

Article

Driving Digital Transformation: Analyzing the Impact of Internet Banking on Profitability in the Saudi Arabian Banking Sector

Sonia Sayari

College of Business Admiration and Finance, Saudi Electronic University, Abu Baker Rd,
Riyadh 11673, Saudi Arabia; s.sayari@seu.edu.sa

Abstract: This study examines the impact of Internet Banking on banking profitability in Saudi Arabia in a sample of conventional and Islamic banks. The study uses Return on Assets (ROA) and Return on Equity (ROE) as key metrics to measure profitability in a sample of 10 Saudi conventional and Islamic banks observed over the 2013–2022 period. The used regression analysis reveals a significant effect of Internet Banking on the profitability of both conventional and Islamic banks, as indicated by the ROA and ROE metrics. These findings have implications that underscore the strategic importance of adopting Internet Banking, emphasizing its substantial contribution to the financial performance of both conventional and Islamic banks in the Saudi Arabian banking landscape. This study offers critical insights into the strategic significance of Internet Banking for Saudi Arabian banks' profitability and future planning, in line with the 2030 Vision goals. This research also supports informed decision making in the digital era, emphasizing the pivotal role of Internet Banking in shaping the future of the Saudi Arabian banking industry.

Keywords: bank profitability; internet banking; Saudi Arabia

JEL Classification: G21; N2; M1; M2



Citation: Sayari, Sonia. 2024. Driving Digital Transformation: Analyzing the Impact of Internet Banking on Profitability in the Saudi Arabian Banking Sector. *Journal of Risk and Financial Management* 17: 174. <https://doi.org/10.3390/jrfm17050174>

Academic Editor: Svetlozar
(Zari) Rachev

Received: 25 February 2024

Revised: 6 April 2024

Accepted: 9 April 2024

Published: 23 April 2024



Copyright: © 2024 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The banking sector, being at the forefront of digital transformation, admits the paramount importance of leveraging the latest information and communications technologies (Khatoon et al. 2020). According to Khokhar et al. (2020) the advent of “Fintech” has introduced innovative technologies like blockchain, artificial intelligence, and cloud technologies, which have contributed to enhanced efficiency unparalleled to that produced by traditional processes. This ever-growing evolution of “Fintech” is crucial for both Islamic and conventional finance, calling for its active leverage in this ongoing digital transformation (Khokhar et al. 2020).

Internet Banking refers to a set of financial services delivered through digital channels. In essence, it allows customers to access and use financial services through their mobile phones, computers, Point-of-Sale (POS) terminals, and ATMs (Abu Sini et al. 2015). Through electronic payments, individuals can seamlessly transfer funds, settle bills, and make purchases from the comfort of their homes or while out shopping, with minimal physical interaction. Internet Banking facilitates a swift and secure method for governments to reach out to vulnerable populations with social transfers and other financial aid packages, especially during periods of restricted mobility or unsafe travel conditions (Digital Financial Services 2020). The ongoing COVID-19 pandemic has underscored the importance of expanding Internet Banking services as they significantly reduce the need for physical contact while conducting both retail and financial transactions, enabling governments to swiftly provide liquidity to the individuals and businesses most affected by the crisis (Annual Report and Financial Statement 2020). Notably, Internet Banking, particularly

through mobile devices, has enabled remote payments and transactions, responding to social distancing measures aimed at curbing the spread of contagion.

Over the past two decades, Information and Communication Technology (ICT) has deeply reshaped traditional business models and service delivery mechanisms (Jaber and Manaa 2021; Yanto et al. 2021). In the financial sector, particularly banking services, ICT has prompted a strategic shift, compelling banks to embrace cutting-edge digital tools to expand their operations, gain market share, and sustain competitive advantages (Miremadi et al. 2012; Abu Sini et al. 2015). This transformation manifested itself in the introduction of new delivery systems and innovative products and services, leading to improved productivity, efficiency, and an expanded customer base. Such a symbiotic relationship benefited both banks and customers, providing efficient banking operations for customers and increased profits for banks (Miremadi et al. 2012).

The technological landscape in Saudi Arabia has experienced substantial growth in the use of Information and Communication Technology (ICT) (Alam et al. 2024). This progress is observable in the widespread integration of technology-driven networks, revolutionizing various facets of the country's financial infrastructure. Deployment of Automated Teller Machines (ATMs) has become ubiquitous, providing convenient and accessible avenues for financial transactions (AlHaliq and AlMuhirah 2016). Similarly, proliferation of credit cards has facilitated cashless transactions, offering individuals and businesses greater flexibility in managing their finances. Moreover, the advent of mobile banking has empowered users to conduct financial activities through their mobile devices, further enhancing accessibility and convenience (Indrasari et al. 2022). Saudi Arabia is one of the world's largest oil producers and exporters¹, making it a crucial player in the global energy market. Any disruption in Saudi oil production or exports could have significant repercussions on the global economy, affecting fuel prices and various industries worldwide. The introduction of debit cards has played a pivotal role in facilitating electronic transactions, contributing to a transition towards a cashless economy. Telephone banking services have leveraged telecommunications technology to offer an additional channel for banking interactions, providing customers with the flexibility to manage their accounts remotely (Elbadrawy et al. 2014).

This paper makes a significant contribution to the understanding of the banking industry's dynamics, specifically in terms of the impact of Internet Banking on banks' profitability. The paper extends previous theoretical discussions by constructing a regression model through panel data analysis, leveraging key metrics such as Return on Equity (ROE) and Return on Assets (ROA) to quantitatively assess the impact of Internet Banking on bank profitability. The numerous incentives for banks, both in Saudi Arabia and other developing nations, to transition from traditional paper-based transactions to digital internet-based platforms underscore the paper's practical relevance and potential influence on strategic decisions within the global banking sector. This paper provides important insights into how Internet Banking affects bank profitability in Saudi Arabia, as measured by metrics such as Return on Assets (ROA) and Return on Equity (ROE). Such insights are invaluable for industry professionals, enabling them to effectively withstand the evolving competitive environment. Moreover, the findings could empower investors to make informed decisions regarding capital allocation within the banking sector by illuminating the relationship between Internet Banking and profitability metrics. Additionally, policymakers can use this paper to develop policies that promote innovation, competition, and financial stability, thereby fostering economic growth and regulatory efficacy.

2. Literature Review

The literature on Internet Banking underscores a paradigm shift in the traditional banking system, showcasing the deep operational and financial changes induced by the adoption of Information and Communication Technology (ICT) tools by both conventional and Islamic banks (Khokhar et al. 2020). This shift is observable in the wide range of services and products offered exclusively online, facilitated by several digital tools, leading

to increased profits and promising growth opportunities for the banking sector (Abdo 2021). The previous literature not only provides insights into the nature and dimensions of the research problem at hand but also delves into the intricate relationships between its different parameters.

Measurement of bank profitability has been a subject of controversy in the literature. While Laallam et al. (2017) argue for Return on Equity (ROE) as the optimal measure, Qing et al. (2020) suggest the alternative use of Return on Assets (ROA). Hernando and Nieto (2007) contest the use of ROA because of its sensitivity to industry variations and dependence on credit allocation thresholds, proposing ROE as a more robust measure. Acknowledging this tradeoff, our study incorporates both ROE and ROA. Researchers highlight the importance of distinguishing between online banking modes, with a particular focus on the impact of how bank profitability is measured (Abde Latif Awwad and Abdallah Salem 2019; Laallam et al. 2017; Qing et al. 2020).

The relationship between Internet Banking and bank profitability is extensively explored in the literature. Huang et al. (2022) argue for the relevance of Digital Insights (DI) through Internet Banking applications, citing several benefits for customers. However, some scholars caution against assuming universal advantages, suggesting that small businesses with limited online services may struggle to reap the benefits of online banking as it requires substantial marketing efforts and additional costs (Julia and Kassim 2020). Hoseini and Dangoliani (2015) and Motlaghi et al. (2015) delve into the impact of e-banking on bank profitability, highlighting the importance of customer satisfaction and long-term strategic planning. Siam (2006) find a short-term negative effect of capital investment, with an anticipated long-term positive impact. DeYoung et al. (2007) compare Internet Banking adoption phases, revealing improved bank profitability, primarily through increased revenue from deposit service fees. Lin et al. (2005) suggest that Internet Banking, while representing an important innovation, may not universally improve bank performance, potentially resulting in dwindling performance for many banks, with younger banks and earlier adopters more likely to enjoy its benefits. Hammoud et al. (2018) explore the Lebanese banking sector, pinpointing key factors that significantly influence customer satisfaction. The identified factors include reliability, efficiency, ease of use, responsiveness and communication, and security and privacy.

In a recent study, Almansour and Elkrghli (2023) explore the factors affecting customer satisfaction with e-banking services in Libyan banks. The authors focus on key dimensions such as perceived usefulness, perceived ease of use, perceived credibility, and customer attitude. They use a descriptive research design with a quantitative approach, using a questionnaire administered online to 215 e-banking users. The findings unveil compelling insights into the determinants of customer satisfaction with e-banking services. Perceived usefulness, perceived ease of use, perceived credibility, and customer attitude are identified as significant factors positively impacting customer satisfaction with e-banking services. Notably, customer attitude emerges as the most influential factor, followed by perceived ease of use, perceived credibility, and perceived usefulness.

In line with previous research, Hernando and Nieto (2007) conduct a study on 72 commercial banks in Spain from 1944 to 2002, revealing that the impact of online transactions on financial performance unfolds gradually. Acceptance of the internet as a distribution channel is associated with progressive decrease in overheads, leading to a statistically significant improvement in bank profitability more than a year and a half after adoption. Similarly, Onay et al. (2008) explore the impact of Internet Banking on bank profitability in Turkey from 1996 to 2005, showing a positive contribution to ROE with a 2-year lag, in line with the findings of Hernando and Nieto (2007). Building upon these insights, our research hypotheses posit that implementation of online banking has a positive and significant impact on the performance of both Islamic and conventional banks.

3. Methodology

3.1. Sample and Study Design

The data used in this study consist of financial and operational metrics from 10 banks operating in Saudi Arabia observed from 2013 to 2022. These banks were selected to represent a mix of conventional and Islamic banks, ensuring a wider view of the banking sector. In selecting the sample, a total of 10 banks were chosen², a mix of conventional and Islamic banks. Inclusion of both types of banks allows for a comprehensive analysis that accounts for the unique characteristics and operations of each. The data were collected from the annual reports and financial statements of the chosen banks. These reports were extracted from the banks' websites and the Saudi Stock Exchange. To deepen the analysis and ensure a well-grounded perspective, indicators from reputable sources such as the World Bank and the Bank-Scope database were also incorporated into the dataset. These external indicators provide a broader economic view, allowing for a more comprehensive understanding of the factors affecting the financial performance of the selected banks. Using a diverse sample, this study aims to provide a comprehensive view of the relationship between Internet Banking adoption and bank profitability in Saudi Arabia. Collecting data from multiple sources strengthens the robustness of the analysis and enhances the credibility of the study's findings.

3.2. Measurement

Return on Assets (ROA) serves as a fundamental metric, representing the ratio of profits to assets and offering insights into a bank's overall profitability and resource allocation efficiency (Darwanto and Chariri 2019). This indicator allows for comparative evaluations, either across different periods or industry competitors (Saif-Alyousfi et al. 2021). The main objective of our study is to scrutinize bank profitability as measured by ROA. Similarly, Return on Equity (ROE) acts as a financial profitability ratio, illustrating the relationship between profits and equity (Setan and Thunpuattadom 2023). This metric, widely recognized in financial literature (Gul et al. 2011), adds a crucial dimension to our measurement of financial performance.

Operating Performance (OP) is defined as the ratio of operating income to total assets. This metric allows us to delve into the efficiency and productivity of a bank in using its assets to generate operating income. Network Security (NET.SECR) is a critical variable, denoting the use of secure servers using encryption technology for safeguarding online transactions. This variable holds significance in the contemporary banking landscape, emphasizing the importance of secure digital transactions. Credit Risk (CR) is captured through the ratio of loan loss provisions to total loans. This variable sheds light on the bank's provisioning for potential losses in its loan portfolio, providing insights into risk management practices.

Non-Performing Loans (NPLADV) represent the ratio of Non-Performing Loans to Deposits, offering a glimpse into the quality of a bank's loan portfolio. Intermediation Cost (IC) includes the overall cost associated with financial intermediation processes, providing insights into the operational expenses incurred by the bank. Spread (SD) is the difference between the bid price and the ask price, serving as a measure of the cost of transactions and revenue generation in the banking sector. Finally, Internet Banking (INTB) is measured as the share of total Internet Banking transactions relative to overall banking sector operations, reflecting the integration and impact of digital banking services. This variable is crucial to our study of the evolving landscape of banking services in this digital era.

3.3. Panel Data Estimation: An Overview

A panel data analysis consists of three main models: the pooled Ordinary Least Squares (OLS) model, the Fixed Effects (FE) model, and the Random Effects (RE) model. These models differ primarily in their treatment of unobserved effects or individual effects. The pooled OLS model assumes an absence of individual effects, whereas both the Fixed Effects and Random Effects models allow for their presence. The Fixed Effects model is

suitable when individual effects are present and correlate with other regressors in the model. Conversely, if there is no correlation between regressors and individual effects, the Random Effects model is preferred. Researchers typically conduct three statistical tests to determine the most appropriate model: the F-test, the Breusch–Pagan Lagrangian Multiplier (LM) test, and the Hausman specification test. The F-test compares the pooled OLS model with the Fixed Effects model to assess their ability to capture variation in the dependent variable. Subsequently, the Breusch–Pagan LM test compares the pooled OLS model with the Random Effects model to evaluate whether inclusion of random effects significantly enhances model fit. Finally, the Hausman specification test compares the Fixed Effects and Random Effects models to determine which one yields a more efficient and consistent estimation of parameters. These tests help researchers to select the most suitable model for the panel data analysis, considering the presence of individual effects and their potential impact on regression results. Several researchers have used this methodology (Benlagha and Mseddi 2019; Pérez-Amaral et al. 2021; Shamsedin and Dargazani 2020). The general regression model is written as follows:

$$\text{Prof}_i = \beta_0 + \beta_1 \text{SD} + \beta_2 \text{NPLDV} + \beta_3 \text{OP} + \beta_4 \text{IC} + \beta_5 \text{CR} + \beta_6 \text{INTB} + \varepsilon_i$$

where

SD	Spread
NPLDV	Non-Performing Loans to Deposits
OP	Operating Performance
IC	Intermediation Cost
CR	Credit Risk
INTB	Internet Banking
Prof	Bank Performance
ε	Error
β_0	Constant

Bearing on the panel data analysis, the following hypotheses are proposed:

- H1.** *There is a significant relationship between Internet Banking adoption (INTB) and bank performance (Prof).*
- H2.** *Spread (SD) has a significant impact on bank performance (Prof).*
- H3.** *Non-Performing Loans to Deposits (NPLDVs) show a significant relationship with bank performance (Prof).*
- H4.** *Operating Performance (OP) significantly correlates with bank performance (Prof).*
- H5.** *Intermediation Cost (IC) significantly affects bank performance (Prof).*
- H6.** *Credit Risk (CR) has a significant effect on bank performance (Prof).*

3.4. Preliminary Analysis

Before performing panel data analysis, a descriptive analysis of the studied variables is in order. This step includes conducting tests to comprehensively depict the study sample. The purpose of this descriptive analysis is to outline the characteristics of both the dependent and independent variables. It offers an initial understanding of correlation between the independent variables and, ultimately, the relationship between Internet Banking and bank profitability. Descriptive statistics, such as mean, standard deviation, minimum, and maximum, are used to summarize the data. Table 1 presents the results of this descriptive analysis for all variables in the sample, for both conventional and Islamic banks.

Table 1. Descriptive statistics.

Variable	Obs.	Mean	Std.	Min	Max
ROA	100	0.022	0.0119	0.0002341	0.069404
ROE	100	0.163	0.1049	0.0009731	0.4182326
NPLADV	100	4.157	0.4469	3.046245	4.891285
OP	100	3.725	2.0405	−0.1683841	8.892964
SD	100	0.179	0.0951	0.0497837	0.4447514
CR	100	6.034	6.5705	0.4918017	35.35183
NETSECR	100	3697.5	2357.097	577	7977
INTB	100	0.160	0.0035	0.1557573	0.1646336
IC	100	5.939	2.3906	0.5300686	11.49568

The profitability indicators, particularly Return on Assets (ROA) and Return on Equity (ROE), offer crucial insights into the financial performance of the banks in the sample. Return on Assets (ROA) measures the efficiency with which a bank uses its assets to generate profits. A mean ROA of 0.022, along with a standard deviation of 0.0119, suggests that, on average, banks in the sample generate approximately 2.2% profit for every unit of asset they possess. This indicates the profitability level achieved by banks, serving as a significant metric to assess their operational efficiency. Similarly, Return on Equity (ROE) evaluates profitability of a bank in relation to its shareholders' equity. With a mean ROE of 0.163 and a standard deviation of 0.1049, it implies that, on average, banks are generating approximately 16.3% return on their shareholders' equity. This statistic indicates how effectively banks are using shareholder funds to generate profits and create value.

Operating Performance measures the efficiency and profitability of a bank's core operations. With an average (mean) of 3.725 and a standard deviation of 2.0405, it suggests that the banks in the sample have varying levels of Operating Performance. A higher OP indicates better efficiency and profitability in managing core banking activities, such as lending, investment, and fee-based services. Network Security reflects the protocols implemented by banks to protect their digital networks and data from unauthorized access or cyber threats. With an average (mean) of 3697.5 and a standard deviation of 2357.097, it indicates the average level of investment or expenditure on Network Security protocols. Higher values suggest greater emphasis on cybersecurity, which is crucial in safeguarding sensitive customer information and maintaining trust in online banking services. Credit Risk assesses the likelihood of borrowers defaulting on their loans, thereby affecting the bank's asset quality and profitability. With an average (mean) of 6.034 and a standard deviation of 6.5705, it indicates the average level of Credit Risk exposure of the banks in the sample. A higher CR implies a greater proportion of loans extended to borrowers with higher Credit Risk profiles, needing effective risk management strategies to mitigate potential losses. Non-Performing Loans represent the portion of loans that are in default or are unlikely to be repaid, thereby impacting the bank's profitability and financial stability. With an average (mean) of 4.157 and a standard deviation of 0.4469, it suggests that the banks, on average, have a portion of loans classified as non-performing. Effective management of NPLs is essential to maintain asset quality and ensure sustainable profitability.

Intermediation cost refers to the expenses incurred by banks when facilitating financial transactions between borrowers and lenders. An average (mean) of 5.939 and a standard deviation of 2.3906 indicate the average cost incurred per unit of intermediated funds. Lower IC values indicate greater efficiency in intermediation activities, thereby enhancing profitability and competitiveness in the banking sector. Spread represents the difference between the interest rate earned on assets (such as loans) and the interest rate paid on liabilities (such as deposits). An average (mean) of 0.179 and a standard deviation of 0.0951 reflect the average spread earned by banks in the sample. A higher spread indicates greater profitability derived from the interest rate differential, highlighting the importance of effective asset–liability management in maximizing bank earnings. Finally, Internet

Banking measures the extent to which banks offer and use online banking services. An average (mean) of 0.160 and a standard deviation of 0.0035 suggest that approximately 16% of banking activities are conducted online on average. Adoption of Internet Banking enhances convenience for customers and can lead to cost savings for banks through reduced physical infrastructure and operational expenses.

Table 2 shows the correlation matrix, revealing relatively low pairwise correlation coefficients among the independent variables. This indicates the absence of a multicollinearity problem. Consequently, these variables are considered independent of each other, possessing individual explanatory power of bank profitability.

Table 2. Correlation matrix.

	ROA	ROE	SD	NPLDV	OP	IC	CR	INTB	NETSECR
ROA	1.000								
ROE	0.783	1.000							
SD	−0.440	−0.581	1.000						
NPLADV	0.310	0.572	−0.215	1.000					
OP	0.482	0.082	0.188	0.073	1.000				
IC	0.169	0.189	−0.265	0.168	−0.121	1.000			
CR	−0.311	−0.188	0.367	0.057	−0.113	−0.257	1.000		
INTB	0.293	0.296	−0.401	−0.351	−0.106	−0.133	−0.085	1.000	
NETSECR	−0.270	−0.274	0.426	0.356	0.101	0.174	0.089	−0.945	1.000

For panel data estimation, it is crucial to examine the nature of the model—whether a Fixed Effects or Random Effects model. However, before determining the nature of the individual effects, it is crucial to identify these effects. The Fisher test is used for this purpose, and the results are presented in Table 3.

Table 3. Fisher test and identification of individual effects.

	Conventional Banks	Islamic Banks
F-stat	11.22	6.043
<i>p</i> -value	0.000	0.001

Table 3 shows that the probabilities of the Fisher statistics for both conventional and Islamic banks are 0.000 and 0.001, respectively, significant at the 5% threshold. These results indicate the presence of individual effects, which may stem from the individual characteristics of banks and/or may exhibit a random nature. The Fisher statistic is commonly used in statistical analysis to test the overall significance of a group of variables in a regression model. As such, it assesses whether the combined effects of the independent variables significantly affect the dependent variable, which in this case is bank profitability.

Probabilities of 0.000 for conventional banks and 0.001 for Islamic banks suggest that the observed Fisher statistics are extremely low, indicating a very low probability of obtaining such values purely by chance. Therefore, these results provide evidence against the null hypothesis and suggest the presence of individual effects.

4. Results

After identifying individual effects, the Hausman test is used to select between the Random Effects or Fixed Effects models. The Hausman test assesses whether the coefficients (β) of the two estimates, fixed and random, are statistically different. Under the null hypothesis of independence between the errors and the independent variables, the two estimators are unbiased, and the estimated coefficients should exhibit slight differences. The Fixed Effects model posits that the impact of the independent variables on the dependent variable is uniform for all individuals, irrespective of the period considered. Conversely, the Random Effects model posits that the relationship between the dependent variable and

the independent variables is not fixed but random; the individual effect is no longer a fixed parameter but a random variable. The results of estimating the Fixed Effects and Random Effects models are presented in Table 4.

Table 4. The impact of Internet Banking on profitability.

Panel 1: Conventional banks								
ROA Model					ROE Model			
	Fixed Effects		Random Effects		Fixed Effects		Random Effects	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
SD	0.001	0.884	−0.028	0.010	0.031	0.481	−0.019	0.003
NPLDV	−0.02	0.000	0.008	0.000	0.450	0.067	0.0484	0.041
OP	0.012	0.000	0.003	0.000	0.019	0.006	0.0135	0.000
IC	0.0009	0.058	0.0008	0.029	0.078	0.018	0.001	0.017
CR	−0.001	0.148	−0.0002	0.115	−0.004	0.367	−0.001	0.209
INTB	0.866	0.008	1.328	0.000	0.016	0.024	1.089	0.002
_cons	−0.075	0.300	−0.237	0.000	−0.062	0.100	−0.306	0.000
Hausman Test (p-value)			118.45 (0.000)				219.03 0.000	
Panel 2: Islamic banks								
SD	0.077	0.302	−0.131	0.146	0.001	0.884	−0.028	0.010
NPLDV	0.028	0.520	0.150	0.000	−0.027	0.000	0.008	0.000
OP	0.091	0.000	0.025	0.000	0.012	0.000	0.003	0.001
IC	−0.004	0.211	0.004	0.253	0.011	0.058	0.058	0.008
CR	−0.001	0.179	−0.001	0.213	−0.0001	0.148	−0.042	0.115
INTB	16.049	0.000	16.004	0.000	0.866	0.008	1.024	0.000
_cons	−2.845	0.000	−3.118	0.000	−0.075	0.930	−0.237	0.000
Hausman Test (p-value)			93.03 (0.001)				89.73 (0.002)	

The Hausman test results indicate that the Chi2 statistics probability values for both conventional and Islamic banks are 0.000, 0.000, 0.001, and 0.002, all below the 5% significance threshold. Consequently, the Fixed Effects model is retained over the Random Effects model, suggesting a uniform impact of the independent variables on the dependent variable. However, for a more in-depth analysis, it is crucial to determine heteroscedasticity and error auto-correlation biases. To address these concerns, the “Breusch and Pagan” and “Wooldridge” tests were used.

Assuming homoscedasticity requires constant variance in error terms for each observation. Presence of heteroscedasticity indicates that the variance in conditional error terms is not consistent, leading to biased and non-convergent variance estimators. Consequently, confidence intervals and unadjusted statistical tests make inferences invalid. The results of these tests, detailed in the table below, reveal error auto-correlation and heteroscedasticity issues. Consequently, the Generalized Least Squares (GLS) method is used to mitigate estimation bias resulting from these anomalies. The results are presented in Table 5 below:

Table 5. Heteroscedasticity test and errors auto-correlation.

Conventional Banks				Islamic Banks		Decision
Heteroscedasticity	chibar2	0.21	No	chibar2	93.03	No
	p-value	0.322		p-value	0.000	
Auto-correlation	F-stat	7.803	Yes	F-stat	5.18	No
	p-value	0.020		p-value	0.011	

The results of the aforementioned tests reveal error auto-correlation and heteroscedasticity issues. Consequently, to address estimation bias resulting from these anomalies, the Generalized Least Squares (GLS) method is used. Table 6 presents the results after correction by the generalized method of moments.

Table 6. The results after correction by the generalized method of moments.

Panel 1: Conventional banks				
Variables	ROA		ROE	
	Coefficients	p-value	Coefficients	p-value
SD	−0.029	0.004 ***	−0.259	0.003 ***
NPLDV	0.008	0.000 ***	0.155	0.000 ***
OP	0.003	0.000 ***	0.006	0.032 **
IC	0.0006	0.037 **	0.003	0.231
CR	−0.0002	0.102	−0.001	0.293
INTB	1.307	0.000 ***	13.587	0.000 ***
_cons	−0.233	0.000 ***	−2.652	0.000 ***
Wald chi2	180.93		220.68	
p-value	0.000		0.000	
Panel 2: Islamic banks				
SD	0.479	0.004 ***	−0.803	0.029 ***
NPLDV	0.008	0.000 ***	0.508	0.007 ***
OP	0.003	0.000 ***	0.561	0.002 **
IC	0.0006	0.037 **	0.01	0.45
CR	1.019	0.102	−0.001	0.189
INTB	3.178	0.000 ***	7.012	0.000 ***
_cons	−1.209	0.000 ***	−4.682	0.000 ***
Wald chi2	216.07		158.12	
p-value	0.000		0.001	

Note: **, and *** indicate significance at the 5%, and 10% levels, respectively.

The regression results presented in the tables above provide detailed insight into the factors affecting the financial performance of both conventional and Islamic banks in Saudi Arabia. In Panel 1, which focuses on conventional banks, the coefficients and associated *p*-values shed light on the significance and direction of these factors. The noteworthy positive and highly significant coefficient observed for Internet Banking (INTB) across both Return on Assets (ROA) and Return on Equity (ROE) in the regression results holds substantial implications. This indicates a considerable positive impact on the financial performance of conventional banks that have integrated Internet Banking services into their operations. The finding suggests that conventional banks using Internet Banking have improved their financial metrics. This improvement is likely attributed to the enhanced efficiency and operational effectiveness gained by the adoption of Internet Banking services. By offering online platforms for various banking transactions and services, such as account management, fund transfers, and bill payments, conventional banks could streamline their operations and reduce the need for physical branches and manual processes. The positive coefficient indicates that, as Internet Banking adoption increases, there is a corresponding increase in both ROA and ROE. This suggests that the use of Internet Banking services contributes positively to the profitability and overall financial health of conventional banks. The increased convenience and accessibility provided by Internet Banking may attract new customers and retain existing ones, leading to expanded customer bases and increased transaction volumes. Moreover, the lower operating costs associated with online banking, compared to the traditional brick-and-mortar paradigm, can contribute to improved cost efficiency and higher profit margins for conventional banks.

The positive and highly significant relationship observed between Non-Performing Loans to Deposits (NPLDVs) and Return on Assets (ROA) suggests an intriguing correlation. Specifically, it indicates that a higher ratio of Non-Performing Loans to Deposits

is associated with increased Return on Assets for conventional banks. This finding may denote the presence of specific financial strategies or risk management practices in conventional banks. One possible explanation could be that banks with a higher proportion of Non-Performing Loans to Deposits are effectively managing these assets in a manner that optimizes their Return on Assets. For instance, banks may have implemented proactive measures to identify and address Non-Performing Loans, such as restructuring loans, negotiating settlements with borrowers, or implementing stringent Credit Risk management policies. Additionally, banks may have diversified their investment portfolios or engaged in other income-generating activities to mitigate the adverse effects of Non-Performing Loans on their overall financial performance. Alternatively, it is also plausible that the observed relationship reflects underlying market dynamics or economic conditions. In times of economic downturn or financial distress, banks may experience higher levels of Non-Performing Loans, which, paradoxically, could coincide with increased returns on assets because of different factors such as lower competition, higher interest rate spreads, or opportunities for distressed asset acquisition.

Furthermore, Operating Performance (OP) shows a positive and a significant relationship with both Return on Assets (ROA) and Return on Equity (ROE). This finding highlights the critical role of operational efficiency in shaping the overall financial performance of conventional banks. This positive relationship suggests that banks with higher operational performance tend to achieve better financial outcomes, as reflected in their ROA and ROE. This underscores the importance of effective operational management practices in enhancing profitability and sustainability. Operational efficiency encompasses different dimensions of a bank's operations, including cost management, process optimization, and resource allocation. Banks that excel in these areas can minimize losses, improve productivity, and enhance customer satisfaction, ultimately leading to higher returns on assets and equity. By efficiently managing their resources and operations, banks can achieve economies of scale, reduce operating expenses, and maximize revenue generation opportunities. Not only does this strengthen their financial position but it also enhances their competitive advantage in the market.

In Panel 2, which focuses on Islamic banks, similar patterns can be observed, highlighting notable trends in the regression results. Once again, Internet Banking (INTB) stands out with a highly significant positive impact on both Return on Assets (ROA) and Return on Equity (ROE). This consistent finding reinforces the notion that Internet Banking plays a pivotal role in enhancing financial performance regardless of the banking model being conventional or Islamic. The robustness of these results is further supported by the Wald chi-squared statistics, which confirm the overall significance of the models. This underscores the combined effect of the included variables on the variation in financial metrics of Islamic banks. However, it is important to signal a noteworthy finding on Credit Risk (CR), which does not show statistically significant coefficients in either panel. This implies that, at least in this study, Credit Risk may not be a significant determinant of financial performance for both conventional and Islamic banks in Saudi Arabia. Table 7 provides a comprehensive overview of the obtained findings.

Table 7. Summary of results and hypotheses testing.

<i>Panel 1: Conventional banks</i>				
Hypothesis	ROA		ROE	
	<i>Coefficients</i>	Result	<i>Coefficients</i>	Result
Spread (SD) has a significant impact on bank performance	−0.029 ***	Accepted	−0.259 ***	Accepted
Non-Performing Loans to Deposits (NPLDVs) show a significant relationship with bank performance	0.008 ***	Accepted	0.155 ***	Accepted

Table 7. Cont.

Panel 1: Conventional banks					
Hypothesis	ROA		ROE		
	Coefficients	Result	Coefficients	Result	
Operating Performance (OP) significantly correlates with bank performance	0.003 ***	Accepted	0.006 **	Accepted	
Intermediation Cost (IC) significantly affects bank performance	0.0006 **	Accepted	0.003	Rejected	
Credit Risk (CR) has a significant effect on bank performance	−0.0002	Rejected	−0.001	Rejected	
There is a significant relationship between Internet Banking adoption (INTB) and bank performance	1.307 ***	Accepted	13.587 ***	Accepted	
Panel 2: Islamic banks					
Spread (SD) has a significant impact on bank performance	0.479 ***	Accepted	−0.803 ***	Accepted	
Non-Performing Loans to Deposits (NPLDVs) show a significant relationship with bank performance	0.008 ***	Accepted	0.508 ***	Accepted	
Operating Performance (OP) significantly correlates with bank performance	0.003 ***	Accepted	0.561 **	Accepted	
Intermediation Cost (IC) significantly affects bank performance	0.0006 **	Accepted	0.01	Rejected	
Credit Risk (CR) has a significant effect on bank performance	1.019	Rejected	−0.001	Rejected	
There is a significant relationship between Internet Banking adoption (INTB) and bank performance	3.178 ***	Accepted	7.012 ***	Accepted	

Note: **, and *** indicate significance at the 5%, and 10% levels, respectively.

5. Conclusions, Implications, and Recommendations for Future Research

In conclusion, this comprehensive study has thoroughly examined the intricate dynamics affecting the financial performance of both conventional and Islamic banks operating in Saudi Arabia. Through meticulous analyses, critical variables such as Internet Banking (INTB), Non-Performing Loans to Deposits (NPLDVs), Operating Performance (OP), and Credit Risk (CR) were found to have an impact on financial outcomes. The robust findings of the study consistently underscore the pivotal role of Internet Banking. It was found to have a significant positive effect on both Return on Assets (ROA) and Return on Equity (ROE). These findings call for financial institutions in Saudi Arabia to prioritize and continuously invest in digital banking infrastructures. Doing so enables them to remain competitive and resilient in a rapidly evolving financial landscape characterized by technological advancements and changing consumer preferences. Furthermore, the study has shed light on the dynamic interplay between operational efficiency, Credit Risk, and financial metrics. These insights offer valuable guidance for banks in developing targeted strategies aimed at enhancing their performance. By optimizing operational efficiency, effectively managing Credit Risk, and embracing digital innovation, banks can position themselves for sustained growth and success in this challenging environment of the Saudi financial sector.

The implications of these findings carry significant weight on several dimensions, with strategic, operational, and policy effects. Firstly, the study underscores the strategic imperative of not only embracing but also optimizing Internet Banking. It emphasizes that Internet Banking should be viewed not merely as a technological breakthrough but as a fundamental pillar of improved financial performance for both conventional and Islamic banks. This suggests that banks need to prioritize investments in digital infrastructure and innovative online banking tools to remain competitive in an evolving financial landscape. Moreover, the nuanced interplay between operational efficiency, Credit Risk, and financial metrics identified in the study provides valuable insights for policymakers to develop more targeted and bespoke strategies. By understanding the intricate relationships between these factors, banks can tailor their approaches to enhance their operational efficiency while

effectively managing Credit Risk. For example, banks may focus on streamlining processes, investing in advanced analytics for Credit Risk assessment, and implementing proactive risk mitigation measures to optimize their overall performance in the Saudi financial market. Additionally, the lack of statistical significance for Credit Risk underscores the need for a tailored and context-specific approach to risk management. While Credit Risk remains a critical factor for banks, the study suggests that its impact on financial performance may vary depending on the specific market dynamics, regulatory environment, and operational strategies used by banks. Therefore, banks need to adopt a flexible and adaptive approach to Credit Risk management, taking into account the unique characteristics and challenges of the Saudi banking sector.

Despite this study's thorough analysis, several limitations should be acknowledged. Firstly, reliance on secondary data sources, such as annual reports and financial statements, may have introduced biases or errors in the data analysis process. Additionally, the study's focus on Saudi Arabian banks may limit the generalizability of the findings to other banking contexts with different regulatory frameworks or market conditions. Moreover, while efforts were undertaken to control for different factors influencing bank profitability, the presence of unobserved variables or omitted variable bias cannot be entirely ruled out. Furthermore, the study's cross-sectional design restricts the ability to establish causality between variables, highlighting the need for longitudinal studies to validate the observed relationships over time. Lastly, the study's option for quantitative analysis may overlook qualitative dimensions that could provide deeper insights into the mechanisms driving financial performance in the banking sector. Despite these limitations, the study offers valuable insights into the role of Internet Banking and other key factors in shaping the financial performance of banks in Saudi Arabia, laying the groundwork for future research endeavors to address these limitations and further enhance our understanding of the banking landscape.

Future research should build upon these foundations and delve deeper into the mechanisms through which Internet Banking shapes financial performance. Understanding user behavior, evolving technological landscapes, and potential cultural nuances will enrich our comprehension of the digital banking ecosystem in Saudi Arabia. Additionally, a focused exploration of Credit Risk dynamics within the Saudi context may provide insights to develop risk management strategies. Comparative studies between Islamic and conventional banks are also encouraged, offering an insightful perspective on sector-specific challenges and opportunities. Ongoing research initiatives should vigilantly consider the ever-evolving digital banking landscape, providing timely guidance for strategic adaptations in the face of emerging trends and challenges.

Funding: This research received no external funding.

Data Availability Statement: The data that support the results and analysis of this study are available from author W.D. upon reasonable request.

Conflicts of Interest: The corresponding author states that there are no conflicts of interest. The authors declare that they have no known competing financial interests or personal relationships that could appear to influence the work reported in this paper.

Notes

¹ <https://t.ly/S3Awv>, accessed on 12 December 2023.

² The sample consists of ten banks operating in Saudi Arabia, including Al Rajhi BankingInvest, Bank Al-Jazira, Islamic Development Bank, Riyadh Bank, Saudi British Bank, Banque Saudi Fransi, Arab National Bank, Saudi Hollandi Bank, Saudi Investment Bank, and Samba Financial Group.

References

- Abde Latif Awwad, Bahaa Sobhi, and Ammar Zakaria Abdallah Salem. 2019. The Role of Financial Analysis in Assessing the Prices of Shares of Jordanian Industrial Joint Stock Companies Listed on the Amman Stock Exchange. *International Journal of Economics and Finance* 11: 120. [CrossRef]

- Abdo, Khawla Kassed. 2021. The effect of external economic variables on the conventional banks and Islamic banks financial performance in Jordan: A comparative study. *Journal of Sustainable Finance and Investment* 13: 229–47. [CrossRef]
- Abu Sini, Ahmad, Yaser Almansour, and Bashar Almansour. 2015. The effect of e-banking on customers' satisfaction in financial services: An empirical investigation on financial sector in Saudi Arabia Ahmed. *Journal of Arts, Science & Commerce* 6: 2–12.
- Alam, Isbat, Lu Shichang, Saqib Muneer, Khalid Mahsan Alshammmary, and Muhammad Zia ur Rehman. 2024. Does Financial Inclusion and Information Communication Technology Affect Environmental Degradation in Oil-Producing Countries? *PLoS ONE* 19: e0298545. [CrossRef] [PubMed]
- AlHaliq, Hani A., and Ahmad A. AlMuhirat. 2016. Customer satisfaction with electronic banking services in the Saudi banking sector. *Asian Social Science* 12: 139–46. [CrossRef]
- Almansour, Bashar, and Sabri Elkrghli. 2023. Factors Influencing Customer Satisfaction on E-Banking Services: A Study of Libyan Banks. *International Journal of Technology, Innovation and Management* 3: 34–42. [CrossRef]
- Annual Report and Financial Statement. 2020. Available online: https://www.centralbank.go.ke/uploads/cbk_annual_reports/569264497_Annual%20Report%202020-2021.pdf (accessed on 31 December 2015).
- Benlagha, Nouredine, and Slim Mseddi. 2019. Return and Volatility Spillovers in the Presence of Structural Breaks: Evidence from GCC Islamic and Conventional Banks. *Journal of Asset Management* 20: 72–90. [CrossRef]
- Darwanto, and Anis Chariri. 2019. Corporate Governance and Financial Performance in Islamic Banks: The Role of the Sharia Supervisory Board in Multiple-Layer Management. *Banks and Bank Systems* 14: 183–91. [CrossRef]
- DeYoung, Robert, William W. Lang, and Daniel L. Nolle. 2007. How the Internet affects output and performance at community banks. *Journal of Banking and Finance* 31: 1033–60. [CrossRef]
- Digital Financial Services. 2020. Available online: <https://pubdocs.worldbank.org/en/230281588169110691/Digital-Financial-Services.pdf> (accessed on 31 December 2015).
- Elbadrawy, Rehaballah, Ahmed Farouk Abdul Moneim, and M. Nashat Fors. 2014. A Hybrid Model AHP and PROMETHEE for Evaluation of E-Banking Services. Paper presented at the 2014 Industrial and Systems Engineering Research Conference, Montreal, QC, Canada, May 31–June 3; pp. 1462–71.
- Gul, Ferdinand A., Bin Srinidhi, and Anthony C. Ng. 2011. Does board gender diversity improve the informativeness of stock prices? *Journal of Accounting and Economics* 51: 314–38. [CrossRef]
- Hammoud, Jamil, Rima M. Bizri, and Ibrahim El Baba. 2018. The impact of e-banking service quality on customer satisfaction: Evidence from the Lebanese banking sector. *SAGE Open* 8: 2158244018790633. [CrossRef]
- Hernando, Ignacio, and Maria J. Nieto. 2007. Is the Internet delivery channel changing banks' performance? The case of Spanish banks. *Journal of Banking & Finance* 31: 1083–99.
- Hoseini, Azadeh, and Saeid Khaje Dangoliani. 2015. Investigating the effect of electronic banking services quality on the customer satisfaction. *International Economics Review* 1: 37–42.
- Huang, Zhuo, Yunqing Tao, Xin Luo, Yongwei Ye, and Tianyi Lei. 2022. Regional digital finance and corporate investment efficiency in China. *Applied Economics* 55: 5115–34. [CrossRef]
- Indrasari, Arum, Nurul Nadjmie, and Endri Endri. 2022. Determinants of Satisfaction and Loyalty of E-Banking Users during the COVID-19 Pandemic. *International Journal of Data and Network Science* 6: 497–508. [CrossRef]
- Jaber, Ali B., and Mehdi E. Manaa. 2021. A Robust Fog-Computing Security Approach for IoT Healthcare Applications. Paper presented at the International Conference on Communication and Information Technology, Basrah, Iraq, June 5–6; pp. 174–79. [CrossRef]
- Julia, Taslima, and Salina Kassim. 2020. Exploring green banking performance of Islamic banks vs. conventional banks in Bangladesh based on Maqasid Shariah framework. *Journal of Islamic Marketing* 11: 729–44. [CrossRef]
- Khatoon, Sadia, Xu Zhengliang, and Hamid Hussain. 2020. The Mediating Effect of Customer Satisfaction on the Relationship between Electronic Banking Service Quality and Customer Purchase Intention: Evidence From the Qatar Banking Sector. *SAGE Open* 10: 2158244020935887. [CrossRef]
- Khokhar, Imran, Mehboob ul Hassan, Muhammad Nauman Khan, and Md Fouad Bin Amin. 2020. Investigating the efficiency of GCC banking sector: An empirical comparison of Islamic and conventional banks. *International Journal of Financial Research* 11: 220–35. [CrossRef]
- Laallam, Abdelkader, Fardous Alom, and Azhar Mohamad. 2017. The effects of corporate governance attributes and code amendments on the performance of Malaysian trading and services firms. *International Journal of Economics and Business Research* 13: 72–94. [CrossRef]
- Lin, Jui-Chu, Jin-Li Hu, and Kang-Liang Sung. 2005. The effect of electronic banking on the cost efficiency of commercial banks: An empirical study. *International Journal of Management* 22: 605.
- Miremadi, A. R., S. Ghalamakri, and A. A. Ramezani. 2012. Challenges in trust and security by implementation of E-CRM among banks and financial institution: A case study of e-banking in Iran. *International Journal of Information Science and Management* 10: 99–118.
- Motlaghi, E. A., H. Hosseini, and M. Teimouri. 2015. Investigating the effect of the quality of e-banking services on customer's satisfaction of ghavamin bank: (Case Study: Tehran City). *International Journal of Applied Business and Economic Research* 13: 4203–14.
- Onay, Ceylan, Emrr Ozsoz, and Aslı Deniz Helvacioğlu. 2008. The impact of Internet-Banking on Bank Profitability—The Case of Turkey. Paper presented at the Oxford Business & Economics Conference, Oxford, UK, June 22–24; ISBN 978-0-9742114-7-3.

- Pérez-Amaral, Teodosio, Angel Valarezo, Rafael López, and Teresa Garín-Muñoz. 2021. Digital Divides across Consumers of Internet Services in Spain Using Panel Data 2007–2019. Narrowing or Not? *Telecommunications Policy* 45: 102093. [\[CrossRef\]](#)
- Qing, Soong Yu, Hooy Chee Wooi, and Abdul Hadi Zulkafli. 2020. The role of country governance on the relationship between firm governance and firm performance: Evidence from emerging countries. *Institutions and Economies* 13: 35–68. [\[CrossRef\]](#)
- Saif-Alyousfi, Abdulazeez Y. H., Asish Saha, Rohani Md-Rus, and Kamarun Nisham Taufil-Mohd. 2021. Do Oil and Gas Price Shocks Have an Impact on Bank Performance? *Journal of Commodity Markets* 22: 100147. [\[CrossRef\]](#)
- Setan, Thantip, and Piyanat Thunputtadom. 2023. Good Corporate Governance and Accounting Performance Affecting the Profit Quality of Companies Listed on the Stock Exchange of Thailand during the COVID-19 Pandemic. *WSEAS Transactions on Business and Economics* 20: 815–23. [\[CrossRef\]](#)
- Shamsedin, Hosseini Seyed, and Nasim Dargazani. 2020. The Effect of Electronic Banking on Deposit Attraction and Market Concentration in Iran's Banking Industry. *Iranian Economic Review* 24: 545–65. [\[CrossRef\]](#)
- Siam, Ahmad Zakaria. 2006. Role of the Electronic Banking Services on the Profits of Jordanian Banks. *American Journal of Applied Sciences* 3: 1999–2004. [\[CrossRef\]](#)
- Yanto, Heri, Norashikin Ismail, Kiswano Kiswanto, Nurhazrina Mat Rahim, and Niswah Baroroh. 2021. The Roles of Peers and Social Media in Building Financial Literacy among the Millennial Generation: A Case of Indonesian Economics and Business Students. *Cogent Social Sciences* 7: 1947579. [\[CrossRef\]](#)

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.