“Nexus between information technology investment and bank performance: The case of Jordan”

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NEXUS BETWEEN INFORMATION TECHNOLOGY INVESTMENT AND BANK PERFORMANCE: THE CASE OF JORDAN

Abstract

Bank stakeholders, such as creditors, investors, regulators, and other bank stakeholders, expect continuous performance improvement. To achieve this goal, bank managers can use information technology (IT) as a strategic resource to improve their bank's capabilities and accordingly gain competitive advantage. In this study, the profitability and efficiency of commercial banks in Jordan are compared to investment in information technology (IT). Return on equity (ROE), return on assets (ROA), and net interest margin (NIM) are used to measure bank profitability while controlling for bank size and financial leverage. Cost efficiency is measured using the cost efficiency ratio. The study sample consists of 13 commercial banks listed on the Amman Stock Exchange between 2010 and 2021. To determine the relationship between the variables, descriptive statistics, correlation analysis, the panel least squares approach, and fixed effects multiple regression models are used. The findings show that banks, on average, spend 0.61 percent of their total assets on information technology (hardware and software). Additionally, banks that invest in IT are predicted to perform better over time, as evidenced by their increased profitability and efficiency. Small banks have more IT investment as a percentage of assets than larger banks. In comparison to highly leveraged banks, less leveraged banks typically have a greater IT investment to asset ratio (0.69%). The findings show that profitable banks (measured by ROE) invest more than 1.1% of their total assets in IT. Meanwhile, highly efficient banks also invest more in IT (0.65%) compared to less efficient banks.

Keywords information technology, bank performance

JEL Classification M15, G11, G21, G23

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INTRODUCTION

Information technology (IT) has become an important strategic tool in today's dynamic economic and banking sector. Empirical evidence suggests that IT investment is a key driver of profitability and a significant contributor to performance and competitiveness. IT investment allows banks to provide e-services to customers. More specifically, IT investment and its effective and efficient use in the banking sector improve customer satisfaction, increase market share, and improve banking operations.

Among the most important decisions made by management in any business sector, but especially the financial sector, is the decision to invest in knowledge and communication technologies. Investing in such technologies enable financial firms to gain momentum and competitive advantage over their competitors. Current technological advancements, continuous innovation, and globalization have forced the banking sector to heavily invest in IT to remain competitive.

By investing in online and mobile banking, such as by supplying point-of-sale terminals (POS) and automated teller machines, some

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empirical evidence suggests that banks can improve their performance and competitive advantage (ATMs). Therefore, by utilizing and investing in digital innovations and IT infrastructure, banks may boost their productivity and efficiency. Given the importance of IT investment and innovation in the banking sector, this study aims to ascertain how much IT investment impacts Jordanian banks' performance. The fact that the Jordanian banking sector has consistently expanded its IT investment over the past ten years shows how crucial IT is to their success. The total amount invested by Jordanian banks and financial institutions in IT (software and hardware) from 2011 to 2020 increased by 107%, from JD 73.139 million to JD 151.491 million.

Although technological innovation has had a significant impact on Jordanian banks, it is still unclear whether IT investment has an effect on their ability to make money. To close this gap in the literature, this study examines how IT investment has affected the performance of commercial banks in Jordan.

1. LITERATURE REVIEW

Technology adoption by corporate organizations has received a great deal of attention from academics. According to empirical research, IT has significantly changed how financial services are provided (Oyewole et al., 2013; Akande, 2016; Kwateng et al., 2019; Liu et al., 2021). The impact of financial technology (FinTech) investment on the performance (ROE), risk (capital asset pricing model (CAPM) beta), and value (price-to-book ratio) of 17 listed Italian banks between 2013 and 2019 is examined by Beltrame et al. (2022). These are the largest banks in Italy. Digital-active banks and banks with an emphasis on digital are two subcategories of the FinTech variable. Findings show that investment in FinTech positively affects ROE of digitally engaged banks, price-to-book ratio of digitally oriented banks, and ROE, but not significantly CAPM beta.

In their study Ghose and Maji (2022) used a sample of 67 commercial banks in India during the period from 2011 to 2019 to investigate the impact of internet banking on bank performance measured by Return on Assets and Return on Equity. They found that using internet banking increased the profitability of the bank, and the higher positive impact were in public sector banks as a result of economies of scale of operation.

In their study of 23 economies between 2002 and 2016, Le and Ngo (2020) examine at the elements influencing bank profitability. The findings show that a number of distribution channels, such as bank cards, ATMs, and point-of-sale terminals, can boost a bank's profitability. These delivery alternatives should be expanded in light of this. Meanwhile, market forces have a detrimental effect on bank profitability. Consequently, competition boosts bank profits. In conclusion, a more diverse financial sector and a less concentrated banking industry can boost bank profitability.

The performance of the Indonesian banks was shown to be negatively impacted by financial technology, according to Phan et al. (2020). The result of their study suggested that banks that are mature and owned by the government are less affected by financial technology than new banks and private banks.

The expansion of FinTech startups has adversely affected the investigated sample's return on assets (ROA) and return on equity (ROE), demonstrating the detrimental effect that financial innovations have on the efficiency of Indonesian banks. Furthermore, it appears that more mature, higher-value, and state-owned institutions are less impacted than younger, lower-capital commercial banks.

Given the expansion of IT, banks must adapt if they wish to continue competing in the global banking industry. Islam et al. (2019) investigate the relationship between online banking, a type of IT adoption, and banks' productivity, efficiency, and profitability. Performance is indicated by ROA and ROE as proxies. The data are derived from the yearly reports of 30 listed banks. The findings indicate that banks with online banking services have higher ROA and ROE than those without any. Therefore, customers prefer banks with online services due to their convenience and benefit. At the

same time, such services allow a bank to reduce their operating costs.

The impact of information system innovation on the business strategy and profitability of banks is examined by Siek and Sutanto (2019). The findings indicate that FinTech payment systems have affected banks since 2015 as new startups emerge. FinTech for loan and investment purposes positively affect bank profitability only if the banks provide traditional services efficiently (Desai et al., 2019). FinTech investment, particularly when they profoundly redefine a bank's business model, needs time before they can improve bank efficiency and performance.

Six Islamic countries – Jordan, Kuwait, Iran, Malaysia, Senegal, and Indonesia – were chosen by Torki et al. (2019) to study how the use of electronic payment systems affected the performance of the financial sector in each of these nations from 2011 to 2017. The study used automated teller machines, bank cards, cell phones, online banking, and bank accounts as proxies for FinTech payment methods. The results show that different payment methods have a favorable and significant impact on how well the banking industry performs. The results also demonstrate that for the chosen countries, economic conditions and population growth have a significant positive impact on the financial sector's performance, whereas inflation and interest rates have a significant negative effect.

Owusu et. al. (2019), use the data envelopment analysis (DEA) to investigate causality between the efficiency of applying information technology (IT) and bank performance. The results show that there are both short-run and long-run relationships between IT efficiency and cost performance. Indicating that; application of IT in bank operations will contribute significantly on bank performance.

In the period 2010–2016, Harelimana (2018) investigates the relationship between ATMs and bank profitability. The results show that a barrier to providing ATM services continues to be a lack of financial education (such as knowledge and client training on how to use ATM cards). The relationships between ATM and ROA and between ROE and net margin are not statistically significant. Low cost, differentiation, and accessibility variables all influence how satisfied ATM users are.

The profitability and cost efficiency of five Chinese banks that have completely embraced the e-banking system are examined by Yang et al. (2018). The data are taken directly from the banks' annual reports. ROA, ROE, operating margin, NIM, and efficiency ratio are all used to assess bank performance. The results demonstrate that e-banking boosts ROA, ROE, and OM. The impact on NIM and efficiency ratio, however, is minimal.

According to Akhisar et al. (2015), e-banking services have a detrimental effect on bank profitability (ROA and ROE). The sample covers the years 2005 to 2019 and includes e-banking services from 23 developed and emerging economies. The results show that bank profitability is significantly impacted by the ratio of bank branches to ATMs in both established and emerging economies. The quantity of cards issued and the proportion of ATMs to branches both affect profitability. Additionally, customers are becoming acclimated to e-banking tools like ATMs that lower operating expenses.

However, some empirical research suggests that the effect of IT investment on bank profitability is yet equivocal. Bacilli (2007), for example, discovers a weak relationship between IT software and infrastructure investment and bank performance. According to other studies, IT investment is irrelevant to bank profitability. This is particularly clear in the short term, since the advantages of IT have not offset their cost of investment (Furst et al., 1998; Mashal, 2006; Siam, 2006).

Finally, several studies (Youssef & Qassem, 2016; Al Amosh & Khatib 2021) find that IT does not significantly affect bank performance as a result of statistical problems such multicollinearity. Based on the above, the main objective of this study is to investigate how IT investment affects the performance of Jordanian banks.

To accomplish the research objectives, the following hypotheses were developed:

H_{01}: *Information technology investment positively related to net interest margin (NIM).*

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H_{02}: *Information technology investment positively related to return on equity (ROE).*

H_{03}: *Information technology investment positively related to return on assets (ROA).*

H_{04}: *Information technology investment positively related to cost efficiency ratio.*

2. METHODOLOGY

There are numerous simple and complex qualitative and/or quantitative methods to evaluate IT investment. Based on the literature review, bank performance is analyzed in terms of profitability and cost efficiency (Yang et al., 2018; Achchuthan & Kajananthan, 2013; Lee & Kim, 2013; Khrawhish & Al-Sa'di, 2011; DeYoung et al., 2007; Hernando, 2007). Profitability is measured using ROA, ROE, and NIM. These are considered as good indicators of bank profitability by practitioners, as they are based on publicly available data. The cost efficiency of the bank's investment is determined by the cost efficiency ratio. A low percentage indicates an increase in revenue or decrease in costs.

In the banks' financial reports for the years 2010 through 2021, the IT investment variable is calculated as the total investment in IT software (computer systems and apps for e-banking and mobile banking, etc.) and infrastructure (computer hardware, ATMs, etc.). Each variable's measurement is described in Table 1.

The following model was developed to analyze and test the hypotheses (model 1):

$$Y_{i,t} = \beta_0 + \beta_1 IT - inv_{i,t} + \beta_2 Size_{i,t} + \\ + \beta_3 Leverage_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where $Y_{i,t}$: profitability and cost efficiency indicators.

All commercial banks listed on the Amman Stock Exchange, which are 13 by the end of 2021, are included in the research sample. The sample period is 2010–2021 with a total of 156 observations.

3. RESULTS

3.1. Summary statistics

The banking sector accounts for 7.6% of Jordan's current price GDP. As noted, the banking industry in Jordan is increasingly mature and growing in scale. There are 25 commercial banks in Jordan as of December 2021, nine of which are foreign. Total domestic banking asset in 2021 was JD 61 billion, while its growth rate ranged between 1.62% and 9.6% in 2010–2021. Table 2 summarizes key indicators of the banking industry in Jordan.

As technology growth in IT causes numerous changes in the services supplied by Jordanian banks, banks must dive into technological innovations to remain competitive and hold onto their market share. The rise of IT investment (hardware and software) from 2011 to 2020 is shown in Table 3.

Table 1. Definition and measurements of variables

Source: Rose and Hudgins (2010).

Variable	Definition	Measurement
Dependent variable		
ROA	ROA is a reliable indicator of profitability. It measures how efficiently assets are managed to generate profit	ROA = Net income after taxes/ Total Assets
ROE	Financial return generated from shareholders' equity	Return on Equity = Net Income/Shareholder's Equity
NIM	Measures profit generated by the banks from borrowing and lending funds	Net interest margin= net interest income/ total assets
Efficiency	The cost to income ratio measures a bank's ability to turn overhead into revenue	Cost Efficiency ratio= Non-interest expense/ revenue
In-Dependent variable		
IT-inv	Total investment in software, hardware, Swift/internet, ATMs, and e-banking system development	IT-inv = end-of-year value of software and hardware investments / total assets
Control variables		
Size	Total assets of a bank	Size = ln(total assets)
Financial leverage	Debt to total assets ratio of bank *i* in year *t*.	Flev = Total Liabilities / total assets

Table 2. Performance indicators for the Jordanian banking sector, 2010–2021

Source: Inter active Database, Central Bank of Jordan.

Variable	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
ROA	1.1%	1.1%	1.1%	1.2%	1.4%	1.3%	1.1%	1.2%	1.2%	1.18%	0.6%	1%
ROE	8.8%	8.3%	8.6%	9.9%	11%	10.3%	8.9%	9.1%	9.6%	9.44%	5.1%	8.3%
Financial Leverage	13.1%	13.1%	13.3%	12.9%	12.5%	12.7%	12.9%	13.2%	12.6%	12.4%	12.2%	11.7%
Legal Liquidity Ratio	161.4%	152.9%	143.5%	149.1%	152.2%	148.98%	137.8%	130.1%	131.9%	133.8%	136.5%	141.5%
Total Assets (in Million JD)	34,973.0	37,686.3	39,275.4	42,802.9	44,868.1	47,133.2	48,383.5	49,102.5	50,917.8	53,642.0	57,038	61,057.7
Growth Rate in Total Assets	9.6%	7.9%	4.3%	9.1%	4.9%	5.08%	2.6%	1.62%	3.02%	5.4%	5.6%	7.9%

Table 3. Investment in IT software and hardware by the banking and financial sector in Jordan, 2011–2020 (JD thousand)

Source: Interactive Database, Department of Statistics, Jordan.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Software	34,099	43,582	51,389	62,233	63,130	81,420	77,618	80,045	71,156	84,179
Hardware	39,040	36,128	49,151	54,325	70,427	56,989	49,539	36,1490	72,733	67,312
Total	73,139	79,710	100,540	116,558	133,557	138,409	127,157	441,535	143,889	151,491

Figures in Table 3 indicate a great growth in IT investment, the IT investment grew by 107% during the period from 2011–2020.

Some summary statistics for the variables utilized in the model are shown in Table 4. Small banks (total assets ≤ JD 10 billion) approximately invest about 0.63% of their total assets in IT software and hardware, while large banks (total assets ≥ JD 20 billion) invest about 0.34% of their total assets in IT.

Additionally, highly leveraged banks invest about 0.51% of their total assets in IT, while less leveraged banks invest 0.69%. More profitable banks (measured by ROE) invest more than 1.1% of their total assets in IT. Banks with higher efficiency ratio also invest more in IT (0.65%) compared to less efficient banks.

Table 5 presents the correlation between the independent and control variables. No multicollinearity is detected between the explanatory and control variables, as the correlation values are less than .80 or .90 (Ghozali, 2012; Gujarati, 2015).

Table 5. Pearson correlation between independent and control variables

Independent & Control Variables	ITONTA	LEVERAG	SIZE
ITONTA	1.000000	–	–
LEVERAG	–0.069497	1.000000	–
	–0.864526	–	–
	(0.3886)	–	–
SIZE	0.011186	–0.104474	1.000000
	0.138824	–1.303623	–
	(0.8898)	(0.1943)	–

Table 4. Summary statistics

Statistics	IT investments to Total Assets	ROA	ROE	NIM	Efficiency Ratio	LEVERAG	SIZE
Mean	0.006055	1.134423	8.024288	0.030671	0.681857	86.30477	21.58537
Median	0.005389	1.160000	8.570000	0.029393	0.602917	86.10626	21.46895
Maximum	0.015988	5.000000	16.87000	0.058347	2.492853	93.50371	24.04164
Minimum	0.000483	–0.170000	–1.450000	0.011162	0.143407	80.91315	19.65224
Std. Dev.	0.003163	0.603151	3.755246	0.007734	0.361299	2.638915	0.930716
Observations	156	156	156	156	156	156	156

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3.2. Hypotheses testing

The hypotheses are tested using multiple linear regression after adjusting for heteroscedasticity. This section presents the hypotheses testing results.

First, it is examined how IT investment affects bank profitability (NIM, ROE, and ROA). According to the findings, IT investment is favorably associated to all profitability measures, however, only NIM and ROA are significantly related. In terms of the control variables, bank size is positively but insignificantly correlated with bank profitability, but financial leverage has a seemingly contradictory impact on profitability. Its effect is positive and significant on NIM but negative and significant on ROE and ROA. The Durbin-Watson statistics for all regression models are between 1.5 and 2.0, indicating the absence of autocorrelation between the contiguous values of the variables. *F*-statistics for all three models are significant, $p < 0.01$.

Table 6. Effect of IT investment on measures of bank profitability

Variable	NIM	ROE	ROA
ITONTA	0.057641**	29.91110	13.06270**
SIZE	0.000290	0.179145	0.027707
LEVERAG	2.75E–11**	–0.036237	–0.034115*
NIM(-1)	0.904872**	–	–
ROE(-1)	–	0.660564	–
ROA(-1)	–		0.494579*
C	–0.004215	1.605096	2.829468***
R-squared	0.885141	0.468389	0.274434
Adjusted R-squared	0.881812	0.452980	0.253403
F-statistics	265.8693	30.39713	13.04906
Prob (F-statistics)	0.000000	0.000000	0.000000
Durbin-Watson stat	2.047359	1.826568	1.544105

Note: * Significant at 1%; **significant at 5%; *** significant at 10%.

To examine the impact of IT investment on bank cost effectiveness, yet another multiple regression analysis is conducted (Table 7). Although the impact of IT investment on bank cost efficiency is minimal, it has a positive and significant impact. Additionally, bank efficiency is negatively non-significantly impacted by bank size, whilst positively non-significantly impacted by financial leverage. The adjusted R^2 (0.75, $p < 0.01$) indicates that as banks invest more in IT (software and hardware), their cost efficiency will improve by 75%.

Table 7. Effect of IT investment on bank cost efficiency

Variable	Coefficient	Std. error	t-Statistics	Prob.
ITINV	1.59E-09	7.26E-10	2.191095	0.0301
SIZE	–0.038639	0.022063	–1.751315	0.0821
LEVERAG	0.006387	0.005682	1.124064	0.2629
EFFECRATIO(1)	0.696581	0.043582	15.98335	0.0000
C	0.399012	0.720686	0.553655	0.5807
R-squared	0.757208	F-statistics		107.5967
Adjusted R-squared	0.750170	Prob (F-statistics)		0.000000
Durbin-Watson stat	1.878066	–		

4. DISCUSSION

The findings imply that IT investment enhances the performance of the banking industry. Two factors are used to assess bank performance: profitability (ROA, ROE, and NIM) and cost efficiency (cost to income ratio). Long-term performance can be improved for banks by increasing their IT spending. Cost effectiveness also increases profit through better delivery and quality of services. Large banks tend to place more interest on IT costs as they invest more in IT to maintain their competitiveness, which allows them to increase their profitability. The study results support Carlson et al. (2000), Brynjolfsson and Hitt (2000), Furst et al. (2002), Kozak (2005), Milne (2006), Akande (2016), Aduda and Kingoo (2012), and Al-Adwan et al. (2013).

CONCLUSION

To achieve the objectives of the study, four hypotheses were created and tested. The study examined the impact of bank size, financial leverage, and IT investment on performance. Return on equity (ROE), return on assets (ROA), and net interest margin (NIM) were used to evaluate a bank's profitability, while the cost-to-income ratio was used to evaluate cost effectiveness. The study's findings, which were based on a sample of 13 commercial banks listed on the Amman Stock Exchange between 2010 and 2021,

demonstrate that IT investment significantly improved the performance of banks in a positive way. The findings revealed that less leveraged banks have a higher IT investment to asset ratio (0.69%) than highly leveraged banks. Moreover, this study showed that profitable banks (measured by ROE) invest more than 1.1% of their total assets in IT. Given the important contribution of the banking industry, the Jordanian government, policy maker and bank management should intensify the computerization of the industry to enable technology-driven banking. Therefore, it is suggested that with continuous product and process innovation, the industry will certainly offer more sophisticated IT-based services to customers and maintain a high level of performance.

AUTHOR CONTRIBUTIONS

Conceptualization: Asma'a Al-Amarneh, Hadeel Yaseen, Anas Bani Atta, Lubna Khalaf.
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Writing – reviewing & editing: Asma'a Al-Amarneh, Hadeel Yaseen.

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