The application of Blockchain in risk management and it`s reflect on bank performance

Seif Hossam El dean Effat Selim

Master of Science in Accounting- Arab Academy for Science, Technology and Maritime Transport

Supervisor

Dr Gamal Khattab

Professor of Accounting and auditing Faculty of Business , Ain shams university

The Dean of Managment faculty Modern university for Tech & information
College of business administration

Abstract

This thesis explores the application of blockchain technology in risk management and its impact on bank performance. As blockchain continues to evolve beyond cryptocurrencies, its potential to enhance financial security and operational efficiency in the banking sector is becoming increasingly apparent. The decentralized nature of blockchain technology provides enhanced transparency, immutability, and security, which are crucial for risk management in financial institutions. By enabling real-time data sharing and reducing the need for third-party verification,

blockchain enhances the accuracy and reliability of financial transactions.

The study examines how blockchain can influence risk management practices, particularly in mitigating liquidity, credit, and market risks. Liquidity risk, which arises from the inability to meet short-term obligations, can be minimized through blockchain's real-time transaction settlement, enhancing liquidity monitoring and cash flow management. Credit risk is addressed by utilizing smart contracts, ensuring automated loan processing and minimizing human errors. Market risks, influenced by price fluctuations, are mitigated through transparent trading records and decentralized exchanges. The study explores how these risk management improvements, facilitated by blockchain, impact bank performance indicators such as Return on Assets (ROA) and Return on Equity (ROE).

The research focuses on Egyptian banks, analyzing data from 11 banks over a ten-year period (2014-2023) using multiple regression models. Egypt's banking sector, characterized by a mix of public and private banks, faces challenges related to financial stability, regulatory compliance, and operational inefficiencies. This study investigates blockchain's role as a moderating variable in the relationship between risk management and bank performance, considering Egypt's unique regulatory landscape. The analysis includes examining the impact of

blockchain adoption on financial stability, operational risk reduction, and overall efficiency improvements.

The findings indicate that blockchain adoption positively influences financial stability by enhancing data integrity and reducing fraud risks. Operational risks, including human errors and system failures, are minimized through automation and decentralized processes. Additionally, blockchain's transparency and auditability enhance regulatory compliance, leading to increased stakeholder trust. These efficiencies contribute to improved bank performance metrics, including higher ROA and ROE. The study further explores the differential impact on public and private banks, highlighting strategic implications for competitive advantage in Egypt's financial industry.

This study fills a significant research gap by providing insights into the challenges and opportunities associated with blockchain adoption in Egypt's banking sector. It identifies key barriers such as regulatory uncertainty, technological infrastructure limitations, and resistance to change among stakeholders. Conversely, it highlights opportunities for enhancing operational efficiency, financial transparency, and customer trust through blockchain solutions. The study concludes that strategic implementation of blockchain can be a pivotal factor in enhancing risk management frameworks and sustaining competitive advantage in the financial industry. Policy

implications are also discussed, emphasizing the need for a supportive regulatory environment to foster blockchain innovation.

Keywords: Blockchain, Risk Management, Bank Performance, Egyptian Banks, Return on Assets (ROA), Return on Equity (ROE), Financial Stability, Operational Efficiency, Liquidity Risk, Credit Risk, Market Risk, Regulatory Compliance.

الملخص :

تستكشف هذه الرسالة تطبيق تقنية البلوكشين في إدارة المخاطر وتأثيرها على أداء البنوك. مع تطور البلوكشين إلى ما بعد العملات الرقمية، أصبح من الواضح بشكل متزايد إمكانياته في تعزيز الأمان المالي والكفاءة التشغيلية في القطاع المصرفي. توفر الطبيعة اللامركزية للبلوكشين شفافية محسّنة وثباتًا وأمانًا، وهي عوامل حاسمة لإدارة المخاطر في المؤسسات المالية. من خلال تمكين مشاركة البيانات في الوقت الفعلي وتقليل الحاجة للتحقق من طرف ثالث، يعزز البلوكشين دقة وموثوقية المعاملات المالية.

تبحث الدراسة في كيفية تأثير البلوكشين على ممارسات إدارة المخاطر، خاصة في تخفيف مخاطر السيولة، ومخاطر الائتمان، والمخاطر السوقية. يمكن تقليل مخاطر السيولة، الناجمة عن عدم القدرة على الوفاء بالالتزامات قصيرة الأجل، من خلال التسوية الفورية للمعاملات عبر البلوكشين، مما يعزز مراقبة السيولة وإدارة التدفقات النقدية. يتم التعامل مع مخاطر الائتمان عبر العقود الذكية، مما يضمن أتمتة عمليات القروض وتقليل الأخطاء البشرية. بينما تُخفف المخاطر السوقية، المتأثرة بتقلبات الأسعار، من خلال سجلات التداول الشفافة والتبادلات اللامركزية. تستكشف الدراسة كيف تؤثر هذه التحسينات في إدارة المخاطر، التي يسهلها البلوكشين، على

مؤشرات الأداء المصرفي مثل العائد على الأصول ((ROAوالعائد على حقوق الملكية (.(ROE

تركز الدراسة على البنوك المصرية، حيث تحلل بيانات ١١ بنكًا على مدى فترة عشر سنوات (٢٠١٤-٢٠٢٣) باستخدام نماذج الانحدار المتعدد. يواجه القطاع المصرفي في مصر، الذي يتميز بمزيج من البنوك العامة والخاصة، تحديات تتعلق بالاستقرار المالي والامتثال التنظيمي والكفاءات التشغيلية. تستقصي هذه الدراسة دور البلوكشين كمتغير معدل في العلاقة بين إدارة المخاطر وأداء البنوك، مع مراعاة البيئة التنظيمية الفريدة لمصر. يتضمن التحليل دراسة تأثير تبني البلوكشين على الاستقرار المالي، وتقليل المخاطر التشغيلية، وتحسين الكفاءة بشكل عام.

تشير النتائج إلى أن تبني البلوكشين يؤثر بشكل إيجابي على الاستقرار المالي من خلال تعزيز سلامة البيانات وتقليل مخاطر الاحتيال. يتم تقليل المخاطر التشغيلية، بما في ذلك الأخطاء البشرية وفشل الأنظمة، من خلال الأتمتة والعمليات اللامركزية. بالإضافة إلى ذلك، تعزز شفافية البلوكشين وقابليته للتدقيق الامتثال التنظيمي، مما يزيد من ثقة أصحاب المصلحة. تساهم هذه الكفاءات في تحسين مقاييس الأداء المصرفي، بما في ذلك زيادة العائد على الأصول ((ROAوالعائد على حقوق الملكية (.(ROEكما تستكشف الدراسة التأثير التفاضلي على البنوك العامة والخاصة، مما يبرز الآثار الاستراتيجية لتحقيق ميزة تنافسية في الصناعة المالية بمصر.

تسد هذه الدراسة فجوة بحثية مهمة من خلال تقديم رؤى حول التحديات والفرص المرتبطة بتبني البلوكشين في القطاع المصرفي المصري. تحدد الدراسة العوائق الرئيسية مثل عدم اليقين التنظيمي، ومحدودية البنية التحتية التكنولوجية، ومقاومة التغيير بين أصحاب المصلحة. بالمقابل، تبرز الفرص لتعزيز الكفاءة التشغيلية، والشفافية المالية، وثقة العملاء من خلال حلول البلوكشين. وتخلص الدراسة إلى أن التطبيق الاستراتيجي للبلوكشين يمكن أن يكون عاملاً حاسمًا في تعزيز أطر

إدارة المخاطر والحفاظ على ميزة تنافسية في الصناعة المالية. كما تناقش الدراسة الآثار السياسية، مع التأكيد على الحاجة إلى بيئة تنظيمية داعمة لتعزيز الابتكار في مجال البلوكشين.

الكلمات المفتاحية: بلوكشين، إدارة المخاطر، أداء البنوك، البنوك المصرية، العائد على الأصول ((ROA، العائد على حقوق الملكية ((ROE، الاستقرار المالي، الكفاءة التشغيلية، مخاطر السيولة، مخاطر الائتمان، المخاطر السوقية، الامتثال التنظيمي.

1. Introduction

The many possibilities this technology has opened up for individuals, yet alone businesses, are not limited to Bitcoin cryptocurrencies and it deserves to be better understood and adapted for its complexity and groundbreaking advantages. Therefore, Blockchain technology should be comprehensively covered through the examination of challenges of adaptation such as its required large-scale implementation in order for it to function as well as the required trust amongst users necessary for keeping the network intact as well as matters of immutability and the reasons as to why it is not being implemented more up until now. The purpose of this paper is to further examine the challenges businesses are faced with when considering the implementation of Block chain technology

Blockchain technology has recently attracted a lot of interested towards it, considering the idea behind it is unique and promising. Back in 2009, Bitcoins were released as the

first digital currency by a person called “Satoshi Nakamoto” which described it as “ A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution” (Nakamoto, 2008). Bitcoins were created based on the blockchain technology which came to live along with bitcoins. Bitcoins has greatly risen in value since 2009 but more importantly is the technology that came along with it. Looking at the blockchain technology, we can see that it can be used to revolutionize many industries such as the financial industry, real estate and government sector. Applications can now run through a trusted intermediary and operate in a decentralized way (Christidis and Devetsikiotis, 2016)

The market cap of bitcoin now reached $1 trillion dollars (Statista, 2021), and is used by millions of people for payments, including a large and growing remittances market. Also, the realization that the underlying technology behind bitcoin could be separated from the currency, especially after the bitcoin hype,and that it can be used for inter-organizational purposes has introduced blockchain technology to multiple industries like pharmaceuticals, food and auto - manufacturing industries. (Vinod Kumar, Sriman Narayana Iyengar, and Goar, 2021)

2. Research Design

2.1 Research Problems: Approach will be discussed, how data is collected to answer the research question. The aim of this

section is to find the factors that will encourage the companies to adapt the blockchain technologies in Egypt and what are the challenges they might face when transitioning from the legacy system to adopt the Blockchain technologies.

The data collected is primarily the value of technological know-how, score of technological know-how, and profit margin of technological use for 12 different banks in Egypt, both private and public banks. The dependent variable is the risk management, which indicates the monetary value of the technological value in terms of the actual value and added value of assets and software. On the other hand, the dependent variables are profit margins and the score of technological know-how. Profit margins explain the portion of the profits attributable to the technological know-how; whereas, the score of the technological know-how is the index of the technological know-how. The independent variables theoretically affect the value of know-how through understanding the technological know-how through its index scoring and the investment and increase in capital through the re-investment of profit margins. Notably, Blockchain and IT are the underlying technologies being used in most – if not all – banks and FinTech companies nowadays; therefore, there basic assumption becomes that the technological know-how is in itself the use of Blockchain and information technology.

2.2 Research Objectives: The purpose of this study is to understand and discuss the effect of blockchain in bank risk management. So, the research questions are:

1- Does the application of blockchain have a relation with the risk management?
2- What is the effect of blockchain on the bank risk management? In the coming section we will try to answer these research questions.

2.3 Hypothesis Development: The hypotheses for this study are grounded in the theoretical framework of risk management and the potential role of blockchain technology in mitigating risks in the banking sector. The following hypotheses were tested:

H1: There is a relation between risk management and return of asset as a proxy of bank performance

H 1/1 There is a relation between Liquidity Risk and return on assets

H 1/2 There is a relation between Credit Risk and return on assets

H 1/3 There is a relation between Market Risk and return on assets

H2: There is a relation between risk management and return on equity as a proxy of bank performance

H 2/1 There is a relation between Liquidity Risk and r return on equity

H 2/2 There is a relation between Credit Risk and return on equity

H2/3 There is a relation between Market Risk and return on equity

H3: There is an effect of Blockchain on the relation between risk management and return of asset as a proxy of bank performance

H 3/1 There is a effect of Block chain on the relation between Liquidity Risk and return on assets

H 3/2 There is a effect of Block chain on the relation between credit Risk and return on assets

H3/3 There is a effect of Block chain on the relation between Market Risk and return on assets

H4: There is an effect of Blockchain on the relation between risk management and return on equity as a proxy of bank performance

H 4/1 There is a effect of Block chain on the relation between Liquidity Risk and return on equity

H 4/2 There is a effect of Block chain on the relation between credit Risk and return on equity

H 4/3 There is a effect of Block chain on the relation between Market Risk and return on equity

2.4 Research Gap: There is limited research on blockchain adoption in Egyptian banks, particularly its role in risk management and performance optimization. This study addresses this gap, contributing to the growing body of knowledge on blockchain in emerging markets.

2.5. Literature view

Section	Name and title	Conclusion	Findings
1	Title:-the effect of financial risk management on the financial performance of commercial banks in kenya **Author :** joel githinji wanjohi	According to the study, Kenyan commercial banks 'financial performance was significantly impacted by their approach to financial risk management. The study also found that risk mitigation practices had a smaller effect on financial performance than risk measuring practices. As a result, as every shilling invested in risk measurement and mitigation strategies enhances the generation of income, banks' financial performance also increases.	The study discovered a substantial correlation between commercial banks' financial performance and their financial risk management procedures. The findings of a correlation analysis indicating a substantial positive relationship between ROA and all risk management practices. There is a significant positive association (+179%) between risk measurement techniques and ROA. Furthermore, there are moderate relationships (54%, 47%, and 48%, respectively) between ROA and risk management environment, internal control procedures, and risk monitoring procedures.
2	The Role of Internal Audit in Risk Management– Evidence from Private Sector of Kosovo **Authors :** Hysen Ismajli1 , Mimoza Guda Ferati2 , Agon Ferati3	As almost all large private companies in Kosovo are family businesses and their impact on the activities and decision making of the company is very large, it is difficult for an internal audit department to operate in the right manner giving it great importance to risk management. Review the internal controls and procedures, as this process is unavoidable in all companies to ensure that risk management is effective	Results show that internal auditors understand the concept of risk management but restricted access from business owners To core and confidential information, inexperienced internal audit staff, insufficient funds allocated to develop internal audit department, and lack of management interest are barriers that leads to improper performance of internal audit in risk management and non-functional internal audit. As the role of internal audit in the private sector.

3	Title: Blockchain technology in corporate governance: disrupting chain reaction or not?	According to the study, the adoption of blockchain technology can improve almost every aspect of corporate governance, including: increased efficiency by reducing administrative burden; improved ownership transparency; reduced risk of fraud for organizations by offering an absolute audit trail; and safe and accurate proxy voting.	In order to demonstrate the links between attitude, perceived usefulness, and ease of use and behavioral intention, the study empirically establishes each relationship using the conceptual model. The manuscript's findings demonstrate how the model fit indices for several constructs support the posited model's model fit. The association between different constructs based on the theoretical model is explained by the values of the various indices being determined to be below the acceptable range.
4-	Relationship between core capital and profitability of commercial banks in Kenya **Authors** kiambi martin mwenda	As a result of the study, a model explaining the connection between Kenyan commercial banks' profitability and core capital was developed. The models don't account for environmental changes, for example. Both the economic environment and the state of technology are evolving. The business climate could change during the test period, making it impossible for the models to predict with accuracy.	Regression analysis was utilized in the study to determine the connection between Kenyan commercial banks' profitability and core capital. After forecasting models were created, their predictive accuracy was evaluated. The study's main conclusion is that there is little correlation between Kenyan commercial banks' core capital and profitability or return on equity.
5	Role of blockchain enabled transparency in risk management and sustainability of the complex global supply chains **Authors** Pankaj Kumar Medhi	Firm performance is probably being impacted by block chain applications in two ways. In the first place, it helps businesses comply with legal requirements and boost consumer trust in their offerings while enhancing business performance through increased sustainability. Second, it's helping businesses to generate resources that are hard to replicate, giving them a competitive edge.	The purpose of this study is to find the evolving areas of application for blockchain technology in supply chain management (SCM). Below, I present the extracted topics from the corpus of documents. Discussion on the possible implications on the underlying tenets of SCM follows. We fit an LDA topic model on a corpus of 1607 frequent terms from 35 documents with 20 topics.

6	Credit Risk and Commercial Banks Performance in Tanzania: a Panel Data Analysis **Author** Indiael Kaaya1 and Dickson Pastory	Conclusively it has been witnessed that the increase in credit risk tends to lower firm performance, both indicators have produced the negative coefficients which tends to lower profit level. Credit risk is not a bad situation as it is related to bank return, from empirical theory it has been stated that the higher the risk the higher the bank return due to the bank ability to increase portfolio, but the bank need to balance and foresee the return.	The study was meant to find the relationship between the credit risk and bank performance as measured by return on asset. Regression model was used to develop the relationship between the indicators of credit risk and bank performance, the credit risk indicators have produced negative correlation which indicate the higher the credit risk the lower the bank performance.
7	A review of Blockchain Technology applications for financial services **Author** Mohd Javaid a,∗, Abid Haleem a , Ravi Pratap Singh b , Rajiv Suman c , Shahbaz Khan	In conclusion, it has been shown that rising credit risk generally results in worse company performance; both indicators have negative coefficients, which generally translate into lower profit margins. In terms of bank return, credit risk is not always a negative thing. Empirical theory suggests that the higher the risk, the higher the bank return because of the bank's capacity to grow its portfolio.	The significance of blockchain technology for financial services is the main topic of this essay. adopts additional tools, tactics, and included services related to financial services based on blockchain technology. The study concludes by identifying and assessing the noteworthy uses of Blockchain technology in the financial services industry. Credit reports have a big influence on consumers' financial life.
8	Cryptocurrency, a successful application of blockchain technology **Authors** Mohammad Hashemi Joo, Yuka Nishikawa	The first successful implementation of blockchain technology is cryptocurrency, which has the potential to power the world's money transmission network.	The authors provide a thorough analysis of blockchain technology and cryptocurrencies, as well as successful uses of the technology across a range of financial fields. The technical investigations on the behaviors of bitcoin prices are critically assessed by the writers.

9	A framework for analyzing block chain technology adoption: Integrating institutional, market and technical factors **Authors** janssen, M.; Weerakkody, Vishanth J.P.; Ismagilova, Elvira; Sivarajah, Uthayasankar; Irani, Zahir	The literature-based framework that has been suggested demonstrates the relationships between the various components and provides businesses with a starting point for deploying blockchain applications. Subsequent studies ought to investigate, enhance, and verify these correlations, as well as broaden the structure by utilizing empirical data.	The resultant comprehensive model for blockchain technology adoption illustrates the intricate interactions between the variables. This is the first all-inclusive framework that incorporates the key elements around the blockchain technology adoption. The framework emphasizes that several results are conceivable and that the process of change is important since it determines the shape that blockchain applications adopt
10	Embedding risk management: structures and approaches **Authors** Ian Fraser William Henry	This report provides a timely assessment of the work being done in this area by UK places and shows that there are still problems to be fixed before risk management is completely integrated into business operations.	There was consensus that lower-level management must take ownership of risks, even while parent boards have the final say. Businesses typically used multiple techniques to create standardized risk management protocols. Although concerns were raised regarding the competency and independence of internal auditors, it was thought that they had a role to perform.
11	Investigating the influence of organizational factors on blockchain adoption **Authors** Trevor Clohessy Thomas Acton	The authors also look at how an organization's decision to embrace blockchain is influenced by the three organizational adoption criteria that have been found to be most important. Lastly, the writers go over the three patterns that were found after looking at the qualities of blockchain technology and Ireland's status as a technologically advanced nation.	The case study's results revealed three trends: large businesses are more likely than small and medium-sized businesses (SMEs) to use blockchain technology, and organizational preparedness and support from top management are facilitators of block chain adoption. The nature of blockchain technology and Ireland's attributes as a developed nation are examined by the writers in order to understand these tendencies. There are also scientific and practical contributions made.

3. Blockchain

3.1 Definition and History: Blockchain is a decentralized digital ledger system ensuring secure, transparent, and immutable transactions without intermediaries. First introduced with Bitcoin by Satoshi Nakamoto in 2008, blockchain technology has evolved with applications in financial services, supply chain management, and corporate governance.

3.2 Technical Dimensions: Blocks and Transactions (secured through cryptographic hashes), Smart Contracts (self-executing), and Consensus Mechanisms (Proof of Work, Proof of Stake, Proof of Authority).

3.3 Types of Blockchain: Public (e.g., Bitcoin), Private (enterprise solutions), and Consortium (managed by a group of organizations).

3.4 Advantages and Limitations: Enhanced security, transparency, and cost efficiency. Challenges include regulatory uncertainty, high implementation costs, and limited technical expertise.

4. Risk Management

4.1 Definition and Importance: Involves identifying, assessing, and mitigating risks to achieve organizational goals. Effective risk management enhances financial stability, especially in banking.

4.2 Types of Risks: Financial (market, credit, liquidity, capital), Operational (system failures, human errors), Compliance (legal violations), Strategic and Environmental Risks.

4.3 Role in Banking: Crucial for maintaining financial stability, profitability, and regulatory compliance in the banking sector.

5. Bank Performance

5.1 Definition and Measurement: Measured through profitability metrics like Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM).

5.2 Determinants: Internal Factors (bank size, capital adequacy, operational efficiency) and External Factors (GDP growth, inflation, regulatory policies).

5.3 Relationship with Risk Management: Effective risk management enhances performance. Blockchain's role in risk mitigation can lead to better financial outcomes.

6. Case Study

Introduction

In this study, I collected data from 1١ banks during a ten-year period from 2014 till 2023 from bank scope. The dependent variable is the risk management and the independent variable is the application of Blockchain technology.

The number of observations, all within a ten-year time span to include the years in which Blockchain came into existence and has developed progressively. The data also concentrates on the technological know-how rather than technologies themselves due to the fact that banks in Egypt have been excessively focusing on the developing its know-how and advancing to where the world is heading globally through international standards and regulations proposed by international organizations. There were some setbacks with the data collection; seeing as that Egyptian banks are not required to disclose their technological use by the regulator and that some of the data had been repetitive, most of the independent variables – such as geographical area and its index of the technological know-how – that should have been used were excluded while testing the results due to perfect correlation between one another. This data included the perfect correlation between geographical area as an index and the profit margins of technological know-how.

6.1. The sample design

The dataset comprises financial data for several Egyptian banks from 2014 to 2023. The data includes key financial metrics such as total assets, net profit, shareholder's equity, operational cash flow, and various risk measures. The banks included in the dataset are Abu Dhabi Islamic Bank-Egypt, Al Baraka Bank Egypt, Commercial International Bank-Egypt (CIB), Credit Agricole Egypt, Egyptian Gulf Bank, Export Development Bank

of Egypt, Faisal Islamic Bank of Egypt, Housing & Development Bank, Qatar National Bank, Societe Arabe Internationale De Banque S.A.E., and Suez Canal Bank S.A.E. The dataset provides a comprehensive view of the financial health and risk profiles of these banks over a decade.

6.1.1 Research Variables:

1. **Independent variable:**

The study independent variable is Risk management measured by

1- Liquidity risk (LR) = Total Loans ÷Total Deposits
2- Credit Risk (CR) = Non Performing Loans ÷Total Loans
3- Market Risk (MR) = Value at risk

2. **Dependent variable**

The study dependent variable is bank performance measured by

1- Return on assets (ROA)= net profit ÷total assets
2- Return on equity (ROE) = net profit ÷Shareholder's Equity

3. **Moderator Variable:**

The study moderator variable is application of Blockchain measured as a dummy variable which takes the value of one or zero

4. Control Variables:

The study control variable is

1- Bank size measured by natural logarithm of total assets in the final of the year

2- Bank operational cash flow size measured by net operational cash flow to total assets

7. Statistical Analysis

7.1 Descriptive Statistics and Correlation Analysis: Identified relationships between risk factors and performance metrics.

7.2 Regression Analysis: Positive effects of blockchain on ROA and ROE, enhancing financial stability and operational efficiency.

8. Discussion

The analysis of the dataset reveals several key trends and insights into the financial performance and risk profiles of Egyptian banks from 2014 to 2023. Overall, most banks showed growth in total assets, net profit, and shareholder's equity, indicating financial expansion and improved profitability. However, the increase in credit risk, market risk, and operational risk exposure highlights the need for robust risk management practices.

The fluctuations in financial ratios such as ROA and ROE across banks and over time suggest that profitability is influenced by various factors, including economic conditions, regulatory changes, and internal management practices. The improvement in CAR for most banks indicates enhanced financial stability, but the fluctuations in some banks suggest that continuous monitoring and improvement of capital adequacy are necessary.

Findings align with prior research indicating that larger banks have lower liquidity risk due to diversified portfolios, supporting the notion that economies of scale enhance resilience.

Blockchain adoption as a moderating factor supports studies suggesting that technological advancements enhance financial security and operational efficiency.

The relationship between risk factors and financial performance corroborates research highlighting the role of strategic financial management in achieving stable and sustainable growth.

Prior studies on ROE confirm that financial leverage and revenue diversification are crucial for determining shareholder returns, consistent with this study’s findings.

6.9 Theoretical Frameworks and Their Application

The results can be interpreted within various financial theories:

- **Efficient Market Hypothesis (EMH):** The observed fluctuations in ROA and risk factors align with the premise that market efficiency influences profitability and financial stability.
- **Risk-Return Tradeoff Theory:** The negative correlation between risk factors and ROA supports this theory, emphasizing the need for balanced risk management strategies.
- **Agency Theory:** The impact of bank size and CFO size on financial performance highlights the importance of management efficiency and decision-making in banking profitability.
- **Technology Acceptance Model (TAM):** The findings on blockchain adoption align with TAM, which suggests that financial institutions embracing technology can achieve higher efficiency and risk mitigation.

6.10 Implications for the Banking Sector

- Banks should focus on improving liquidity management to reduce financial risk, ensuring that they maintain adequate cash reserves for financial stability.

- Adoption of blockchain technology could provide enhanced security and efficiency in banking operations, reducing fraud and transaction costs.
- Risk mitigation strategies should be strengthened to handle market fluctuations effectively, emphasizing the importance of predictive risk analysis and contingency planning.
- Policymakers and regulatory authorities should consider reinforcing regulatory frameworks to ensure sustainable banking practices and safeguard financial systems against potential crises.

6.11. Limitations and Future Research Directions

- The study is limited to banks within the analyzed period (2014-2023) and may not account for long-term trends beyond this timeframe.
- Future research should explore the impact of emerging financial technologies and regulatory changes on bank performance.
- Further investigation is required to understand the role of external economic shocks, such as global recessions, on financial stability.
- Comparative studies across different banking sectors and geographic regions could provide a more holistic understanding of financial performance dynamics.

9. Conclusion

Blockchain significantly impacts risk management and bank performance by enhancing financial stability and efficiency.

This chapter has provided a detailed analysis of the financial performance of banks, identifying key trends, risk factors, and the impact of moderating variables. The findings highlight the importance of asset management, liquidity control, and technological adoption in maintaining financial stability. The interrelationship between financial performance indicators and risk management strategies emphasizes the need for continuous improvements in regulatory frameworks and operational practices. Future research should continue to explore the evolving financial landscape and its implications for banking institutions.

In conclusion, the dataset provides valuable insights into the financial health and risk profiles of Egyptian banks over the past decade. The findings highlight the importance of effective risk management and capital adequacy in ensuring the stability and profitability of banks in a dynamic economic environment.

Recommendations

1. **Investment in Blockchain Solutions:**

Banks should strategically invest in blockchain solutions to enhance risk management practices and improve financial

performance. Blockchain technology offers real-time transaction transparency, reduced operational risks, and enhanced data integrity. By adopting blockchain-based smart contracts, banks can automate complex financial agreements, reducing human errors and ensuring compliance with regulatory standards. Investments should focus on scalable blockchain platforms that integrate seamlessly with existing financial systems. Collaborations with fintech startups and blockchain solution providers can accelerate the implementation process, ensuring that banks stay competitive in an evolving financial landscape.

2. **Supportive Regulatory Frameworks:**

Policymakers should establish supportive regulatory frameworks that encourage blockchain adoption while maintaining financial stability and security. Regulations should be designed to balance innovation with consumer protection, fostering a transparent and secure digital financial ecosystem. This includes developing clear guidelines for smart contract usage, digital asset management, and cross-border blockchain transactions. Policymakers should also collaborate with international regulatory bodies to harmonize blockchain standards, ensuring compliance in global financial markets. Educational initiatives and public-private partnerships can promote blockchain awareness and build trust among stakeholders.

3. **Future Research Directions:**

Future research should explore the long-term effects of blockchain adoption on financial stability in emerging markets. This includes analyzing the impact of blockchain on financial inclusion, liquidity management, and systemic risk reduction. Research should also investigate the potential of decentralized finance (DeFi) platforms in transforming traditional banking models. Empirical studies focusing on cross-country comparisons can provide valuable insights into best practices and regulatory frameworks. Collaboration between academia, industry experts, and regulatory authorities will drive innovation and strategic adoption of blockchain technology.

References

1. Abdullatif, M., & Kawuq, S. (2015). The role of internal auditing in risk management: evidence from banks in Jordan. Journal of Economic and Administrative Sciences, 31(1), 30-50.
2. Alzeban, A., & Gwilliam, D. (2014). Factors affecting the internal audit effectiveness: A survey of the Saudi public sector. Journal of International Accounting, Auditing and Taxation, 23(2), 74-86.
3. Angelova, B., & Koleva, B. (2015). The role of internal audit in risk management system of the companies. Economic Development, Journal of the Institute of Economics-Skopje, (3/2015).
4. Arena, M., & Azzone, G. (2009). Identifying organizational drivers of internal audit effectiveness. International Journal of Auditing, 13(1), 43-60.
5. Baharud-din, Z., Shokiyah, A., & Ibrahim, M. S. (2014). Factors that contribute to the effectiveness of internal audit in public sector. International Proceedings of Economics Development and Research, 70, 126.
6. Baxter, R., Bedard, J. C., Hoitash, R., & Yezegel, A. (2013). Enterprise risk management program quality: Determinants, value relevance, and the financial crisis. Contemporary Accounting Research, 30(4), 1264-1295.
7. Bayyoud, M., Sayyad, N. (2015). The relationship between Credit Risk Management and Profitability between Investment and Commercial Banks in Palestine. International Journal of Economics and Finance. Vol.7, No.11. 163-169
8. Botha, L. M., & Wilkinson, N. (2019). A framework for the evaluation of the perceived value added by internal auditing. Meditari Accountancy Research. Cagnin, F., Oliveira, M. C., Simon, A. T., Helleno, A. L., & Vendramini, M. P. (2016). Proposal of a

method for selecting suppliers considering risk management: An application at the automotive industry. International Journal of Quality & Reliability Management, 33(4), 488-498.

9. Clohessy, T., & Acton, T. (2019). Investigating the influence of organizational factors on blockchain adoption: An innovation theory perspective. Industrial Management & Data Systems
10. Das, T. K., & Teng, B. S. (1996). Risk types and inter- firm alliance structures. Journal of management studies, 33(6), 827-843.
11. Dinu, A. M. (2012). Risk types in international business relations. International Journal of Academic Research in Accounting, Finance and Management Sciences, 2(Special 1), 89-95.
12. Fraser, I., & Henry, W. (2007). Embedding risk management: structures and approaches. Managerial Auditing Journal, 22(4), 392-409.
13. Garsztka, P., Holubowiecz, K. (2015). The application of asymmetric risk measure in modeling the risk of investment, pp.84-100
14. Janssen, M., Weerakkody, V., Ismagilova, E., Sivarajah, U., & Irani, Z. (2020). A framework for analysing blockchain technology adoption: Integrating institutional, market and technical factors. International Journal of Information Management, 50, 302-309
15. Javaid, M., Haleem, A., Singh, R. P., Suman, R., & Khan, S. (2022). A review of Blockchain Technology applications for financial services. BenchCouncil Transactions on Benchmarks, Standards and Evaluations, 100073.
16. Joo, M. H., Nishikawa, Y., & Dandapani, K. (2019). Cryptocurrency, a successful application of blockchain technology. Managerial Finance

17. Kaaya, I., Pastory, D. (2013). Credit risk and commercial banks performance in Tanzania; a Panel Data Analysis. Research Journal of finance and accounting, Vol.4 No.16, pp.55
18. Kabuye, F., Nkundabanyanga, S. K., Opiso, J., & Nakabuye, Z. (2017). Internal audit organizational status, competencies, activities and fraud management in the financial services sector. Managerial Auditing Journal, 32(9), 924-944.
19. Kashyap, A. K. (2010). Lessons from the financial crisis for risk management. Financial Crisis Inquiry Commission, 27.
20. Masinde, K. (2017). Effect of credit risk on financial performance of commercial banks in Kenya
21. Medhi, D. P. K. (2019). Role of Blockchain Enabled Transparency in Risk Management and Sustainability of the Complex Global Supply Chains. *Available at SSRN 3448606*.
22. Morkunas, V. J., Paschen, J., & Boon, E. (2019). How blockchain technologies impact your business model. Business Horizons, 62(3), 295-306.
23. Mwenda, K. (2011). Relationship between core capital and profitability of commercial banks in Kenya, pp1-62
24. Nguyen, Q., Gan, C. (2019). Bank Risk Management: A Regulatory Perspective
25. Singh, H., Jain, G., Munjal, A., & Rakesh, S. (2019). Blockchain technology in corporate governance: disrupting chain reaction or not?. Corporate Governance: The International Journal of Business in Society
26. Singhal, B., Dhameja, G., & Panda, P. S. (2018). Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions. Apress.

27. smajli, H., Guda Ferati, M., & Ferati, A. (2017). The role of internal audit in risk management–Evidence from private sector of Kosovo. Acta Universitatis Danubius. Œconomica, 13(5).
28. Wanjohi, S., Wanjohi, J., Ndambiri, J. (2017) The effect of financial risk management on the financial performance of commercial banks in Kenya. International Journal of Finance and Banking Research. Vol.3, No.4 pp.70-81