (2012). T-tests, non-parametric tests, and large studies — A paradox of statistical practice? *BMC Medical Research Methodology*, *12*, 78. https://doi.org/10.1186/1471-2288-12-78
16. Furst, K., Lang, W. W., & Nolle, D. E. (2002). Internet banking. *Journal of Financial Services Research*, *22*, 95–117. https://doi.org/10.1023/A:1016012703620
17. Gutu, L. M. (2014). The impact of internet technology on the Romanian banks performance. In *Proceedings of the 12th International Academic Conference* (pp. 495–501). Prague, Czech Republic: International Institute of Social and Economic Sciences.
18. Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, *46*(6), 1251–1271. https://doi.org/10.2307/1913827
19. Hernando, I., & Nieto, M. J. (2007). Is the internet delivery channel changing banks' performance? The case of Spanish banks. *Journal of Banking and Finance*, *31*(4), 1083–1099. https://doi.org/10.1016/j.jbankfin.2006.10.011
20. Hoffmann, P. S. (2011). Determinants of the profitability of the US banking industry. *International Journal of Business and Social Science*, *2*(22), 255–269. Retrieved from http://ijbssnet.com/journals/Vol_2_No _22_December_2011/30.pdf
21. Hosein, S. S. M. (2013). Consideration the effect of e-banking on bank profitability: Case study selected Asian countries. *Journal of Economics & Sustainable Development*, *4*(11), 112–117. Retrieved from https://www.iiste.org/Journals/index.php/JEDS/article/view/6851
22. Hussein, A., & Saad, M. M. (2016). Perceived risk and behavioral determinants of using internet banking in Egypt. *Journal of Behavioral Economics, Finance, Entrepreneurship, Accounting and Transport*, *4*(3), 40–48. Retrieved from https://buescholar.bue.edu.eg/cgi/viewcontent.cgi?article=1088&context=bus_admin
23. Islam, S., Kabir, M. R., Dovash, R. H., Safa-E-Nafee, & Saha, S. (2019). Impact of online banking adoption on bank's profitability: Evidence from Bangladesh. *European Journal of Business and Management Research*, *4*(3), 1–4. https://doi.org/10.24018/ejbmr.2019.4.3.38
24. Kassem, N. M., & Sakr, A. (2018). The impact of bank-specific characteristics on the profitability of commercial banks in Egypt. *Journal of Finance and Bank Management*, *6*(2), 76–90. https://doi.org/10.15640/jfbm.v6n2a8

25. 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. Retrieved from https://eis.hu.edu.jo/deanshipfiles/pub108681358.pdf

26. Lalon, R. M. (2015). Green banking: Going green. *International Journal of Economics, Finance and Management Sciences, 3*(1), 34–42. https://doi.org/10.11648/j.ijefm.20150301.15

27. Le, T. D., & Ngo, T. (2020). The determinants of bank profitability: A cross-country analysis. *Central Bank Review, 20*(2), 65–73. https://doi.org/10.1016/j.cbrev.2020.04.001

28. Macdonald, P. (1999). Power, type I, and type III error rates of parametric and nonparametric statistical tests. *The Journal of Experimental Education, 67*(4), 367–379. https://doi.org/10.1080/00220979909598489

29. 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. Retrieved from https://www.ejbe.org/EJBE2009Vol02No04p43MALHOTRA-SINGH.pdf

30. Mann, H. B., & Whitney, D. R. (1947). On a test of whether one of two random variables is stochastically larger than the other. *Annals of Mathematical Statistics, 18*(1), 50–60. https://doi.org/10.1214/aoms/1177730491

31. Marinč, M. (2013). Banks and information technology: Marketability vs. relationships. *Electronic Commerce Research, 13,* 71–101. https://doi.org/10.1007/s10660-013-9107-2

32. Nisar, S., Peng, K., Wang, S., & Ashraf, B. N. (2018). The impact of revenue diversification on bank profitability and stability: Empirical evidence from South Asian Countries. *International Journal of Financial Studies, 6*(2), 40. https://doi.org/10.3390/ijfs6020040

33. 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,* 187–204. https://doi.org/10.1007/s10693-011-0124-9

34. Onay, C., Ozsoz, E., & Helvacıoğlu, A. D. (2008). The impact of internet-banking on bank profitability — The case of Turkey. Paper presented at the *Oxford Business & Economics Conference.* Retrieved from https://studylib.net/doc/8491836/the-impact-of-internet-banking-on-bank-profitability

35. Ramlall, I. (2009). Bank-specific, industry-specific and macroeconomic determinants of profitability in Taiwanese banking system: Under panel data estimation. *International Research Journal of Finance and Economics, 34,* 160–167.

36. Rega, F. G. (2017). *The bank of the future, the future of banking — An empirical analysis of European banks.* https://doi.org/10.2139/ssrn.3071742

37. Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal: Promoting Communications on Statistics and Stata, 9*(1), 86–136. https://doi.org/10.1177/1536867X0900900106

38. Rose, P. S., & Hudgins, S. C. (2008). *Bank management and financial services.* New York, NY: McGraw-Hill.

39. Roy, M. K., Sarker, M. A. S., & Parvez, S. (2015). Sustainability in banking industry: Which way to move? *ASA University Review, 9*(2), 53–69. Retrieved from http://asaub.edu.bd/asaubreview/data/v9n2sl4.pdf

40. Staikouras, C. K., & Wood, G. E. (2004). The determinants of European bank profitability. *International Business & Economics Research Journal, 3*(6), 57–68. https://doi.org/10.19030/iber.v3i6.3699

41. Sufian, F. (2012). Determinants of bank profitability in developing economies: Empirical evidence from the South Asian banking sectors. *Contemporary South Asia, 20*(3), 375–399. https://doi.org/10.1080/09584935.2012.696089

42. Wahdan, M., & El Leithy, W. (2017). Factors affecting the profitability of commercial banks in Egypt over the last 5 years (2011–2015). *International Business Management, 11*(2), 342–349. Retrieved from https://medwelljournals.com/abstract/?doi=ibm.2017.342.349

43. Wilcoxon, F. (1945). Individual comparisons by ranking methods. *Biometrics Bulletin, 1*(6), 80–83. https://doi.org/10.2307/3001968

44. Yadav, R., Chauhan, V., & Pathak, G. S. (2015). Intention to adopt internet banking in an emerging economy: A perspective of Indian youth. *International Journal of Bank Marketing, 33*(4), 530–544. https://doi.org/10.1108/IJBM-06-2014-0075

45. 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. https://doi.org/10.5539/ijef.v10n2p82