The Measurement of Blockchain Technology in Financial Reports in Commercial Banks

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Abstract

The objective of the present study is to measure the impact of blockchain technology on financial reports. The study utilizes a time series analysis covering eleven commercial banks listed on the Amman Stock Exchange from 2009 to 2019. Two key measures, namely other operating expenses and customer deposits are employed in the Return on Assets (ROA). The findings indicate that blockchain technology can be quantified by 0.038 of other operating expenses. However, there are no discernible indications of measuring blockchain technology through customer deposits. The study suggests that blockchain technology is a double-edged sword; when not utilized as required, it leads to increased expenses, and conversely, its effective exploitation can have cost-reducing effects. In other words, operational inefficiencies or heterogeneity are associated with elevated costs associated with implementing blockchain technology.

Keywords: Blockchain Technology; ROA; Other Operating Expenses; Customer Deposits; Financial Reports.

1. Introduction

Blockchain technology has changed paradigms in several industries, most notably the financial services and transaction environment [1–3]. Blockchain was first envisioned as the underpinning technology for cryptocurrencies, but it has since attracted a lot of interest for its potential to improve efficiency, security, and transparency across a range of sectors [4–6]. In the financial sector, commercial banks are especially interested in investigating how to incorporate blockchain technology into their operations to reduce risks, expedite procedures, and comply with changing regulatory standards [7].

One important consideration that has surfaced as commercial banks work through the challenges of using blockchain technology is the necessity of measuring and assessing how it will affect financial reporting procedures [8−10]. For stakeholders, financial reporting is essential since it offers information about an organization's performance, financial standing, and future possibilities [11, 12]. Therefore, it is critical for all parties involved—investors, regulators, and management—to comprehend how blockchain technology affects financial reporting in commercial banks [13].

Key issues that are expected to surface from the literature analysis include how blockchain improves openness and auditability, how it affects regulatory compliance [14], and how it integrates with current financial reporting requirements [15, 16]. In addition, the review will look at how difficult it is to measure assets and liabilities connected to blockchain adoption, how difficult it is to reconcile distributed ledger technology with traditional accounting principles, and how the changing regulatory environment affects financial reporting practices [17].

In Jordan's context, maintenance is the major issue Jordanian banks are facing. financial and monetary stability on the one hand, while also enhancing the climate for investing and promoting economic growth on the other [18]. These issues arise as a result of advancements in blockchain technology and electronic payment system technologies. The Central Bank of Jordan worked to implement the necessary changes at the level of legal frameworks and regulatory practices to support the use of contemporary financial technology and electronic transactions and improve the capacity of banks and financial institutions to manage risks associated with financial technology (Fintech) and risks [19, 20]. Cyber technology is activated with a focus on developing a financial culture and boosting awareness of its use, and that assists banks in better preparing to utilize financial technology for services and business [21]. To ensure the strengthening of financial stability, in addition to activating the central electronic system that was established in (2014) the strategic plan of the Central Bank of Jordan 2014–2016, which was under test - to link its affiliated banks to each other, provided that it is based on the foundations of its objectives, especially for banks, gradually paving the way for digital financial services in Jordan. In 2016, Jordanian banks were effectively subdued using blockchain technology (Central Bank of Jordan, 2024).

The financial reporting procedures used by commercial banks to include blockchain technology create a complex and difficult environment [12]. Concerns about how best to monitor and assess blockchain's effects on financial reporting are raised as commercial banks look more closely at implementing the technology to improve security, efficiency, and transparency in their operations [22]. The distinct features of blockchain technology provide several intricate issues for financial reporting in commercial institutions. Notwithstanding its prospective advantages, including the absence of reconciliation problems [23], the speed of transactions made possible by smart contracts, and the immutability of transaction records, it is believed that its deployment will boost overall banking efficiency and profitability [24, 25]. However, these assertions are not supported by any actual data [26, 27]. Based on previous studies, we will rely on two variables that affect the measurement of blockchain technology, which are other operating expenses and customer deposits. Other operating expense benefits in areas of central finance reporting, compliance, centralized operations, and business operations will result from the financial sector's use of blockchain [28−31]. Accordingly, customer deposits are some additional financial-related fields of blockchain [25, 32, 33].

The purpose of this study of the literature is to examine the body of knowledge that currently exists about the measurement of blockchain technology in financial reports produced by Jordanian commercial banks. This study aims to clarify the approaches, difficulties, and consequences involved in integrating blockchain technology into financial reporting systems by synthesizing and evaluating pertinent research. This study attempts to provide insights into the complex dynamics at play in the measure of the effect of blockchain technology in financial reporting in commercial banks by thoroughly examining academic publications, case studies, and empirical data.

2. Literature Review and Hypothesis Development

The blockchain technology measure is determined by developing hypotheses based on previous studies; the controlling variable is the performance indicator (ROA). The use of modern technology and big data management, which is serious progress in accounting and the financial field, can provide a new approach that in turn expresses an efficient way to address various challenges.

2.1. Other Operating Expenses

The promise of blockchain technology to change operational capabilities and save costs has attracted substantial attention from a variety of businesses. This overview of the literature examines how blockchain-related costs are measured, with an emphasis on other operational expenditures in particular, and it presents the main conclusions of previous empirical research. An empirical test was carried out by Pan et al. (2020) [34] to investigate how blockchain technology affects corporate operating capabilities. Their research showed that the use of blockchain has a favorable impact on a number of operational characteristics, such as transparency and efficiency. Despite not specifically focusing on other running costs, the report offers insightful information about the overall advantages of blockchain integration for businesses. Furthermore, the relationship between transaction and processing costs in a blockchain context was

examined in research by Jabbar & Dani (2020) [35]. They discovered that although blockchain has many benefits, like immutability and decentralization, it also has high processing costs. Although it doesn't specifically address additional running costs, this analysis clarifies the intricate cost dynamics related to blockchain deployment. Cocco et al. (2017) [36] investigated how blockchain technology may reduce costs in the banking industry. Their study demonstrated the cost and efficiency savings that may be realized with blockchain-based solutions, especially when it comes to transaction processing and regulatory compliance. The report indirectly discusses the influence of other operational expenditures inside financial institutions [37], despite its primary focus being on cost savings. Moreover, the economic viability of blockchain technology for financial institutions' use in client identification was assessed by Bataev et al. (2020) [38]. According to their results, blockchain-based solutions can save operating expenses and improve client identification procedures. The study offers insights into the possible consequences for other operational expenditures in financial institutions, even though it explicitly focuses on the economic efficiency element. All things considered, these studies highlight how blockchain technology has the ability to revolutionize a variety of sectors by cutting costs and increasing productivity. Although there is a lack of direct measurement of other operating expenses associated with blockchain implementation in the literature, empirical data indicates that the adoption of blockchain technology can result in significant cost savings and operational improvements, which in turn can improve organizational performance. Based on the above, the following hypothesis will be proposed:

H1: Other operating expenses are a metric to measure blockchain technology by ROA.

2.2. Customer Deposits

Due to its potential to improve security, transparency, and efficiency in financial transactions, the measuring of client deposits in the context of blockchain technology has drawn attention. This study of the literature looks at current studies on blockchain-based solutions and how they affect the measurement of consumer deposits. Xu et al. (2021) [39] look into ways to enhance the client due diligence procedure using a blockchain-based anti-money laundering system. Their research emphasizes how blockchain may improve financial transaction traceability and transparency, which can lead to more reliable client deposit measurement procedures. Financial institutions can enhance risk management and compliance with client deposits by utilizing blockchain technology for anti-money laundering campaigns. Eduardo Demarco (2020) [40] examines distributed ledger technology (DLT) and blockchain in the context of capital markets, emphasizing the know-your-customer (KYC) procedure. The report highlights how blockchain technology may improve data security, expedite KYC processes, and increase the accuracy of consumer deposit measurements. Financial institutions may reduce the risk of fraud and guarantee the accuracy of client deposit records by implementing blockchain-based KYC solutions.

Moreover, for the financial industry, Joseph & Karunan (2021) [41] suggested a decentralized transaction settlement system built on blockchain technology. Their study investigates how blockchain technology may transform transaction settlement procedures, such as managing client deposits. Blockchain provides a more transparent and effective method for handling consumer deposits in the banking industry by enabling peer-to-peer transactions that happen directly without the need for middlemen. Central bank blockchain applications are the subject of comprehensive mapping research by Dashkevich et al. (2020) [42]. Although their research does not directly address consumer deposits, it does provide light on the wider ramifications of blockchain adoption in the banking industry. Blockchain technology has the potential to revolutionize central bank functions, particularly the measurement and administration of client deposits, by enabling safe and decentralized ledger systems. Additionally, central bank blockchain applications are the subject of comprehensive mapping research by Dashkevich et al. (2020) [42]. Although their research does not directly address consumer deposits, it does provide light on the wider ramifications of blockchain adoption in the banking industry [43]. Blockchain technology has the potential to revolutionize central bank functions, particularly the measurement and administration of client deposits, by enabling safe and decentralized ledger systems [44]. All in all, these studies demonstrate how blockchain technology has the potential to revolutionize the financial industry's assessment and handling of consumer deposits. Financial institutions may boost client trust and optimize operations by implementing blockchain-based solutions, which improve transparency, security, and efficiency in deposit-related procedures. Based on the above, the following hypothesis will be proposed:

H2: Customer deposits are a metric to measure blockchain technology by ROA.

3. Research Methodology

This study uses a quantitative correlation design. To conduct some relevant tests. This study relies on the descriptive approach and the comparative approach for the time delay by panel data and time series, as shown in Figure 1. This study aims to identify the extent to which the study blockchain variables are related to financial statements from 2009 to 2019. The data used in this study on 11 commercial banks was obtained from the Amman Stock Exchange. Handsome, according to Figure 1 for data analysis:
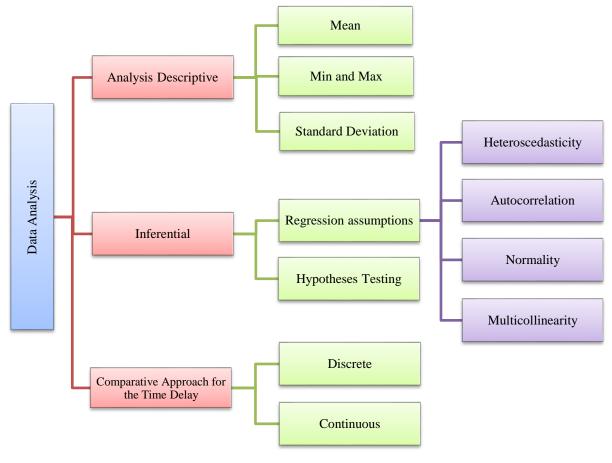
Figure 1. Data Analysis

3.1. Analysis Descriptive

This section contains descriptive information about the variables. Return on assets (ROA), customer deposits (CD), and other operating costs (OEs). Before going on to the descriptive analysis, Table 1 displays the analysis to make sure the data is accurate and complete. The table shows that every variable in the research has comprehensive data.

Table 1. Summary statistics

	Mean	Median	min	max	Std. Dev.
Years	2014	2014	2009	2019	3.175
ROA	1.099	1.1	0.210	1.94	0.421
OEs	0.177	0.175	0.107	0.265	0.045
CD	147M	128M	32M	4833M	1.251

The average mean score value for the variables over the period between 2009 and 2019 was also calculated (for instance, the mean score of ROA for 2009 to 2019 was added and divided by 11). The mean score values of the variables for each year were calculated (the observations of the 11 banks were added up and divided by 11). A summary of the mean score values for the variables is shown in Table 1. Additionally, it displays the variables' combined mean score value.

4. Results

4.1. Inferential

The test was run on heteroscedasticity, the outcome revealed that the Prob Chi-squared= 0.0626. The significance level (P-value or Sig) is known as prob. This demonstrates that the null hypothesis cannot be ruled out and that heteroscedasticity is not a problem with the data, as shown in Figure 2.
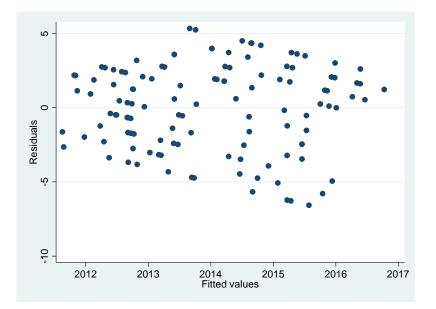
Figure 2. Heteroscedasticity

Furthermore, the normality variables were tested by skewness and kurtosis. According to Ryu (2011) [45], normality represents whether is valuable skewness < 2 and kurtosis < 7. According to Table 2, the values of skewness (0.7, 0.317, and 1.535) are less than 2, and kurtosis (2.173, 2.272, and 4.958) are less than 7. The data is subject to a normal distribution.

Table 2. Normality test

	Skewness<2	Kurtosis<7
Years	0	1.78
ROA	-0.07	2.173
OEs	0.317	2.272
CD	1.535	4.958

None of the correlations between the variables in Table 3 surpass 0.90, showing that there is no significant link between them and demonstrating that the variables in this research do not exhibit multicollinearity problems.

Table 3. Pairwise correlations

Variables	Years	ROA	OEs	CD
Years	1.000			
ROA	-0.207	1.000		
OEs	0.251*	-0.467*	1.000	
CD	0.210	0.319*	-0.281*	1.000

*** $p<0.01$, ** $p<0.05$, * $p<0.1$*

The main variable utilized in testing hypotheses is the value of the prob>chin, sometimes referred to as a p-value. The results of the direct impact hypothesis test are presented in Table 4.

Table 4. Linear regression

ROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
OEs	-0.409	0.077	-4.94	0	-0.573	-0.245	***
CD	0.204	0.083	2.47	0.015	0.04	0.368	**
Mean dependent var		0.990		SD dependent var		1.000	
R-squared		0.256		Number of obs		121	
F-test		20.303		Prob > F		0.000	
Akaike crit. (AIC)		312.595		Bayesian crit. (BIC)		320.982	

*** $p<.01$, ** $p<.05$, * $p<.1$*

Because Prob>f is 0.000, which indicates that the independent variables may predict the dependent variable, Table 3 demonstrates that the model is appropriate. The R-squared of the model is 0.256, suggesting that the independent variables of this research can explain a total of 25.2% of the variation in the ROA.

According to the results of Table 3 hypothesis testing, there is a negative correlation between OEs and ROA (Coef=-0.409, T-value= -4.94, P-value>0.000). This verified the study's presumption. H1 is accepted.

According to Table 3 direct impact hypothesis testing results, there is a positive and significant correlation between CD and ROA (Coef=0.204, T-value=2.47, P-value>0.015). H2 is therefore supported.

4.2. Comparative Approach for the Time Delay

The comparative approach for the time delay is based on dividing the time phase into discrete and continuous phases [46]. Work on blockchain began in Jordanian banks in 2016, indicating that this technology had not been used before this date. Therefore, the years 2009–2015, which did not use blockchain technology (discrete), will be compared with the years 2016–2019, which did introduce this technology (continuous), to test time series the suitability of these variables to express blockchain. Time series forecasting makes predictions of activity using knowledge of previous values and related trends. This usually has to do with trend analysis [47], as shown in Table 5:

Table 5. Descriptive statistics - mean by (years)

Years	ROA	OEs	CD- million
2009	1.112	0.181	1103
2010	1.175	0.167	1200
2011	1.15	0.173	1237
2012	1.187	0.164	1240
2013	1.207	0.161	1301
2014	1.223	0.150	1456
2015	1.223	0.148	1547
2016	1.08	0.191	1582
2017	0.945	0.207	1731
2018	0.895	0.217	1836
2019	0.894	0.191	1935

Blockchain was used in Jordanian banks in 2016. Table 5 shows the effect of the change in variables from 2009 to 2019, where the mean of ROA from 2009 to 2015 (discrete) was 1.112, 1.175, 1.15, 1.187, 1.207, 1.223, and 1.223, respectively, which are somewhat close ratios of average 1.182. In 2016 (which began the use of blockchain, continuous) until 2019, the performance decreased to 1.08, 0.945, 0.895, and 0.894, respectively; it was average 0.9535. Furthermore, the mean of OEs in Table 4 for 2009–2015 was 0.181, 0.167, 0.173, 0.164, 0.161, 0.150, and 0.148, respectively, with an average of 0.163. but in 2016–2019, the percentage increased by 0.191, 0.207, 0.217, and 0.191, respectively, with an average of 0.201. Additionally, the mean in Table 4 of the CD 2009–2019 In comparison to 2015 and 2016, the rise was reasonable and was unaffected by blockchain technology. The increase may be explained by an increase in the number of customers or their deposits.

Table 6 indicates that blockchain leads to a decrease in ROA of about 0.228. The use of blockchain technology also led to an increase in OEs by 0.038. Blockchain technology also led to an increase in CD by 473.

Table 6. Summary of mean descriptive variables

Years	ROA	OEs	CD- million
2009-2015 (Discrete)	1.182	0.163	1298
2016- 2019 (Continuous)	0.9535	0.201	1771
Changes	0.228	0.038	473

5. Discussion

The first main result of the descriptive approach is: The analysis also showed that other operating expenses negatively affect the ROA of Jordanian commercial banks. The second result is that customer deposits have a positive impact on ROA. In the comparative approach for the time delay, the data is divided into two parts: discrete, in which blockchain technology is not used at this time, and continuous, in which blockchain technology is used at this time, which takes into account the difference between the ratios [46]. As a result of that, the use of blockchain technology increased in OEs by 0.038. Blockchain technology increased in CD by 473.

The banking sector in Jordan is suffering from a weakening ROA due to blockchain, as the results show a decline of 0.228. This is an indication that blockchain technology is not being used well. Khalil et al. (2021) and Mansour et al. (2024) [48, 49] demonstrate a favorable relationship between blockchain and financial performance through business process innovation. The company's payment and financial information have therefore been greatly protected, thanks in large part to the blockchain. People feel more secure and comfortable while utilizing blockchain technology for transactions [33]. According to Kim & Shin (2019) [50], the information transparency, information immutability, and smart contract properties of blockchain technology have considerable beneficial impacts on partnership growth and minor favorable effects on partnership efficiency. Partnership growth has a positive effect on business success, even though partnership efficiency has a negative effect. This is an indication that blockchain technology is not being used well in Jordanian banks. This enhances the measurement of the other variables used in this study.

Additionally, the banking sector in Jordan is suffering from high blockchain costs for other operating expenses, as the results showed a rise of 0.038. Mafakheri et al. (2018) [51] found that using blockchain technology reduces costs using smart contracts, which contradicts this conclusion. This study found that operators can offset and offload hosting, security, and maintenance costs by using a decentralized network of nodes to maintain a distributed ledger. The Sarker & Datta (2022) [25] study also found the potential of this blockchain-based digital transformation for the pension industry to reduce implementation time, reduce other operating expenses, and facilitate the achievement of other pension reform agendas. Blockchain technology can reduce expenses because some cryptocurrencies are being used as payment methods increasingly often [33]. Furthermore, in line with this study by Breda (2023) [26], which used a difference-in-differences approach to compare banks that use blockchain technology to those that do not, it found that, when compared to non-adopted banks, adopted banks did not experience higher liquidity in the post-implementation period, and adoption did not improve operating efficiency or valuation. With a lengthier post-adoption history, early adopters show a considerable drop in operational efficiency and liquidity nonetheless. All things considered; our findings show that the long-term benefits of blockchain adoption outweigh any short-term drawbacks. The result may also be explained by the fact that the banking sector throughout the world faces several difficulties due to high administrative expenses and related operational inefficiencies or operational heterogeneity, which consequently affect ROA. Furthermore, in the study by Moradi & Mohammadi (2020) [46], the difference between discrete and continuous ratios is efficient for solving time-delay fractional optimal control problems. Based on the above, a ratio of 0.038 is considered a strong metric for measuring blockchain. It should be noted that Jordanian banks did not disclose an item in the financial statements about technology expenses. For example, at JPMorgan Bank, which is considered one of the largest American banks, there was an expense account called Technology, Communications, and Equipment. Therefore, it must be added to other operating expenses before taking a percentage of 0.038.

Customer deposits are rising in banks, as found in this study by 473M after using blockchain technology. Customer deposits in general have gradually increased. In the study by Rajindra et al. (2021) and Okun (2012) [30, 31], customer deposits have been considered to rise with time. As a result, banks that use efficient deposit-attraction tactics will continue to post higher ROEs in the future. Therefore, it appears that customer deposits enhance shareholder wealth. Therefore, initiatives should be made to promote consumer deposit attractiveness. Hence, it is not a good measure of blockchain technology.

It is worth noting that the absence of uniform accounting procedures for transactions involving blockchain technology is one drawback. It may be difficult to precisely measure and report blockchain-related assets and liabilities if current accounting rules do not sufficiently take into account the special features of blockchain technology [52]. Subsequent investigations may go into the creation of accounting rules customized for blockchain transactions, tackling matters like disclosure, recognition, and value.

The scant empirical data about the effect of blockchain adoption on the caliber of financial reporting in commercial banks represents another drawback. Empirical research is required to evaluate how blockchain implementation affects the accuracy, dependability, and relevance of financial information disclosed in banks' reports, even though theoretical frameworks are available to guide the analysis of blockchain's effects on financial reporting [53]. Longitudinal studies might be conducted in the future to investigate the long-term effects of blockchain adoption on stakeholders' decision-making processes and the quality of financial reporting.

Further complicating assessment in financial reporting is the scalability and interoperability of blockchain networks. Commercial banks may have challenges as blockchain technology develops in integrating blockchain-based solutions with current financial reporting infrastructures and guaranteeing data consistency across many platforms [54]. Future studies might examine methods, such as the creation of standardized data formats and interoperability protocols, for resolving issues with scalability and interoperability in blockchain-based financial reporting.

Moreover, there is still uncertainty in the regulatory environment around blockchain technology in financial reporting. Commercial banks may face compliance risks and regulatory ambiguity as a result of regulatory frameworks that lag behind technology improvements [55, 56]. Future studies should look at the regulatory ramifications of using blockchain technology in financial reporting and evaluate how regulators might modify current laws to allow blockchain-based transactions while preserving the interests of investors and the stability of the financial system.

6. Conclusion

The purpose of this study was to ascertain the measurement of blockchain technology through other operating expenses and customer deposits by financial performance at Jordanian banks. The findings demonstrated a link between blockchain measurements and other operating expenses in a time series. That is, 0.038 percent of the sum of other operating expenses can be measured in Jordanian banks. This result can be generalized as other operating expenses increase with the increase in blockchain technology costs and vice versa [57]. Similarly, according to this theoretical model, blockchain technology's real-time transparency and cost reductions help companies become more profitable and competitive, which in turn ensures sustainability. Moreover, the time series doesn't depict a connection between consumer deposits for blockchain measurement. The situation may also be explained by the fact that Jordan banking experiences several challenges due to high administrative costs and associated operational inefficiencies or operational heterogeneity, which negatively impact ROA. Although there are several restrictions and opportunities for further study, the measurement of blockchain technology in commercial banks' financial reporting has the potential to improve financial markets' efficiency, trustworthiness, and transparency. Accounting academics, blockchain engineers, regulators, and business professionals will need to work collaboratively to address these issues and further our knowledge of how blockchain affects the accuracy of financial reporting.

7. Declarations

7.1. Author Contributions

Conceptualization, N.Z. and H.A.; methodology, A.L.; software, M.A.A.; validation, B.S.R., A.L., and M.A.; formal analysis, N.Z.; investigation, B.S.A.; resources, M.A.A.; data curation, H.A.; writing—original draft preparation, N.Z. and H.A.; writing—review and editing, A.L.; visualization, H.A.; supervision, N.Z.; project administration, A.L.; funding acquisition, M.A. All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

The data presented in this study are available in the article.

7.3. Funding

7.4. Institutional Review Board Statement

Not applicable.

7.5. Informed Consent Statement

Not applicable.

7.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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