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, Mariné (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 internet banking has no significant impact on bank profitability, especially in emerging markets. However, most emerging countries are still in the early stages of internet banking development, especially transactional e-banking adoption (Yadav et al., 2015). Banks in developing markets offer their customers more basic “information-only” websites compared to transactional internet banking services. 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 for 42 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 to implement all simultaneous impacts 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 qualitative 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), Guto (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 (Guto, 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, Oszoz, and Helvaciglu (2008), and Khrawish and Al’Sa’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.

| 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 |
| Blior 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 |
| Societe Arbe 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 (Guto, 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),     | Egypt, various Organisation of Islamic    |
|                                  | Al-Harbi (2019), Onay et al. (2008), Gutu    | Cooperation (OIC) countries, Turkey,     |
|                                  | (2004)                                       | Romania                                  |
| Operating income ratio           | El-Ansary and Megahed (2016), Abobakr        | Egypt, Taiwan                            |
|                                  | (2018), Ramli (2009)                         |                                          |
| 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),     | Egypt, various OIC countries, the UK,    |
|                                  | Staikouras and Wood (2004)                   | France, Greece, Spain                    |
| Capital adequacy                | Wahdan and El Leithy (2017), Kassem and Sakr| Egypt, various OIC countries, the United  |
|                                  | (2018), Al-Harbi (2019), Hoffman (2011)     | States                                   |
| Liquidity risk                  | Abobakr (2018), Sufian (2012)                | Egypt, Bangladesh, Sri Lanka, Pakistan   |
| Market capitalization           | El-Ansary and Megahed (2016), Sufian (2012)  | Bangladesh, Sri Lanka, Pakistan          |
| Overhead costs                  | Sufian (2012)                                | Bangladesh, Sri Lanka, Pakistan          |
| GDP growth rate                 | Wahdan and El Leithy (2017), Abobakr (2018),| Egypt, various OIC countries, various EU |
|                                  | Al-Harbi (2019), Staikouras and Wood (2004)  | 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 (OLA), net non-interest income to total assets (NNIA), and the cost to income ratio (CII) (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 (Intl), 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     | Net income divided by total equity (Abobakr, 2018) |
|                       |          | variable                                        |                                                  |
| 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      |
| Operating income to   | OIA      | The measure of income, independent variable      | Operating income divided by total assets         |
| total assets          |          |                                                  | (El-Ansary & Megahed, 2016)                      |
| Net non-interest      | NNIA     | The measure of income, independent variable      | Net non-interest income divided by total assets  |
| income to total assets|          |                                                  | (Al-Harbi, 2019)                                |
| Cost-to-income ratio  | CII      | The measure of cost, independent variable        | Interest and non-interest income are divided by  |
| GDP growth rate       | GDPgr    | Economic indicator, independent variable         | interest and non-interest expense (Kassem & Sakr,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 for 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 are assigned depending on the 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-adoptions of e-banking (Abaenewe, Ogbulu, & Ndugbu, 2013; Yang et al., 2018; Islam, Kabir, Dovash, Saha, & 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:

\[ y_{it} = a_0 + \beta_1 \text{MACRO}_t + \beta_2 \text{CTRL}_{it} + \sum_{j=1}^{n} \beta_{ij} X_{ij} + \beta_{it} \text{Internet}_t + \epsilon_{it} \]  

(1)

\[ y_{it} = a_0 + \beta_1 \text{MACRO}_t + \beta_1 \text{CTRL}_{it} + \sum_{j=1}^{n} \beta_{ij} X_{ij} + \beta_{it} \text{Int}_t + \epsilon_{it} \]  

(2)

\[ y_{it} = a_0 + \beta_1 \text{MACRO}_t + \beta_1 \text{CTRL}_{it} + \sum_{j=1}^{n} \beta_{ij} X_{ij} + \beta_{it} \text{Adv}_{it} + \epsilon_{it} \]  

(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. Int1 represents the dummy variable matrix containing Int1, Int2, and Int3. Similarly, Adv1 represents the dummy variable matrix Adv1, Adv2 and Adv3 (the application of internet banking features per bank).

All coefficients \( \beta \) are estimated for bank \( i \) at time \( t \). \( a_0 \) represents the constant term and \( \epsilon_{it} \) represents the error term.

The data show no multicollinearity issues, and outliers were winsonized 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. Consequently, 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 |
| IVFA     | 150 | 17.75 | 1.15      | 13.40 | 21.13 |
| 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 | 0.013 |
| CDR      | 150 | 0.466 | 0.272     | 0.119 | 1.71 |
| GDP/hr  | 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 20.3% 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 subsidiaries banks.

4.2. Regression analysis

Table 7 displays the regression results for the sample spanning 2009–2018, using the equation (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 | 0.032    | 0.128   |
| Internet | 0.014 | 0.035    | 0.684   |
| Constant | 0.48  | 0.245    | 0.050*  |
| Overall r-squared | 0.811 |

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

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

| Variable | Coef. | St. err. | p-value |
|----------|-------|----------|---------|
| LnTA     | -0.025| 0.013    | 0.048** |
| LLP      | -4.309| 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    | 0.279 | 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     | 0.014 | 0.025    | 0.289   |
| Int3     | 0.019 | 0.038    | 0.613   |
| Constant | 0.352 | 0.216    | 0.011** |
| Overall r-squared | 0.833 |

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     | 0.000***|
| NNIA     | -17.986| 3.415 | 0      |
| CTI      | -0.067| 0.044    | 0.129   |
| GDPgr    | -3.312| 0.702    | 0.054   |
| Listed   | 0.078 | 0.036    | 0.032** |
| 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 |

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 Int3 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    | 0.000***|
| LLP      | -0.271| 0.349    | 0.437   |
| OIA      | 4.672 | 1.831    | 0.011** |
| NNIA     | -13.762| 6.043 | 0.023**|
| CTI      | -0.29 | 0.221    | 0.032** |
| GDPgr    | -0.519| 1.246    | 0.677   |
| Listed   | -0.011| 0.05     | 0.824   |
| Large    | -0.02 | 0.042    | 0.633   |
| Adv1     | 0.086 | 0.042    | 0.117   |
| Adv2     | 0.107 | 0.027    | 0.000***|
| Adv3     | 2.016 | 0.665    | 0.001***|
| Constant | -0.076| 0.029    | 0.000***|
| Overall r-squared | 0.905 |
| Chi-square | 181,649 |
| Number of obs. | 30 |
| Prob > chi2 | 0 |

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.

| Test Type | Test | Sample Size | 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 < 0.001, ** p < 0.01, * 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 Al-Sa’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 brokerages’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 features are 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; Abaeewe et al., 2013; Onay & Oszoz, 2013; Angelakopoulos & Mihiotis, 2011; Khrawish & Al-Sa’idi, 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 comparing “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.

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