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**TOKAT GAZIOSMANPAŞA UNIVERSITY**

**GRADUATE EDUCATION INSTITUTE**

**THE INFLUENCE OF FINANCIAL TECHNOLOGY APPLICATIONS  
ON BANKING CREDIT RISKS: EMPIRICAL EVIDENCE FROM IRAQI  
FINANCIAL SECTOR FOR THE PERIOD OF 2018-2023**

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## **ETHICAL CONTRACT**

I attest to the originality of the Master's thesis titled "The Influence of Financial Technology Applications on Banking Credit Risks: Empirical Evidence from the Iraqi Financial Sector for the Period of 2018-2023" presented in this document. I confirm that I followed the thesis writing guide of Tokat Gaziosmanpaşa University Graduate Education Institute in preparing this thesis. Additionally, I affirm that all the information has been gathered and presented in accordance with academic regulations and ethical principles. In compliance with these regulations, I have properly cited all data, ideas, and findings that are not my own.

**06/01/2025**

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## JURY ACCEPTANCE AND APPROVAL

The defense exam of the thesis titled "**The Influence of Financial Technology Applications on Banking Credit Risks: Empirical Evidence from Iraqi Financial Sector for the Period of 2018-2023**" prepared by **Awaz Hakeem Mousa** was held on January 6, 2025, and was unanimously accepted as a Master's Thesis by the following juries at Tokat Gaziosmanpaşa University Graduate Education Institute, Department of Business Administration, Branch of Accounting and Finance.

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Head of Graduate Education Institute

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## ÖZET

Bu çalışma, son on yılda Irak finans sisteminde önemli gelişmeler kaydedildiği için finansal teknolojinin Irak finans sektöründeki kredi riskleri üzerindeki etkisini araştırmayı amaçlamaktadır. Bu çalışmanın metodolojik yönlerini hazırlamak için soğan araştırma modeli kullanılmıştır, çünkü kredi riskleri (bağımlı değişken olarak) (Toplam Nakit Kredi, Kredili Mevduat Hesabı, Ödenmiş Sermaye, Gecikmiş Borç ödemeleri, Krediler ve İlerlemeler) ve finansal teknoloji (bağımsız değişken olarak) (Toplam Elektronik Ödeme, Nass Pay İşlem Sayısı, NassPay Hacmi, Asya Hawala İşlem Sayısı, Asya Hawala Hacmi, Zain İşlem Sayısı, Zain Nakit İşlem Hacmi) ile ölçülmüştür. Toplanan verilerin zaman çerçevesi, Irak Merkez Bankası'nın resmi web sitesinden toplanan her iki değişkenin tüm ölçümleri için aylık bazda 2018'den 2023'e kadardır.

Bu çalışma birçok sonuca ulaşmıştır, bunlardan en önemlileri Irak'ın finansal sisteminin 2021'den bu yana artan petrol üretimi ve kamu hizmetleri ve altyapıya yönelik hükümet harcamalarını destekleyen dünya çapındaki petrol fiyatlarının bir sonucu olarak genişlemiş olmasıdır. Finansal kapsayıcılığı artırmanın yanı sıra, bankacılık sektörünü modernize etmeye, para birimini sabitlemeye ve dijital bankacılığı büyütmeyle yönelik bu girişimler uluslararası yatırımları da çekmiştir. Devam eden reformlar ve FinTech personelinin eğitime yapılan yatırımlarla birlikte gelecek ihtiyatlı bir iyimserlikle görünüyor. En önemli öneri ise, fintech'in Irak'taki bankacılık kredi riskleri üzerindeki etkisine ilişkin araştırmanın, mikro düzeydeki vaka çalışmalarına ve diğer gelişmiş FinTech merkezleriyle karşılaştırmalara odaklanarak 2023'ten sonra yapılmasıdır. Blok zinciri ve yapay zekâ uygulamaları araştırılmalı, düzenlemelerin etkileri değerlendirilmeli ve politika önerileri oluşturulmalıdır. Ayrıca, finansal kapsayıcılık, kültürel tutumlar, kullanıcı alışkanlıkları ve ekonomik durumların incelenmesi kapsamlı bir risk değerlendirmesi sağlayacaktır. Kavrama ve karar alma süreçlerini iyileştirmek için risk yönetimine yönelik yeni yaklaşımlar araştırılmalı, fintech-banka işbirlikleri ve paydaş perspektiflerini içeren nicel modeller oluşturulmalıdır.

**Anahtar Kelimeler:** FinTech, Bankacılık Kredi Riskleri, Finansal Tabana Yayılma, Finansal Sektör, Irak



## ABSTRACT

This study aims to investigate the influence of financial technology on credit risks in the Iraqi financial sector, as significant improvements have been observed in the Iraqi financial system over the last decade. The onion research model has been used to draft the methodological aspects of this study. Credit risks (the dependent variable) have been measured using Total Cash Credit, Overdraft Accounts, Paid Capital, Late Debit Payments, Loans, and Advances, while financial technology (the independent variable) has been measured using Total Electronic Payments, the Number of NassPay Transactions, NassPay Volume, the Number of Asia Hawala Transactions, Volume of Asia Hawala, the Number of Zain Transactions, and the Volume of Zain Cash Transactions. The data were collected monthly from 2018 to 2023, with all measurements for both variables sourced from the official website of the Iraqi Central Bank.

This study reached several conclusions, the most significant being that Iraq's financial system has improved since 2021 due to rising oil production and global oil prices, which have strengthened government spending on public services and infrastructure. In addition to enhancing financial inclusion, efforts to modernize the banking sector, stabilize the currency, and expand digital banking have also attracted international investment. With ongoing reforms and investments in FinTech staff training, the future appears cautiously optimistic.

The most important recommendation is that research on the impact of fintech on banking credit risks in Iraq should be conducted after 2023, focusing on micro-level case studies and comparisons with other developed fintech hubs. Future studies should explore blockchain and artificial intelligence applications, assess the effects of regulations, and provide policy recommendations. Moreover, examining financial inclusion, cultural attitudes, user behaviors, and economic conditions will offer a comprehensive risk assessment. To enhance understanding and decision-making, innovative approaches to risk management should be explored, along with fintech-bank collaborations and the development of quantitative models that include stakeholder perspectives.

**Keywords:** FinTech, Banking Credit Risks, Financial Inclusion, Financial Sector, Iraq



## LIST OF CONTENTS

|                                                                 |      |
|-----------------------------------------------------------------|------|
| ETHICAL CONTRACT .....                                          | i    |
| JURY ACCEPTANCE AND APPROVAL .....                              | ii   |
| ACKNOWLEDGEMENTS .....                                          | iii  |
| ÖZET .....                                                      | iv   |
| ABSTRACT.....                                                   | vi   |
| LIST OF FIGURES .....                                           | x    |
| LIST OF TABLES.....                                             | xi   |
| LIST OF APPENDIX .....                                          | xii  |
| ABBREVIATIONS .....                                             | xiii |
| INTRODUCTION .....                                              | 1    |
| CHAPTER 1 .....                                                 | 4    |
| 1.1. RESEARCH OBJECTIVES .....                                  | 4    |
| 1.2. RESEARCH QUESTIONS.....                                    | 4    |
| 1.3. RESEARCH HYPOTHESIS .....                                  | 6    |
| 1.4. IMPORTANCE OF THE STUDY .....                              | 6    |
| 1.5. LIMITATIONS .....                                          | 7    |
| CHAPTER 2. LITERATURE REVIEW .....                              | 8    |
| 2.1. FINTECH'S IMPACT ON CREDIT RISKS IN FINANCIAL SECTOR ..... | 8    |
| 2.2. THE RISE OF FINTECH IN THE WORLD.....                      | 24   |
| 2.2.1. The Concept of Financial Technology .....                | 25   |
| 2.2.2. Financial Technology Applications .....                  | 26   |
| 2.2.3. Benefits of Digital Financial Technology .....           | 28   |
| 2.2.4. The Importance of Financial Technology Innovations ..... | 30   |
| 2.2.5. Objectives of Financial Technology (FinTech) .....       | 31   |

|                                                          |    |
|----------------------------------------------------------|----|
| 2.2.6. Unique Characteristics of Fintech Companies ..... | 32 |
| 2.3. DIGITAL CURRENCY (MONEY) .....                      | 32 |
| 2.4. CREATING VALUE IN DIGITAL WORLD .....               | 36 |
| 2.5. CREDIT RISK MODELS .....                            | 38 |
| 2.5.1. Types of Credit Risk.....                         | 39 |
| 2.7. CREDITWORTHINESS CRITERIA .....                     | 41 |
| 2.8. UNDERSTANDING THE 5 CS OF CREDIT .....              | 41 |
| 2.8.1 Character .....                                    | 42 |
| 2.8.2. Capacity.....                                     | 42 |
| 2.8.3. Capital .....                                     | 42 |
| 2.8.4. Collateral.....                                   | 43 |
| 2.8.5. Conditions .....                                  | 43 |
| 2.9. CREDIT RISKS MEASUREMENTS .....                     | 43 |
| 2.10. ALTMAN’S Z SCORE MODEL .....                       | 45 |
| CHAPTER 3. METHODOLOGY .....                             | 47 |
| 3.1. RESEARCH DESIGN .....                               | 47 |
| 3.2. RESEARCH VARIABLES .....                            | 48 |
| 3.3. DATA COLLECTION.....                                | 49 |
| 3.4. SAMPLING .....                                      | 50 |
| CHAPTER 4. RESULTS .....                                 | 51 |
| 4.1. DATA ANALYSIS .....                                 | 51 |
| 4.1.1. Financial Analysis.....                           | 51 |
| DISCUSSION AND CONCLUSIONS .....                         | 74 |
| Scientific and Practical recommendations: .....          | 75 |
| REFERENCES .....                                         | 78 |

## LIST OF FIGURES

| Figure No                                                                                                                      | Page |
|--------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Figure 1.1:</b> Overdraft Accounts in Iraq - – Monthly Basis for the period 2018-2023.....                                  | 5    |
| <b>Figure 1.2:</b> Electronic Payment by Mobile in Iraq – Monthly Basis for the period 2018-2023. ....                         | 5    |
| <b>Figure 2.1:</b> Evolution of digital transformation (Berman and Bell, 2011). ....                                           | 38   |
| <b>Figure 2.2:</b> Innovation trajectories for Industry 4.0 and servitization (Frank et al., 2019) .....                       | 38   |
| <b>Figure 3.1:</b> Late Debit Payments in Iraq - – Monthly Basis for the period 2018-2023. ....                                | 50   |
| <b>Figure 4.1:</b> Total Cash Credit in Iraq (IQD Millions), Monthly Basis for the period 2018-2023. ....                      | 51   |
| <b>Figure 4.2:</b> Total loans and advances in Iraq (IQD Millions), Monthly Basis for the period 2018-2023.....                | 52   |
| <b>Figure 4.3:</b> Total Paid Capital of Commercial Banks in Iraq (IQD Millions) – Monthly Basis for the period 2018-2023..... | 53   |

## LIST OF TABLES

| Table No                                                     | Page |
|--------------------------------------------------------------|------|
| <b>Table 3.1:</b> Variables its Measurements .....           | 48   |
| <b>Table 4.1:</b> Descriptive Statistics for Variables ..... | 54   |
| <b>Table 4.2:</b><br>Correlations.....                       | 60   |



## LIST OF APPENDIX

|                                                                |    |
|----------------------------------------------------------------|----|
| <b>Appendix 1:</b> Total cash credit regression results.....   | 89 |
| <b>Appendix 2:</b> over draft account regression results.....  | 91 |
| <b>Appendix 3:</b> Paid capital regression results.....        | 93 |
| <b>Appendix 4:</b> Late debit payments regression results..... | 95 |
| <b>Appendix 5:</b> loans and advanced regression results.....  | 97 |



## ABBREVIATIONS

|                  |                                    |
|------------------|------------------------------------|
| <b>FinTech</b>   | Financial Technology               |
| <b>SMEs</b>      | Small and Medium-sized Enterprises |
| <b>MENA</b>      | Middle East and North Africa       |
| <b>EPayment</b>  | Total Electronic Payment by Mobile |
| <b>NassT</b>     | Nass Pay Transactions              |
| <b>NassV</b>     | Nass Pay Volume                    |
| <b>HawalaT</b>   | Asia Hawala Transactions           |
| <b>HawalaV</b>   | Volume of Asia Hawala              |
| <b>ZainT</b>     | Zain Cash Transactions             |
| <b>ZainV</b>     | Volume of Zain Cash                |
| <b>CCredit</b>   | Total Cash Credit                  |
| <b>Overdraft</b> | Overdraft Account                  |
| <b>PaidC</b>     | Paid Capital for Commercial Banks  |
| <b>LateP</b>     | Late debit payments                |
| <b>LoansA</b>    | Loans and Advanced                 |
| <b>SSRN</b>      | Social Science Research Network    |
| <b>GECON</b>     | Green Economy                      |
| <b>FICO</b>      | Fair Isaac Corporation             |

## INTRODUCTION

The rapid development of mobile smartphones worldwide, particularly in the last decade, along with faster internet access, has greatly expanded the capabilities offered to users. As a result, users now expect more efficient services and easier ways to meet their daily needs. This shift has intensified competition and contributed to the decline of traditional business models in favor of innovative sectors, including Fintech. To survive in the financial sector and ensure long-term continuity, businesses must fully embrace digital transformation. Consequently, many businesses, particularly in Iraq's financial sector, have adopted non-traditional methods to remain competitive and drive financial inclusion(Alaeddin et al.,2021).

However, modern technology has led to the development of a new area, which combines expertise in finance with technological innovations applied to financial services and the internal performance of companies and institutions: what is known as "Financial Technology," or FinTech. Interest in FinTech has grown massively since 2014, with increased investment in it. With the sudden development of cryptocurrencies, crowdfunding, data analytics, and artificial intelligence, corporations and organizations began to develop a keen interest in FinTech, investing in it and utilizing the financial services it provides. This evolution and movement have made immense changes in the financial world, especially in banking, where all commercial banks have turned into digital and electronic banks. Notwithstanding such progress, companies investing in FinTech have turned out to be significant competitors to traditional banks, hence influencing the dynamics of banking credit risks and furthering financial inclusion in markets like Iraq(Banks,1993).

It is worthwhile to mention that the pace of FinTech adoption could very well be dictated by the regulatory framework of infrastructure development and awareness among people in general. In most cases, FinTech advocates for mobile payment solutions for users to conduct transactions using smartphones. This would also include peer-to-peer transfers, bill payments, and retail purchases. Digital-only banks, like the First Iraqi Bank, and all other digital banking features within traditional banks enable users in Iraq to handle their money with ease and speed.

Online services include opening account, conducting digital transactions, and monitoring accounts in real time. With the use of advanced algorithms to determine the credit risks of banking customers in lending, online finance helps to streamline the loan approval processes for increased access to finance by small-scale business entities and individuals, thus raising the level of financial inclusion in the financial sector Banks (1993).

FinTech expands access to vital services for people and businesses that cannot effectively reach traditional banking systems, hence improving financial inclusions by a wide margin. By embedding automation and data analytics into FinTech, financial institutions can meet regulatory frameworks and ensure full compliance with financial laws. With data analytics and artificial intelligence, FinTech has created insight into customers' behavior and enhanced various credit risk management processes in order to offer highly personalized financial solutions. They also serve as better avenues for delivering financial education and literacy programs, empowering them to be more proactive in their financial decisions. Especially in the emerging market that is Iraq, the structure of improving financial literacy and access will serve to develop and stabilize the financial sector Yu (2024).

This rapid growth of FinTech, finally mushrooming in the early 21st century, has brought to the fore a challenge—a balance between innovation and the efficient management of capital risk—which ought to assume increasing importance both for banks and their regulators. Has made efforts to investigate this dynamism based on the influence of FinTech on commercial banks through identifying their leverage risks using a comprehensive dataset from Chinese banks in the period between 2005 and 2020. The research questions involve: (1) an optimal leverage ratio exists that minimizes the risk of commercial banks, (2) FinTech leads to more balance in asset allocation and may act as an endogenous determinant in performing a countercyclical function since the risks go down during economic downturns, and (3) FinTech significantly enhances the improvement in profitability while reducing leverage risks, especially for large, medium-sized, and listed banks. The findings also give useful guidelines for banks in their pursuits of FinTech enablement, as well as for regulators in the pursuit of governance in an increasingly digital financial ecosystem.

In Iraq, telecommunications and internet companies have jumped on the bandwagon regarding the development of electronic platforms and programs which form part of FinTech. Generally, FinTech is an innovative technology, and its benefit has been felt across different sectors, a factor that has driven the goal of financial inclusion closer to reality than ever in all parts of the world, including the Arab region, especially in countries like the United Arab Emirates whose FinTech investments have gone high due to increasing consumer demand. These platforms have increasingly started to be used for a range of financial and commercial services ranging from financing, loans, the exchange of currency, and money transfers. The acceptance of FinTech in these countries has totally recast the financial landscape, forcing its modernization and expanding access to almost all financial services.

## CHAPTER 1

### 1.1. RESEARCH OBJECTIVES

This research aims to:

1. Identify the factors influencing *banking credit risks* in Iraq.
2. Determine the *financial technologies* currently utilized in the Iraqi banking sector.
3. Measure the effectiveness of *financial technology* applications in Iraq's banking sector.
4. Understand the relationship between *financial technology* applications and *banking credit risks* in Iraq.
5. Analyze the impact of *financial technology* applications on *banking credit risks* in Iraq's banking sector.

### 1.2. RESEARCH QUESTIONS

1. What are the factors affecting *banking credit risks* in Iraq?
2. What are the determinants of *financial technologies* currently applied in the Iraqi banking sector?
3. How effective are *financial technology* applications in the Iraqi banking sector?
4. What is the relationship between *financial technology* applications and *banking credit risks* in the Iraqi banking sector?
5. What is the impact of *financial technology* applications on *banking credit risks* in the Iraqi banking sector?

One of the major indicators of *banking credit risks* in Iraq is the amount of overdrafts, which has significantly increased over the last three years. This rise is a clear indication of the problem, as shown in Figure 1 below.

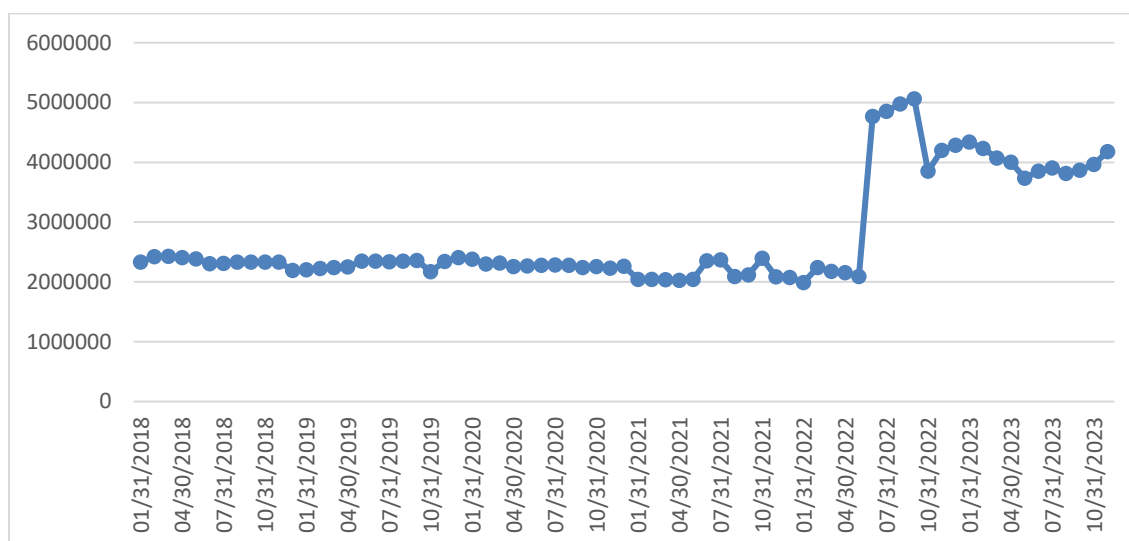


Figure 1.1: Overdraft Accounts in Iraq - – Monthly Basis for the period 2018-2023

Source: Central Bank of Iraq official website - <https://cbiraq.org/Default.aspx>

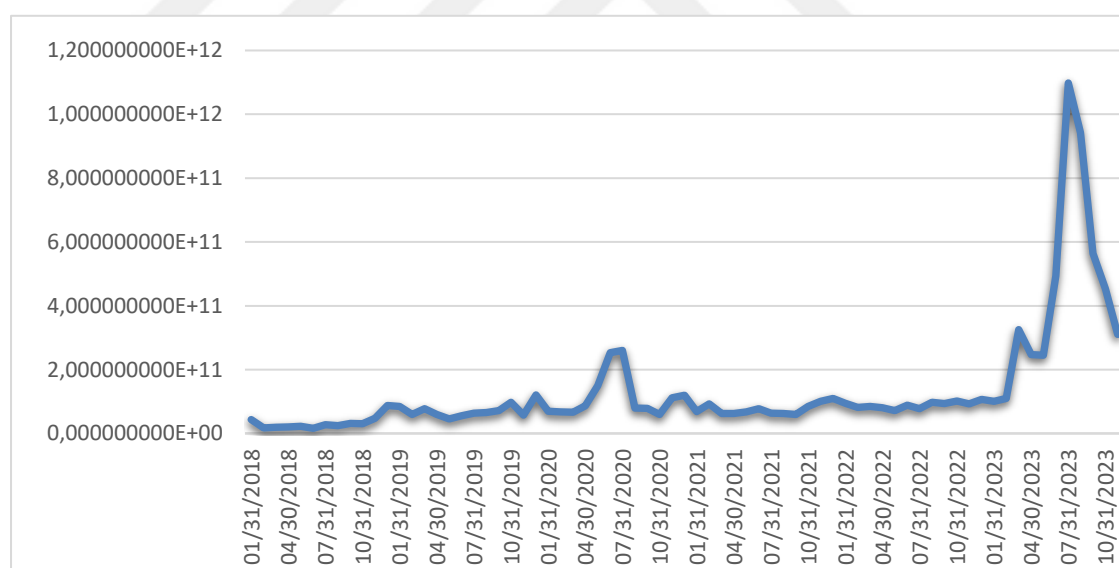


Figure 1.2: Electronic Payment by Mobile in Iraq – Monthly Basis for the period 2018-2023.

Source: Central Bank of Iraq official website - <https://cbiraq.org/Default.aspx>

### 1.3. RESEARCH HYPOTHESIS

1. The application of financial technologies in Iraq's banking sector is effective.
2. There is a positive relationship between financial technology applications and banking credit risks in Iraq's banking sector.
3. Payment system indicators have a positive relationship with financial technology applications and banking credit risks in Iraq's banking sector.
4. Iraq's retail payment system infrastructure has a positive relationship with financial technology applications and banking credit risks in the banking sector.
5. Financial technology applications are influencing banking credit risks in Iraq's banking sector.

### 1.4. IMPORTANCE OF THE STUDY

The paper analyzes the channels through which FinTech affects corporate credit risk; it presents evidence that FinTech development may loosen the financial constraints of non-financial firms and improve their corporate investment efficiency, hence reducing corporate credit risk. Our study is important for some reasons such as:

1. Innovation is progressing rapidly across all sectors, especially with the rise of advanced technology and AI applications. This has made it easier for financial institutions to deliver high-quality services by incorporating *FinTech* into their operations, investments, and financial decision-making processes.
2. The banking sector in Iraq stands out as the most dominant, technologically advanced, and reliable sector, with impressive growth rates. According to the Iraq Stock Exchange's annual data on trading volume, transactions, traded shares, and market capitalization, the banking sector has shown remarkable performance over the past few years, as documented in the Iraqi Securities Commission's annual reports.
3. Moreover, the banking sector in Iraq is the only one to have implemented corporate governance codes, which became mandatory for all banks operating in the country in November 2018. These codes were introduced by the Central Bank of Iraq in collaboration with the International Finance Corporation (IFC)

and the Governance Institute of Directors, the only institution in Iraq dedicated to corporate governance matters.

4. This research contributes to providing empirical evidence on the relationship between FinTech and corporate credit risk in an emerging market like China. It underlines the role of various mechanisms of financial and investment efficiency through which FinTech contributes to the real economy.
5. The additional value of this research lies in the fact that, for the first time, the authors extend existing empirical studies of corporate credit risk by incorporating the macro-environmental variable concerning FinTech development. The research reveals that the effectiveness of FinTech in reducing corporate credit risks stems not only from the relaxation of financial constraints but also from the more accurate measurement of risk through the effective use of digital credit scoring algorithms and big data. It underscores the important role of FinTech not only in providing financing but also in building market confidence and minimizing credit risk.

### 1.5. LIMITATIONS

Like all research, this study has a few limitations, which are outlined below:

Since *FinTech* applications are relatively new in Iraq, the data available spans only a few years, collected on a monthly basis.

Due to the difficulty in obtaining *FinTech* application data at the individual bank level, as it is not freely accessible and requires significant time to gain authorization, this research relies solely on the aggregated data of *FinTech* applications in Iraq's banking sector that has been officially and freely published.

## **CHAPTER 2. LITERATURE REVIEW**

### **2.1. FINTECH'S IMPACT ON CREDIT RISKS IN FINANCIAL SECTOR**

This literature review examines the burgeoning body of research on the impact of Financial Technology (FinTech) on the global banking sector. The reviewed studies reveal a complex and multifaceted relationship, with FinTech simultaneously presenting opportunities and challenges for traditional banks and reshaping the broader financial landscape. The findings are categorized thematically, highlighting key areas of inquiry and debate.

Wonglimpiyarat (2017) utilizes Rogers' Diffusion of Innovations theory to analyze the rapid proliferation of FinTech within the banking sector. The study acknowledges FinTech's transformative influence, noting its substantial global venture capital investment. The research aims to identify systemic factors facilitating FinTech innovation, its impact on collaborative networks, and the subsequent diffusion processes within the banking industry. This paper proposes a systemic innovation model to track the growth of diffusion rates and technological trends. The findings suggest that these systemic factors evolve over time, consequently shaping innovation strategies and market dynamics. The study offers practical implications for banks navigating the complexities of technological adoption, advocating for proactive competitive technology strategies. This is illustrated through a case study of Prompt Pay FinTech within Thailand's financial services sector.

Thompson (2017) identifies key factors driving technological advancements in conservation, including the proliferation of mobile phones impacting human-environment interactions, increased private sector engagement in conservation finance, and the application of technologies such as FinTech. The paper examines benefit distribution mechanisms within conservation initiatives, such as Payments for Ecosystem Services (PES) and Reducing Emissions from Deforestation and forest Degradation (REDD+), highlighting inherent challenges. Furthermore, the study explores the role of FinTech innovations, particularly mobile money, in promoting financial inclusion and risk mitigation, especially among marginalized populations.

In the work "The impact of rapid growth of third-party payments on traditional commercial banks: An empirical study of China, 2007-2014," by Yao et al. (2018) researchers have studied and investigated the fast growth of technological innovation in third-party payments within the Chinese financial sector from 2007 to 2014. The study underlined strong effects received by traditional commercial banks so far, including substitution, competition, and displacement of their payment functions. Empirical results showed that this rapid growth of technological innovation of third-party payments thus influences traditional commercial banks with remarkably positive effects.

Paulet and Mavoori (2020) highlight the transformative impact of the digital revolution on all sectors, including finance. They underscore the urgent need for banks to adopt new technologies to enhance performance and customer satisfaction. This study assesses the impact of this evolving landscape on the performance of financial institutions. While prior research has demonstrated a positive correlation between electronic banking services and bank performance (citation needed), this study expands the scope of investigation. It examines not only traditional banks but also purely digital entities, such as FinTechs, and the involvement of technology giants like Google, Apple, Facebook, and Amazon (GAFA). The objective is to identify potential differences in efficiency and business practices among these diverse actors.

Phan et al. (2020) analyzed the impact of FinTech on bank performance through the lenses of consumer theory and disruptive innovation theory. Employing empirical data from Indonesia, their study demonstrates a negative correlation between FinTech adoption and bank performance, particularly affecting key metrics such as net interest income, return on equity (ROE), return on assets (ROA), and yield on earning assets. Furthermore, the findings indicate that the disruptive influence of FinTech is disproportionately felt by larger, more established banks, including state-owned institutions. This research highlights the significant, yet under-examined, role of FinTech in shaping the performance of the banking sector.

Cheng and Qu (2020) examined the impact of FinTech on credit risk in Chinese commercial banks (2008-2017). Employing web crawler technology and word frequency analysis, they constructed a bank FinTech index revealing significant credit risk reduction, particularly for large, state-owned, and listed banks. This index, analyzed at the bank-year level, addresses a literature gap by quantifying the relationship between bank-specific FinTech development and credit risk. While the study highlights the positive impact of FinTech, especially within the internet technology sub-sector of state-owned banks, it also underscores the uneven adoption rates across different banking segments and the need for further research into the complex interplay between technological innovation and bank risk management practices. The findings ultimately contribute to the ongoing discussion regarding FinTech's role in banking reform and advocate for a comprehensive risk assessment framework adaptable to evolving regulatory and technological landscapes.

Karaman et al. (2021) compared the efficiency of FinTech and traditional consumer lending in Turkey, an emerging market. This study investigates the operational independence of FinTech lending from traditional banking, utilizing data from the fifth-largest private Turkish bank and its FinTech subsidiary. This context is shaped by stringent lending regulations implemented following the 2001 banking crisis. Findings indicate that Turkish FinTech borrowers exhibit distinct characteristics compared to their traditional counterparts: they are younger, better educated, possess higher incomes and savings, and demonstrate superior credit histories and lower default rates. This contrasts with findings from developed economies, where FinTech borrowers are often perceived as higher risk. These contrasting outcomes are attributed to differing regulatory environments, suggesting that FinTech market growth trajectories may diverge significantly between emerging and developed economies.

Cho and Chen (2021) investigated the impact of FinTech on banking industry performance, focusing on operational cost reduction. Their study established innovation as a significant driver of firm value and competitiveness. Employing a system generalized method of moments (GMM) dynamic panel model, they analyzed the determinants of productivity change among FinTech-adopting banks. Performance

evaluation utilized stochastic frontier analysis and meta-frontier analysis to assess the effects of FinTech on banking productivity.

Du et al. (2021) developed a robust early warning system for internet credit risk using big data technology and a backpropagation (BP) neural network. The model, trained and tested on a large dataset from diverse enterprises, achieved an initial accuracy of 85%. Subsequent optimization using a genetic algorithm improved accuracy to 97%. This study demonstrates the efficacy of applying BP neural networks, enhanced by genetic algorithms, to internet finance, offering a novel approach to internet credit risk assessment and mitigation.

Nguyen et al. (2022) investigated the interplay between FinTech credit, bank regulation, and bank performance across 73 countries from 2013 to 2018. Their findings suggest a competitive dynamic in which FinTech firms challenge traditional banks, potentially impacting profitability while simultaneously contributing to enhanced systemic stability. The study emphasizes factors conducive to collaboration between banks and FinTech companies within a highly regulated environment. These analyses offer valuable insights for policymakers, regulators, and industry stakeholders navigating the evolving landscape of financial services.

Kharrat et al. (2022) developed a novel approach to constructing a FinTech index. Employing text mining techniques with AntConc, they analyzed data from Islamic and conventional banks in the Middle East and North Africa (MENA) region from 2010 to 2020. This data, encompassing both Islamic and conventional banking sectors, underwent principal component analysis and factor analysis. A simultaneous equations model was then utilized to investigate the relationship between FinTech adoption and bank performance. The results indicate that the resulting composite measure effectively proxies FinTech industry representation in MENA financial markets, demonstrating a positive impact of FinTech innovation on the performance, profitability, stability, and efficiency of both Islamic and conventional banks. The findings offer valuable implications for practitioners and researchers seeking to leverage FinTech collaborations to enhance banking performance across the MENA region.

Methodologically, this study makes a significant contribution to the FinTech literature by integrating factor analysis with corpus processing software (AntConc) to create a comprehensive FinTech index for the MENA region.

Łasak and Gancarczyk (2022) develop a theoretical framework to explain the evolving roles and functions of banks in response to FinTech developments. Employing a systematic literature review and integrating concepts from transaction cost economics, external enablers, and modular organizational design, they articulate a comprehensive understanding of this transformation. Their framework proposes three scenarios for banks' evolving roles, contingent upon the adoption and managerial application of technological innovations. This evolution, particularly with advanced FinTech applications, culminates in the formation of financial ecosystems. Significantly, instead of a general sector-wide analysis, the study focuses on the decision-making processes within individual banking organizations. These scenarios offer a valuable tool for decision-making simulations and future empirical research. By examining the motivations and consequences of FinTech integration within bank structures, the paper contributes to the literature on organizational change and provides practical guidance for decision-makers navigating FinTech-driven transformations in banking.

Sidaoui et al. (2022) analyze the impact of FinTech on financial inclusion by comparing the financial performance of the ten largest Islamic and US conventional banks. Employing Bloomberg data (2006-2021), the study reveals that Islamic banks exhibit higher risk-return profiles and experienced faster growth than their US counterparts. While Islamic banks demonstrate a dependence on credit for profitability, US conventional banks struggle to maintain consistent interest rate ratios. The findings highlight FinTech's significant role in fostering Islamic finance growth, even during economic crises. However, the authors acknowledge a limitation in the availability of bank-specific FinTech data, suggesting a promising avenue for future research. The study contributes novel risk and return measures (Return on Equity Market and volatility) and offers valuable insights into the comparative risk-return profiles, growth trajectories, and business models of Islamic and conventional banking systems.

Metawa et al. (2022) highlight the significant interest generated within economic and policy circles by the convergence of green economy, technology, and finance. Their work explores the potential of FinTech to facilitate green and sustainable project financing and the deployment of clean technologies through voluntary sustainability initiatives. This analysis rests on the causal relationship between FinTech, CleanTech, and the green economy, with daily data from 2012 to 2021 indicating a bilateral correlation between these variables, suggesting that global economic conditions are a key driver of FinTech and CleanTech development. This research underscores the need for a synergistic approach, integrating clean technologies and digitalization within the financial sector to foster environmentally sustainable economies. Furthermore, it emphasizes the interconnectedness of the green economy and sustainability with social equity and environmental risk management. The paper's contribution to the literature lies in its analysis of the interrelationship between clean technology, the green economy, and FinTech, offering valuable insights for policymakers and investors.

Frost et al. (2022) examine the interplay between wealth inequality, financial development, and technological change. They posit that unequal access to financial instruments and technologies contributes to escalating wealth disparities over time. Employing Italy as a case study, they analyze household-level data spanning 1991–2016 to assess the impact of financial development and technological progress on wealth accumulation. Their findings indicate that while both financial development and technological advancement contribute to wealth accumulation, this effect is disproportionately concentrated among higher-wealth households. Furthermore, the results suggest that technological change may exacerbate wealth inequality, highlighting the need for policies promoting equitable access to financial and technological resources to mitigate such disparities.

Li (2022) investigated the impact of transformative finance on the financial sector in China. Employing text mining to develop a FinTech adoption index for banks, the study utilized regression analysis to examine the relationship between FinTech adoption and banking risk. Results revealed a U-shaped relationship between FinTech innovation and bank credit risk, indicating an initial increase followed by a decrease in

non-performing loans beyond a certain threshold of FinTech adoption. The research advocates for accelerated FinTech integration within commercial banking, coupled with strategic digital transformation initiatives. However, it cautions against uncontrolled FinTech growth, highlighting potential security risks such as excessive credit issuance. Accordingly, Li (2022) recommends enhanced national financial supervision and risk management frameworks to effectively mitigate these risks.

Le (2023) examined the determinants of rising household lending during the rapid expansion of FinTech credit, employing data from 41 countries between 2015 and 2018. Utilizing a fixed-effects model and controlling for geographic region and year effects, the study investigated the underlying factors driving this increase. Results indicate a positive correlation between the ratio of household to firm credit and both credit information sharing and financial literacy, suggesting these factors are significant facilitators of household credit growth. This research represents the first empirical investigation of the roles of credit information sharing, financial literacy, and FinTech credit development in shaping household lending trends.

Khan et al. (2023) investigated the impact of FinTech adoption on the stability of Gulf Cooperation Council (GCC) banking sectors from 2010 to 2022. They constructed a comprehensive FinTech adoption index incorporating factors such as digital presence and mobile banking capabilities. Their findings suggest that FinTech adoption contributes to heightened instability, necessitating robust risk assessments, regulatory oversight, and close collaboration among banks, FinTech firms, and regulatory bodies.

Chen and Huang (2023) investigated the impact of FinTech development on financial risks in Chinese commercial banks from 2011 to 2020 using unbalanced panel data and regression analysis. Their study addresses concerns that FinTech innovation increases both costs and financial risks for these institutions. The analysis illuminates the complex interplay between FinTech integration and traditional banking systems during a period of rapid economic growth, revealing potential trade-offs and challenges. The authors conclude that further research is needed to fully understand the evolving

relationship between FinTech and financial risk management within rapidly developing economies, such as China.

Danisewicz and Elard (2023) investigate the relationship between FinTech, specifically marketplace lending, and personal bankruptcy rates. Their analysis reveals a significant negative correlation between marketplace lending activity and personal bankruptcy filings, suggesting that this lending modality may exert a different influence on household financial well-being than traditional credit sources. This finding indicates a potential for FinTech, via marketplace lending, to offer alternative solutions that mitigate personal bankruptcy. However, further research is warranted to explore fully the implications of this relationship for both financial scholarship and policy development.

Cornelli et al. (2023) investigate the interplay of economic and institutional factors influencing the diffusion of FinTech and Big Tech credit. Their analysis reveals a positive correlation between per capita GDP and the diffusion of both FinTech and Big Tech credit, although this relationship exhibits diminishing returns at higher GDP levels. Furthermore, the study identifies significant associations between the diffusion of FinTech and Big Tech credit and several institutional factors, including ease of doing business, investor protection, judicial efficiency, lower bank credit-to-deposit ratios, and a more developed bond and equity market.

Shah et al. (2023) investigated the impact of FinTech on pre- and post-financing credit risk within the Islamic banking sector. Employing a mixed-methods approach, their study utilized primary data on FinTech awareness and adoption, complemented by secondary data on financial and economic indicators from 2009 to 2021. Analysis relied on baseline regression and a dynamic panel two-stage generalized method of moments (GMM) estimation to assess the moderating effect of FinTech on various variables. The findings reveal a heterogeneous level of FinTech awareness, understanding, and adoption across Islamic countries, with the Asia-Pacific region, particularly Indonesia and Malaysia, demonstrating significantly higher adoption rates and, consequently, improved credit risk management. The study further indicates that FinTech exerts a

more pronounced influence on pre-financing credit risk compared to post-financing risk. Moreover, it highlights the challenge of "adverse selection under Shariah compliance" faced by Islamic banks. The authors advocate for accelerated FinTech integration within the Islamic banking system through regulatory intervention and suggest further research into operational and market risks. The study concludes that while FinTech offers potential benefits, it may also amplify systemic risk and the vulnerability of Islamic banks to financial crises, potentially leading to reduced regulatory capital requirements over time. This conclusion warrants further investigation.

Elsaid's (2023) comprehensive analysis of existing literature, sourced from Scopus, SSRN, and Google Scholar, examines the opportunities and challenges presented by FinTech firms to traditional banking systems. The findings suggest that, while FinTech firms are positioned to erode the market share of established banks, complete displacement is unlikely. Instead, the study emphasizes the need for banks to adopt innovative technologies to remain competitive in the evolving financial landscape. Moreover, the paper advocates for strategic partnerships and collaborations between banks and FinTech companies, highlighting the potential for synergistic benefits.

Dasilas and Karanović (2023) examined the impact of FinTech on the performance of UK banks using panel data from 2010 to 2019. Employing both static and dynamic panel data regression analyses, their study investigates the relationship between FinTech penetration and bank profitability. The findings reveal a statistically significant positive relationship between the presence of FinTech firms and key bank performance indicators. This research represents a pioneering contribution to the literature, offering a comprehensive long-term analysis—spanning nearly a decade—of FinTech's influence on bank profitability within a developed market. The study's novelty lies in its integrated analysis of this extended dataset, providing valuable insights into the evolving financial services landscape and the role of FinTech within it.

Thomas et al. (2023) conducted a critical analysis of the conceptual framework of FinTech credit within the financial industry, identifying promising avenues for future

research. Employing a bibliometric approach, their study analyzed 268 articles retrieved from the Web of Science database, spanning the period 2010–2021. The methodology incorporated citation analysis, keyword analysis, co-author analysis, co-citation analysis, and bibliographic coupling. Results indicated a surge in FinTech credit research after 2016, with significant contributions from China, the United Kingdom, and the United States. The *\*International Journal of Bank Marketing\** emerged as the most prolific publication in this field. Co-citation analysis revealed three dominant themes: (1) factors influencing user adoption of FinTech credit products and services; (2) characteristics impacting fundraising on FinTech credit platforms; and (3) the evolution of the FinTech credit market. Bibliographic coupling highlighted recent trends, including the influence of emerging technologies such as blockchain and artificial intelligence, drivers of consumer adoption, and the transformative impact of FinTech on formal credit markets. Furthermore, the analysis identified effective fundraising mechanisms within FinTech platforms and critical perspectives on digital lending platforms. This study offers a novel contribution to the literature by providing a pioneering bibliometric analysis of FinTech credit research. The findings offer valuable insights for future research, including investigations into the balance-sheet lending model, the systemic impact of FinTech on the financial system, and the potential for interdisciplinary collaboration to unlock new market opportunities.

Turki and Rieg (2023) investigated the relationship between founder industry experience and the performance of European FinTech companies, focusing on the impact of this experience on venture capital (VC) investment. Employing a Bayesian quantile regression analysis of data from 105 European FinTech firms (including firms in the UK) participating in 201 VC rounds between 2006 and 2019, they found that prior experience in finance and information technology (IT) significantly predicted FinTech firm performance. However, this relationship was contingent on the specific performance metric. While finance and IT experience positively correlated with market success, it did not demonstrably translate into superior post-investment returns for VC investors. This study contributes to the understanding of the critical role of founder expertise in finance and IT within the FinTech sector, elucidating its impact on firm performance and VC investment outcomes.

Elia et al. (2023) conducted a bibliometric analysis examining the influence of FinTech on the banking sector. Their study, based on 377 Scopus-indexed articles published between 2014 and 2021, employed keyword extraction and document analysis (utilizing a Risk and Volume of Sales viewer) to identify trends in technological development and delineate current and future research agendas. The resulting overview comprehensively addresses the multifaceted impacts of FinTech on customers, corporations, financial institutions, regulators, and society, tracing its evolution from the advent of digital banking to its contemporary implications. This contribution expands the existing literature by providing a thorough review of FinTech's transformative influence on the banking industry and its diverse consequences.

Ozili (2023) investigates the determinants of interest in Nigeria's central bank digital currency (CBDC), the eNaira, and its relationship with financial inclusion. The study analyzes the potential role of interest in fintech and cryptocurrency in driving eNaira adoption, leveraging Google Trends data to examine the correlation between online interest in fintech, cryptocurrency, CBDCs, and the eNaira, alongside its association with financial inclusion. Results reveal positive correlations between interest in fintech and eNaira information, as well as between financial inclusion and eNaira information. Furthermore, a positive correlation was observed between interest in fintech and interest in financial inclusion. These findings suggest that disseminating information about financial innovations, including fintech and CBDCs, positively influences interest in financial inclusion, highlighting the potential benefits of public awareness campaigns promoting the eNaira and broader fintech adoption. The study acknowledges limitations, including potential biases stemming from the reliance on "interest over time" data from Google Trends and the use of limited sample periods.

Liang et al. (2023) examine the moderating effect of FinTech development on the relationship between macroeconomic uncertainty and proactive risk-taking by Chinese commercial banks. Employing a fixed-effects panel data model and annual data from 145 commercial banks spanning 2010–2019, the authors find that FinTech development mitigates the impact of macroeconomic uncertainty on bank lending behavior by reducing information asymmetry. These findings suggest that promoting

FinTech development, particularly in rural areas, could enhance financial inclusion and bolster the real economy by dampening the effects of macroeconomic uncertainty on banks' risk-taking.

Rahman et al. (2023) investigated the impact of FinTech and financial development on the shadow economy across BRICS+ nations using panel data from 2004 to 2018. Employing a battery of econometric techniques—including Breusch-Pagan tests for heteroskedasticity, Pesaran and cross-sectionally augmented Dickey-Fuller (CADF) tests for panel unit roots, Westerlund cointegration tests, cross-sectional autoregressive distributed lag (CS-ARDL) models, and Konya's panel causality test—the authors examined the dynamic relationships among these variables. Their findings reveal a negative association between financial development, FinTech adoption, and the size of the shadow economy. Furthermore, the study identifies a significant moderating effect of FinTech on the relationship between financial development and shadow economy activity. Specifically, bidirectional causality between economic growth and the shadow economy was detected in South Africa, India, and Russia; similarly, bidirectional causality between FinTech and the shadow economy was observed in India and Russia. These empirical results offer valuable insights for policymakers seeking to curtail the shadow economy.

Phan Thi Hang's 2023 study examines the impact of the COVID-19 pandemic on credit risk management in Vietnamese commercial banks. Employing a quantitative methodology, the research analyzed survey data from 300 credit risk managers across a range of banks. Findings reveal that over 60% of participating banks experienced pandemic-related disruptions, impacting both subjective and objective credit risk factors. Through regression analysis and stakeholder consultation, the study identifies key determinants of credit risk and offers empirically-supported policy recommendations to enhance risk management practices within Vietnamese commercial banks, contributing to greater resilience in the face of future economic challenges. The analysis spans the period from 2019 to 2020, providing a pre- and post-pandemic comparative perspective.

Nie et al. (2023) examined the potential of FinTech to mitigate systemic corporate debt default risk during the COVID-19 pandemic's economic disruption in China. Their findings indicate that FinTech adoption is associated with a reduced likelihood of corporate debt defaults, thereby significantly mitigating the vulnerability of non-state-owned enterprises (NSOEs) and smaller firms, particularly those in the growth and maturity stages. The study identifies a range of micro- and macroeconomic factors influencing corporate debt default risk, including corporate financial health, governance and social responsibility practices, innovation investment, family ownership structure, the financial cycle, economic policy uncertainty, credit mismatches, and deleveraging policies.

Murtaza et al. (2023) employed partial least squares (PLS) analysis on a randomly sampled dataset from Pakistani banks to examine the influence of environmental, market, and operational risks, alongside organizational structure and operational efficiency, on credit risk management. The study highlighted the moderating role of financial technology (FinTech). Results indicate that exchange rate fluctuations, market risks, operational systems, and operating expenses significantly impact customer relationship management (CRM) and, consequently, credit risk. FinTech was found to significantly enhance the effectiveness of these factors in mitigating credit risk. The authors offer theoretical insights into CRM challenges, practical recommendations for optimizing credit risk assessment and overall risk management efficiency, and advocate for integrating environmental risk assessment into CRM strategies. Future research avenues include extending the analysis to microfinance and Islamic banking sectors, and conducting cross-country comparative studies on CRM practices and the moderating effect of FinTech across diverse financial and technological contexts.

Agustin (2023) applied the Vector Error Correction Model to analyze credit risk, fundamental loan interest rates, the quantity of lending entities, and total outstanding loan amounts in the FinTech sector. Credit data from FinTech firms in Indonesia, along with the overall performance of the sector and credit risk ratios, have been examined, with an analysis of the impact of credit risk on loan amounts and long-term borrowing dynamics. The study suggests that the credit risk ratio may reach higher levels in the

future, potentially having a greater impact on long-term loans. It also highlights that, in cases where credit risks increase, the credit provision processes and repayment performance in the FinTech sector may be negatively affected.

Baker et al. (2023) investigated the impact of financial technology (FinTech) adoption on the performance of commercial banks listed on the Amman Stock Exchange and the Abu Dhabi Securities Exchange. Employing total deposits and net profits as key performance indicators (KPIs), their study treated FinTech adoption as an independent variable. The results indicated a positive relationship between FinTech adoption and both KPIs, corroborating prior research on the beneficial effects of FinTech on bank performance and its significance within the banking sector.

Du and Geng (2024) empirically investigate the impact of FinTech on corporate financing constraints among listed companies from 2012 to 2022. Their findings indicate a negative relationship between FinTech adoption and financing constraints, suggesting that increased FinTech utilization alleviates information asymmetry and thereby facilitates access to capital. This study contributes to the literature by explicitly examining the mediating role of information asymmetry in the FinTech-financing constraints nexus for listed firms.

Tan et al. (2024) investigate the impact of FinTech development on the credit risk of non-financial firms, focusing on emerging markets, particularly China. Utilizing data from the Ant Finance Service Group, the authors construct a city-level FinTech development index. Their findings indicate a significant negative correlation between FinTech infrastructure development and firm credit risk. This risk-mitigating effect, however, is demonstrably stronger for non-state-owned enterprises, small and medium-sized enterprises (SMEs), firms operating in less market-oriented regions, and those experiencing operational challenges. These results suggest that FinTech can enhance financial resilience, especially for more vulnerable firms and regions.

Liu et al. (2024) examine the evolution of FinTech regulation in China, its impact on the financial sector, and specifically, its influence on banks' liquidity creation. Initially, China adopted an inclusive regulatory approach to stimulate FinTech

development. However, rapid innovation and escalating risks, exemplified by the Ezubao scandal, necessitated a shift in strategy. The study underscores the critical role of regulatory frameworks in harnessing the benefits of FinTech innovation while mitigating potential market failures. These findings contribute to a more comprehensive understanding of the dynamic interplay between evolving FinTech regulations, banks' liquidity creation mechanisms, and the pursuit of a balance between innovation and financial stability. Furthermore, the research highlights the impact of FinTech innovations on their own potential and their capacity to prevent market failures, ultimately demonstrating the significant influence of FinTech regulation on banks' liquidity creation processes and the overall efficiency of the financial system.

Lan (2024) employs panel data and spatial econometric methods to analyze the impact of FinTech on capital misallocation across 284 Chinese cities from 2012 to 2020. The findings reveal a complex, temporally evolving relationship. Initially, FinTech exacerbates capital misallocation; however, this negative effect gradually diminishes over time. Furthermore, a significant spatial spillover effect is observed, with FinTech initially mitigating, and subsequently amplifying, capital misallocation in neighboring regions. These results underscore the critical importance of considering both temporal and spatial dimensions when assessing the broader economic consequences of FinTech. The study offers valuable implications for policymakers seeking to leverage FinTech's benefits while mitigating its risks to regional economic development.

Zhu and Guo (2024) found a positive correlation between FinTech innovation and bank performance using monthly operational data from a Chinese joint-stock bank between 2016 and 2019. Their findings suggest that banks should strategically balance the risks and benefits of FinTech adoption to foster inclusive finance. Specifically, the study demonstrated that integrating FinTech into digital inclusive finance strategies improves operational efficiency and enhances decision-making. This improvement, the authors argue, may mitigate challenges associated with inclusive finance by reducing information asymmetry and transaction costs.

Branzoli et al. (2024) examine the impact of bank digitalization on lending to Italian businesses during the COVID-19 pandemic. Utilizing a unique dataset merging bank- and firm-level information, they demonstrate that banks with higher information technology (IT) expenditure relative to total costs experienced a significantly greater increase in lending following the pandemic's outbreak. This credit expansion primarily manifested as term loans to small, financially sound enterprises, particularly within sectors severely affected by the crisis. The authors elucidate the role of information technologies in facilitating this credit expansion, providing evidence on the key drivers of online lending platforms and technology-enabled credit risk assessments. This study contributes to the existing literature on banking innovation and technology diffusion, highlighting the crucial role of both physical and digital channels in maintaining banking services, especially during periods of crisis such as the COVID-19 pandemic.

Rosdini et al. (2024) investigate the regulatory frameworks, governance structures, and methodologies employed by peer-to-peer (P2P) lending platforms in three major ASEAN markets: Indonesia, Malaysia, and Singapore. Utilizing a qualitative research approach encompassing literature reviews, semi-structured interviews, focus group discussions, and document analysis, the study reveals significant divergence in P2P lending practices despite the use of similar credit scoring variables. This divergence is attributed to variations in regulatory environments, organizational cultures, and data processing methodologies. The findings offer valuable insights for investors, businesses, and academics regarding the crucial role of credit scoring governance within the P2P lending sector. By comparing the regulatory and operational contexts of these three ASEAN countries, the study provides a unique perspective on the evolving influence of governance in shaping this rapidly developing financial technology landscape.

Yu (2024) proposes several policy recommendations stemming from an analysis of the interplay between financial technology (FinTech) and leverage in risk management. A theoretical model elucidates the relationships among these elements, and empirical findings support the hypothesis that FinTech exerts a positive influence on leverage-related risks. Consequently, the study advocates for the countercyclical

application of FinTech and emphasizes the need for increased cooperation and investment in enhancing FinTech capabilities.

In summary, the collective body of research presented demonstrates a complex and evolving relationship between FinTech and the financial sector. The studies reveal a range of both positive and negative impacts, highlighting the need for ongoing research, robust regulation, and strategic collaboration between traditional banks and FinTech firms to maximize the benefits while mitigating potential risks.

## **2.2. THE RISE OF FINTECH IN THE WORLD**

The contemporary digital economy is witnessing a shift from investment-driven to innovation-driven growth for enterprises. However, innovation necessitates substantial financial resources, and many businesses face financing constraints that impede both structural economic optimization and real economic growth. The 2008 financial crisis spurred the emergence of Financial Technology (FinTech), leading to a proliferation of non-licensed credit companies utilizing technological advancements to address market financing gaps. Responding to increasingly stringent financial regulations, these institutions have developed innovative and flexible financial products and services, contrasting sharply with traditional offerings. The superior financial performance of banks integrating technology into services such as savings accounts, checking accounts, and ATMs provides compelling evidence of this trend. Furthermore, financial inclusion plays a crucial role; broader access to banking services increases total deposits through a larger client base. Other deposit-increasing strategies include the utilization of checks, mobile, and electronic transfers (Baker et al., 2023).

The significance of FinTech is highlighted by initiatives such as the People's Bank of China's 2019-2021 Fintech development plan and the surge in venture capital investment in the Asia-Pacific region. FinTech offers numerous benefits, including improved access to affordable financing, enhanced credit scoring, and reduced financial constraints for small and medium-sized enterprises (SMEs). However, challenges persist, including the potential for rapid financial contagion and complex regulatory

issues. This study concludes that, *ceteris paribus*, effective financial oversight mitigates the corporate debt default risk associated with FinTech. Consequently, FinTech provides a refined framework for analyzing corporate debt default risk, offering a deeper understanding of its potential to address the shortcomings of traditional financial systems. Empirical evidence supports the integration of finance and technology to mitigate corporate debt defaults (Nie et al., 2023).

FinTech presents both opportunities and risks for the banking industry. While it poses a threat to certain traditional business activities, such as money transfers, it simultaneously creates new avenues for growth and enhances transaction security, enabling banks to operate more securely and efficiently (Ben Zidane et al., 2019).

Despite modernizing the global financial landscape through increased efficiency and transparency facilitated by digital platforms and advanced technologies, FinTech remains largely unexplored regarding its potential impact on capital misallocation, a factor that could hinder economic growth and contribute to capital productivity and policy distortions. Its disruption of traditional financial mechanisms necessitates a thorough investigation of its nonlinear pathways and spatial spillover effects. This study addresses this research gap by examining the nonlinear effects of FinTech on capital misallocation and its spatial spillover consequences, providing novel insights into the complex relationship between FinTech and capital misallocation.

### **2.2.1. The Concept of Financial Technology**

Financial technology (FinTech) leverages technology to improve and optimize financial services and operations (Cao et al., 2021). This rapidly expanding industry benefits both consumers and businesses by facilitating the management of financial activities through specialized software and algorithms designed for computers and smartphones. The integration of technologies such as artificial intelligence, blockchain, and data science into traditional financial sectors enhances security and efficiency. The FinTech sector is among the fastest-growing technological industries globally.

However, the rapid pace of technological advancement presents significant challenges for the banking industry. The evolving financial needs of individuals and institutions necessitate a corresponding acceleration in the development and updating of financial services and products across all sectors. The anticipated progress in global communication systems will fundamentally alter how individuals and institutions conduct business and transfer funds. Traditional banks, whose profitability has historically relied on mobilizing cash deposits and lending, face challenges as the use of physical currency declines and transactions shift toward electronic currencies (Chesnais, 2016). Adaptation to these technological advancements is crucial for maintaining competitiveness.

FinTech's emergence as a significant force in the financial landscape is largely driven by its potential for global economic growth. It diversifies economic activities and fosters innovation in financial products and tools. Technologies such as blockchain, cryptocurrencies, and smart contracts provide solutions to existing problems and offer new models for transactions between individuals and entities. Furthermore, FinTech enhances the accessibility of financial services to underserved populations and institutions, promoting greater financial inclusion (Dakash et al., 2021).

Several definitions of FinTech exist. It is described as the application of technology and innovation to compete with traditional financial methods in delivering financial services, representing an emerging industry aimed at enhancing activities within the financial sector (Rashida, 2019). Other definitions emphasize FinTech's role in providing more affordable, user-friendly, and accessible products and services that improve the quality of traditional financial services (Omani et al., 2021). Ultimately, FinTech encompasses financial products and services that leverage digital technology to enhance quality, offering benefits such as reduced time and costs, and simplified processes.

### **2.2.2. Financial Technology Applications**

There are numerous applications of financial technology, and some of the most significant and widely adopted include:

- **Machine Learning and Artificial Intelligence:** Machine learning and artificial intelligence, integral to computer science, are among the most prevalent technologies utilized in developing intelligent systems. Banks employ these technologies for market research and to refine their loan approval processes. Additionally, machine learning enhances the efficiency of call center operations.
- **Blockchain:** Blockchain technology is gaining significant traction in the financial industry due to its capacity to securely store transaction records and other sensitive data. With this technology, each transaction is encrypted, greatly reducing the chances of hacking. Furthermore, blockchain technology underpins cryptocurrencies.
- **Data Analytics and Big Data:** Large datasets are utilized to analyze consumer preferences, spending habits, and investment behavior. Predictive analytics are then applied to this information to develop marketing strategies, enhance fraud detection systems, and improve marketing efforts.
- **Algorithmic Trading:** Algorithmic trading processes large volumes of data simultaneously, executing thousands of transactions each day. This enables traders to make swift decisions, providing them with a competitive edge in the market.
- **Fraud Detection and Prevention:** Fraud is a major concern for banks and financial service companies. Nowadays, many organizations utilize machine learning and artificial intelligence to detect and prevent fraudulent financial activities.
- **Portfolio Management:** Online applications leverage machine learning and robo-advisors to enhance clients' investment returns. They provide a user-friendly way for people of all ages to access affordable investment opportunities with minimal effort.
- **Loan Origination:** Companies in the banking and insurance sectors possess vast amounts of customer data, which can be utilized to train machine learning models for processing loan origination.

- **Robotic Processes:** Robotic process automation assigns repetitive tasks to robots rather than humans, streamlining operations within financial institutions.
- **Regulatory Technology (RegTech):** Regulatory technology, often referred to as RegTech, is designed to streamline compliance operations for financial institutions. It facilitates the management of large volumes of data, including transactions, records, and compliance documents, thereby saving both time and costs Bamberger (2009).

### 2.2.3. Benefits of Digital Financial Technology

Digital financial technology is rapidly transforming the way individuals and businesses manage their finances, offering a plethora of benefits that extend beyond simple convenience. From enhanced accessibility and affordability to increased efficiency and security, FinTech is revolutionizing financial inclusion and empowering users worldwide. Here we will explore the key advantages of this burgeoning sector, examining how innovations in mobile payments, online banking, crowdfunding, and other digital financial services are reshaping the financial landscape and improving the lives of millions. Here are some advantages of FinTech:

1. FinTech is an important avenue for information asymmetry reduction, which in turn implies cost reduction in debt financing and overall efficiency enhancement in credit allocation (According to Yu, 2024).
2. The rise of FinTech companies has increased accessibility to financial services, fundamentally altering banking strategies. Competition is no longer solely defined by the breadth of services offered but, rather, by the quality of service and customer focus exhibited by both traditional banks and FinTechs (Paulet and Mavoori, 2020).
3. Due to use the insulation of innovative technology, FinTech firms can offer services more efficiently and at lower costs than the "incumbents." This is likely to displace the incumbent traditional factor banks. In spite of FinTech's increasing influence, its exact implications for the financial system remain less

than perfectly understood, with precious little research into this area (Phan et al, 2020)

4. FinTech credit, being more disruptive of the growth of firm than household credit, nonetheless has the ability to complement traditional lending growth. More importantly, these results were quite consistent across various sensitivity analyses (Le, 2023).
5. Urom (2023) discusses the nexus between FinTech and green finance in considering how the former can help in pursuing sustainability goals and combating climate change. FinTech and green financial assets, thereby assisting investors and policymakers with comprehension to drive investment portfolio actions and eco-friendly policy actions forward. This analysis deepens the understanding of how FinTech and green investments interact and what that finally means for investment strategies as well as policy decisions. This study underlines that FinTech, and green investments are among trending topics in the world and have huge interest from investors.
6. FinTech development is useful in offsetting the deterring effect of macroeconomic uncertainty on the banks' risk-taking behavior. Specifically, FinTech promotes bank lending and the holding of transactional financial assets, while it reduces banks' risk aversion during times of economic uncertainty. However, the dampening effect of FinTech on banks' risk aversion diminishes as banks become more active in taking up risks. Its differential effect operates according to bank type and thus is less pronounced in banks with higher capital adequacy ratios. Moreover, the digital transformation of commercial banks induced by FinTech increases their lending activities as well as their holdings of transactional financial assets, hence fostering credit risk-weighted assets (Liang et al, 2023)
7. FinTech has increasingly become a key driver of transformation within the finance industry, especially in improving the level of performance and efficiency of credit with big data and artificial intelligence. FinTech is also positively correlated with shadow banking activities of non-financial firms, in particular, in credit intermediation functions. This influence is significantly more pronounced

for less profitable firms and solely A-share listed ones. Robustness tests confirm these findings (Zhang et al., 2023).

8. Additionally, the quality of information disclosure moderates the relationship between *FinTech* and financing constraints, with better disclosure weakening this connection. Recent technological advancements in *FinTech* have contributed to continuous improvements in enterprise performance (L. Du & Geng, 2024).
9. It was reported that FinTech credit affects banks in a dual fashion: it decreases profitability while improving risk-related performance. Regulatory frameworks play a crucial role, with stricter regulations positively associated with bank stability. The influence of FinTech credit on banks varies depending on regulatory stringency, with deeper effects observed in more regulated environments (Nguyen et al, 2022)

#### 2.2.4. The Importance of Financial Technology Innovations

- The importance of financial technology (FinTech) lies in its role as a major channel for delivering modern financial products and services to beneficiaries. It provides essential technologies to banks, supporting various financial institutions and capital markets, and facilitates the analysis of financial data, statements, payments, and customer money management. FinTech also plays a crucial role in reducing costs and efficiently increasing capital for all users. However, it presents challenges for regulators and market participants, who must balance the benefits and potential risks of these innovations to ensure their continued viability in the market. Additionally, FinTech significantly contributes to boosting a country's Gross Domestic Product (GDP) by making financial tools, such as credit facilities, more accessible to individuals and institutions (Iskandar, 2020). Various studies have highlighted the significance of FinTech innovations, which can be summarized as follows:

- **Expanding Financial Services:** Fintech covers a wide range of financial services such as crowdfunding, mobile payment solutions, international money

transfers, and online investment portfolio management tools, addressing gaps left by traditional banks for many customers.

- **Transforming Financial Service Delivery:** It is reshaping the structure of financial services and how banking services are delivered, making them faster, more affordable, secure, transparent, and accessible.

- **Enhancing Service Quality and Accessibility:** Fintech improves the quality and type of financial services, providing availability anytime and anywhere. It focuses on enhancing customer access to services, increasing cross-border sales opportunities, and offering multiple channels for service consumption.

- **Boosting Competitive Advantage:** Fintech contributes to gaining a competitive edge for financial institutions and startups. Technologically advanced institutions have greater potential to compete effectively at both regional and international levels Shehata & Muhammad (2019).

#### 2.2.5. Objectives of Financial Technology (FinTech)

Financial technology FinTech aims to achieve several key objectives, including:

- **Lower Costs:** Fintech seeks to reduce expenses, making financial services more accessible to a broader range of users, particularly those who are underserved by traditional banks.

- **Enhanced Privacy:** Fintech products and services are tailored to individual customer preferences, recognizing that each bank has unique needs, which can be addressed through various channels.

- **Increased Speed:** Fintech solutions leverage technology to streamline processes and operations, resulting in quicker service delivery.

- **Global Reach:** Fintech services are designed to be borderless, catering to customers beyond specific geographic regions.

- **Comparative Options:** Fintech enables customers to compare financial services and pricing across multiple companies and banks Hosseini et al. (2019).

### 2.2.6. Unique Characteristics of Fintech Companies

Fintech companies are distinguished by several key features, including:

- **Universal Access:** Unlike traditional financial services, which often require substantial assets or regular income for access, fintech startups aim to serve all social strata. They continuously improve their offerings through partnerships or by redesigning products to accommodate customers with limited income.
- **Flexibility and Cost Efficiency:** Fintech startups provide various payment options and plans for goods and services, including clean energy solutions. Their flexible payment structures cater to different customer needs, whether daily, weekly, or monthly.
- **Customer-Centric Design:** FinTech companies prioritize user needs, creating products that are simple and easy to use.
- **Speed:** Fintech companies leverage advanced analytics, big data, algorithms, and machine learning to process transactions quickly, often completing them within minutes. This contrasts with traditional insurance companies, which may take several days to approve a new policy or verify a loan, particularly in lending and digital identity verification Mugane (2018).

## 2.3. DIGITAL CURRENCY (MONEY)

The impact of electronic money on the banking sector could be significant if it becomes widely adopted due to its appeal as a payment method, especially with support from major technology companies or innovative fintech startups. This could potentially lead to the decline of physical cash. However, will individual bank deposits shift en masse to electronic money service providers? It is unlikely that banks will disappear entirely. This section explores three potential scenarios regarding the future of banks in the context of electronic money. It also addresses the risks associated with the rapid adoption of electronic money, although it does not delve deeply into these risks to keep the focus of this paper narrow (Adrian & Mancini-Griffoli, 2019).

The adoption of electronic money could accelerate if it serves as a payment medium with a fixed value in a relevant unit of account for users, making it more likely to gain widespread acceptance. For effective use, parties involved would need to agree to hold it for the duration of the transaction and would need to find its value agreeable compared to the transaction price, which is typically expressed in a common unit of account. Therefore, stable value is a crucial requirement for a payment medium to be adopted on a large scale. The key questions are: How stable is electronic money? Can it achieve the same level of stability as some traditional forms of money? If not, can its advantages as a convenient payment method outweigh its stability issues and lead to widespread adoption? While this discussion focuses on electronic money, many of these insights could also apply to electronic currency if and when it becomes available (Adrian & Mancini-Griffoli, 2019).

Investment funds, abbreviated as i-money (Investment Money), issued by private banks; electronic money (e-money) provided by new private sector service providers; and cryptocurrencies; as well as cash, which currently serves as various forms of payment; and central bank money. These five types of payment methods help distinguish between different forms of money and payment systems (Adrian & Mancini-Griffoli, 2019).

The term "FinTech" combines "finance" and "technology." It refers to organizations or digital services that automate the delivery of financial products and services, often in ways that differ significantly from traditional financial institutions. FinTech companies typically consider themselves to be technology-driven organizations. While some FinTech institutions may offer services similar to those of traditional banks, others may focus solely on inter-company solutions rather than direct interactions with individual customers. This sector represents a rapidly evolving area of financial solutions (Nicoletti, 2022).

At the same time, FinTech companies can greatly benefit from collaborating with banks. These partnerships enable startups to expand their consumer base and scale their operations. Early-stage FinTech companies often struggle to reach a broad audience,

and collaborating with established banks provides an opportunity to introduce their innovations to a larger market. Additionally, such collaborations help FinTech companies build a strong reputation. Finally, as noted, partnerships between banks and FinTech firms allow them to consolidate their strengths and better compete against major technology companies (Nicoletti, 2021).

In Nicoletti's study on financial services, several key points about FinTech and its impact are highlighted. First, FinTech plays a vital role in enhancing brand reputation, broadening usage scenarios, and reaching a larger consumer base. While it can rapidly expand and adapt, it faces challenges such as cultural shock, especially when major technology companies enter the market, which can lead to a loss of control over innovation. FinTech companies also need to manage regulatory compliance costs and share critical aspects of technological innovation. Despite these challenges, FinTech provides benefits such as cost reduction, improved consumer features, and enhanced technological capabilities. It also offers opportunities to target new customer segments and access top talent and advanced technology. However, FinTech companies must remain vigilant in maintaining customer relationships and addressing safety concerns. Overall, the partnership between banks and FinTech companies presents both opportunities and risks, necessitating careful risk management (Nicoletti, 2021).

The future looks promising for FinTech companies, as they can leverage groundbreaking technologies to provide a superior digital customer experience, enhance efficiency, and lower costs in various sectors. One notable development in this area is "embedded finance," where financial technology is integrated into other activities to digitize services. This trend is evident in e-commerce, point-of-sale systems, and telecommunications, impacting both Business-to-Business (B2B) and Business-to-Consumer (B2C) sectors. Cloud-based solutions utilizing Software-as-a-Service (SaaS) or Banking-as-a-Service (BaaS) technologies, along with application programming interfaces (APIs), can facilitate embedded finance solutions with user-friendly data, appealing pricing, and seamless digital payment processes. Financial services are familiar to over 96% of U.S. consumers, and 64% of global consumers use financial technology (E&Y, 2019). Despite these advances, FinTech companies must also heed

the lessons from established firms, recognizing that trust remains a crucial element in delivering valuable financial services, even amidst digital transformation (Nicoletti, 2021).

Caragea et al. (2020) estimated the value of financial technology innovations as reflected in patent applications in the United States from 2003 to 2017. Their findings highlight the benefits that financial services companies gain from developing in-house financial technology solutions. Notably, private companies and individuals hold a greater share of patents in the financial sector (62.7%) compared to technology firms outside the financial industry (57.8%).

George (2019) discusses various aspects of the financial services industry, including the impact of artificial intelligence and big data applications. He addresses the threats posed by cybercrimes, the need for auditing, and strategies for customer and employee retention. Additionally, he examines the integration of blockchain technology and the challenges and opportunities it presents for the industry.

FinTech firms are enlarging the spectrum of financial services provided, ranging from payments to credit granting, from investment advice to account management. Small FinTechs generally specialize in niche financial markets to distribute technological solutions either developed or adopted in order to meet the emerging demand of particular customer segments. Large technology companies, on the other hand, enter the supply of financial services with the purpose of exploiting the network externalities of their non-financial businesses, ranging from e-commerce platforms and messaging services to ride-sharing applications. One of the driving factors contributing to the rise in scale for financial services and products is FinTech innovations. New entrants compete by creating new financial products that are more convenient and time-saving for customers. This, in turn, puts pressure on traditional financial institutions to develop competing products or form partnerships with FinTech companies that enable them to offer new technology-enabled services to their customer base. By providing new, accessible, and affordable financial products, FinTech companies can reach

broadier segments of the population who previously lacked access to such services. Financial inclusion is often cited as a major public benefit of the FinTech sector's growth. Additionally, customers who already receive good traditional services may allocate more of their funds to new asset classes and technology-supported trading strategies. Overall, FinTech innovations play a crucial role in expanding the financial system's reach, bringing more individuals into the increasingly dynamic world of transactions (Chiu & Deipenborck, 2021).

#### **2.4. CREATING VALUE IN DIGITAL WORLD**

Luz et al. (2018) highlight the significant impact of digitalization on economic mechanisms. They argue that the emergence of digital technologies has transformed the operations of economic agents. Today, social networks, smart devices, and various interactive tools are crucial for interacting with other economic actors, establishing trust, making decisions about destinations, and choosing products. This shift has redefined success for companies in digitalized markets, where continuous value creation has become essential.

In this evolving digital landscape, companies face a new set of rules defined by the global dynamics of Volatility, Uncertainty, Complexity, and Ambiguity. They must navigate these challenges while continuously creating and sustaining value for their shareholders (Bennett & Lemoine, 2014). As a result, companies are increasingly compelled to undertake their own digital transformations.

These transformations require a fundamental reevaluation of what customers value and how to deliver it effectively. Companies are redesigning their operating models to fully leverage digital technologies, especially by scaling networks through platform business models. This process involves more than superficial adjustments; it necessitates profound organizational restructuring. Consequently, traditional company structures are evolving, with boundaries becoming more flexible and less rigidly defined (Martins et al., 2015).

Moreover, in the instance of digital transformation, companies are changing with the

times as technology advances, but also with the way consumers are behaving and how market dynamics have shifted. Consumers today want more personalized experiences and seamless interactions across each touchpoint. This forces companies into continuous innovation and evolution.

However, this journey of transformation is strewn with a myriad of challenges. Too often, companies face resistance to change from both internal and external aspects. Organizational culture, for instance, could be among the biggest impediments, supplemented internally by legacy systems and established processes that generate considerable resistance in total. In addition, regulatory frameworks, issues related to cybersecurity, and competitive pressures add to the complexities from an external perspective. Despite these barriers, the compulsion to be competitive in digital markets drives companies to try harder. Digital transformation can be leveraged for new opportunities in growth, efficiency, and innovation. This requires a strategic approach: from investing in technology to developing a culture of agility, collaboration, and continuous learning.

In the end, a new era has been opened by digitalization, where the ability and talent for adaptability and innovation determine success. It requires companies to recognize this change by initiating their own digital transformation, reimagining their value proposition, and leveraging digital technologies in their efforts to create durable competitive differentiation in a dynamic marketplace.

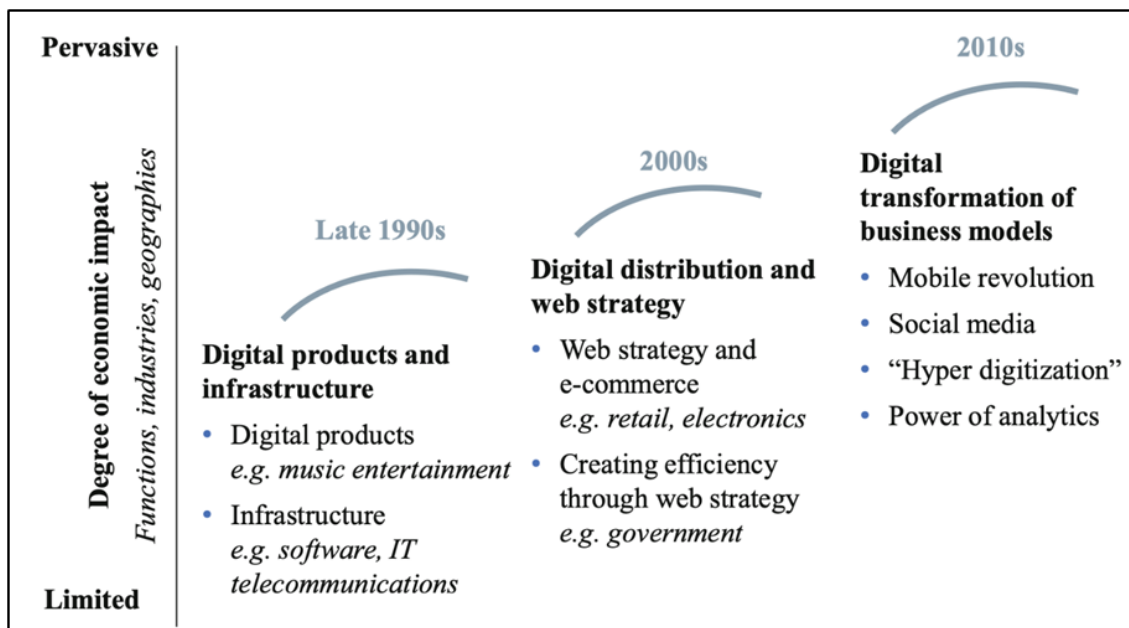


Figure 2.1: Evolution of digital transformation Berman & Bell (2011).

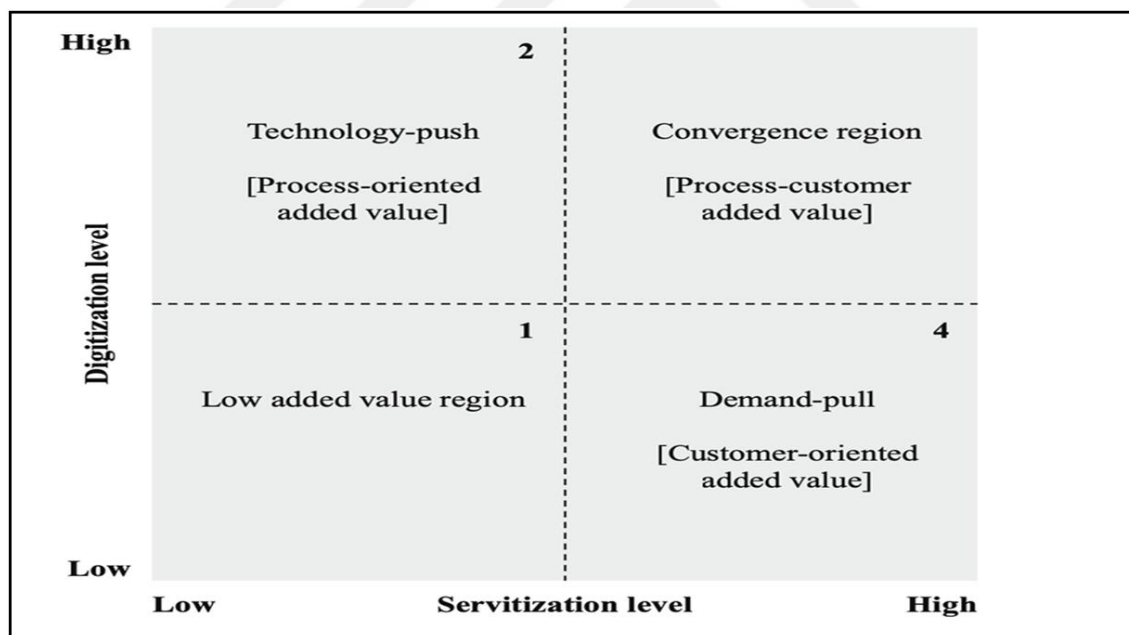


Figure 2.2: Innovation trajectories for Industry 4.0 and servitization Frank et al. (2019)

## 2.5. CREDIT RISK MODELS

Credit risk models apply financial analysis to compute the expected loss in the event of a default by a borrower. Financial institutions use such models to determine

how likely a borrower is to default, thus providing an accurate real-time view of credit risk. Without these models, lenders fall into the trap of defaults and financial loss. Hence, the latter serves as the basis for a fully informed decision on the part of the lender regarding whether to extend credit at appropriate interest rates or not. Credit risk arises when a borrower, whether a corporation or an individual, fails to meet their debt obligations. It represents the probability that the lender will not receive the principal and interest payments necessary to service the debt extended to the borrower. For the lender, credit risk can disrupt cash flows and increase collection costs, as they may need to employ a debt collection agency to recover the owed amounts (Bhatore et al., 2020). The resulting loss may be partial or total, where the lender incurs a loss on either a portion of the loan or the entire loan amount. The interest rate charged on a loan compensates the lender for bearing this credit risk. In an efficient market system, banks typically charge higher interest rates for loans perceived as high-risk to offset the increased risk of default. For instance, a corporate borrower with a stable income and a strong credit history is likely to receive credit at a lower interest rate compared to high-risk borrowers (Cetin et al., 2004). Since 1997, two influential models, Risk Metrics Group's Credit Metrics and Credit Suisse Financial Products' Credit Risk, have been publicly available and quickly established themselves as key benchmarks in the field. Although practitioners and policymakers have extensively implemented and studied each model individually, comparative analyses between them have been relatively scarce. Both models are designed to assess similar types of credit risks.

### 2.5.1. Types of Credit Risk

- **Credit Default Risk:** Credit default risk arises when a borrower is unable to fully repay their loan obligations or is significantly overdue, typically 90 days past the due date. This risk impacts all credit-sensitive financial transactions, including loans, bonds, securities, and derivatives. The level of default risk can fluctuate due to broader economic changes or shifts in a borrower's economic situation, such as increased competition or an economic recession, which may impair the borrower's ability to meet principal and interest payments Collin-Dufresne & Goldstein (2001).

- **Concentration Risk:** Concentration risk is the possibility of suffering large losses due to dependence on one single counterparty, being over-exposed to market products, or depending on an industrial sector. This kind of risk occurs because, in a non-diversified portfolio, uncertainty factors of assets become highly correlated. One good example—if a corporate borrower depends on just one major buyer for its primary products, then that would imply very high concentration risks. For instance, if this one buyer stops buying, then this borrower can suffer huge losses Beck et al. (2022).
- **Country Risk:** Country risk is the likelihood that a country will not be able to pay its foreign-currency obligations due to political instability or adverse macroeconomic conditions. It is an investment risk arising from a country's overall political and economic environment, which could negatively impact the value of investments and obligations Collin-Dufresne & Goldstein (2001).

## 2.6. FACTORS AFFECTING CREDIT RISK MODELLING

To effectively minimize credit risk, lenders should strive for greater accuracy in their risk forecasting. Key factors to consider when assessing credit risk include:

- **Probability of Default (PD):** The Probability of Default refers to the chances that a borrower will default on paying the loan. For individual borrowers, this normally depends on the credit score and other factors such as the debt-to-income ratio. For corporate borrowers, the same is generally assessed by credit rating agencies. A lower Probability of Default usually translates into a loan with a low interest rate and little or no down payment. Collateral against the loan can also mitigate risk, as noted by Jo et al. (2022).
- **Loss Given Default (LGD):** Loss Given Default can be defined as the amount of loss a lender encounters following the default of the borrower of his debt. Kaposty et al. (2020) That is to say, for two borrowers A and B, with the

same debt-to-income ratio and credit score but with a loan amount of \$10,000 and \$200,000 respectively, the lender will be at risk of a higher possible loss, given a higher amount of lending upon the default of Borrower B. Since there is no standard approach to the calculation of LGD, traditional methods from lenders usually consist of evaluating that single risk by considering the whole portfolio of loans to determine how their whole exposure can be confronted due to potential losses Collier et al. (2021).

- **Exposure at Default (EAD):** Exposure at Default refers to the degree of loss exposure a lender is exposed to in case of defaulting and hence may be used to depict the risk appetite of the lender. This is applicable whether it is a single borrower or corporate borrower. It is obtained by multiplying the outstanding loan obligation by a certain percentage adjusted according to the details of the loan.

## 2.7. CREDITWORTHINESS CRITERIA

Creditworthiness refers to the financial dependability of a company regarding its capability to meet its debt obligations in due time. This evaluation is essential for businesses, as it helps them decide whether it would be risky to issue credit terms to other companies.

Various factors influence B2B creditworthiness. First, the company's financial stability can be manifested by steadily improving revenues. Of no less importance is the payment history: timely payments increase creditworthiness, while delays or failure to pay decrease it. Another important factor is what is called a credit score, which means a quantified representation of creditworthiness. In fact, many lenders and suppliers use credit scores as a rule of thumb for assessing the risk associated with granting credit to a customer (Banks, 1993).

## 2.8. UNDERSTANDING THE 5 CS OF CREDIT

The five Cs of credit consider creditworthiness on both a qualitative and quantitative basis. Credit reports and credit scores, along with income statements and other financial reports, are evaluated by lenders in concert with information about the loan itself. While each lender assesses this information in a slightly different way, most

lenders use the five Cs—character, capacity, capital, collateral, and conditions—when evaluating either personal or business credit requests.

### **2.8.1 Character**

Character, the first "C," refers to a borrower's credit history or reputation for paying debts. It reflects credit reports from Equifax, Experian, and TransUnion, showing the history concerning borrowing and payment reputation, including collections and bankruptcies that remain on such reports for 7 to 10 years. This is where credit risk would be assessed if lenders were to use it. Scores are calculated from the information in one's credit report and, as mentioned earlier, are designed to predict how likely one is to repay a loan on time. Other scoring systems include VantageScore, which also makes similar predictions. At a minimum, lenders usually have a minimum credit score threshold for approving loans and will also use credit scores when issuing loans—these scores are used to determine the loan rate and terms. Those with higher scores receive better deals. Considering how crucial this information about credit scores and reports is, using a credit monitoring service will ensure that such important information remains secure.

### **2.8.2. Capacity**

The capacity is the borrower's ability to repay the loan. This is weighed by comparing income against recurring debts. This comparison is called debt-to-income. Lenders find debt-to-income by comparing total monthly debt payments with gross monthly income. A lower debt-to-income ratio increases the likelihood of loan approval. Many mortgage lenders favor debt-to-income ratios hovering near 36%, and some are prohibited from lending to those with higher debt-to-income ratios. According to the Consumer Financial Protection Bureau, to qualify for a new mortgage, one typically has to have a debt-to-income ratio of 43% or less.

### **2.8.3. Capital**

Lenders also consider the capital contributions of the borrower, such as a down payment, which decreases the risk of default. The larger the contribution normally means the easier it will be to get loans, including special mortgages such as Federal

Housing Administration loans, and loans that often require zero percent down. Capital contributions signal the level of investment of the borrower and reassure the lenders. Larger down payments can also secure better loan rates and terms, and for mortgages, a 20% down payment eliminates the need for private mortgage insurance.

#### **2.8.4. Collateral**

Collateral makes loans more accessible to a borrower because these loans allow lenders to be certain of at least recovering the money in case of default by the borrower. Very common examples include cars for auto loans and homes for mortgages. These are secured loans, in comparison with unsecured loans, and are less risky; hence, the interest rates are lower, too, as are most of the terms.

#### **2.8.5. Conditions**

Lenders also consider the general conditions of the loan and the borrower's employment stability, industry performance, and job outlook. Conditions of the loan, such as interest rates and principal amounts, impact lender willingness to provide financing. The use of a business loan, for instance if it is used for future cash flow, impacts pricing compared to non-profitable uses. External factors impacting the economy, industry trends, and/or changes in legislation can also affect decisions to grant loans or on what terms.

### **2.9. CREDIT RISKS MEASUREMENTS**

Credit risk measurement is an indispensable component in credit risk management. Some of the key components involved in the measurement of credit risk include credit rating agencies, credit scoring models, probability of default, and loss given default Chatterjee (2015).

- **Know your customer and anti-money laundering:** Know your customer and anti-money laundering are common financial regulation practices. They are designed to verify that your customer is, indeed, who they say they are and create a paper trail to prevent illicit monetary transactions. Depending on local

requirements, either one of these or the other is done. Commonly, it is done by running the ID and proof of address information of an individual through a database where the identity verification is carried out Chatterjee (2015).

- **Credit scoring:** Traditional credit scoring systems often involve running a potential client through a database to determine their credit score. In the US, that may be an agency such as Fair Isaac Corporation (FICO) or Vantage Score, returning a digital value to the lending provider that they can use to decide whether to issue a loan. Even though credit scores convey some information about one's creditworthiness, they have also received criticism for being non-inclusive. For example, about 45 million Americans can be defined as credit visible, meaning they do not have a credit score at all (Chatterjee, 2015; Zheng et al., 2018).
- **Micro and macro loans:** Credit risk need not emanate from a single client. Sometimes, this could be a portfolio-related risk. Essentially, it's the assessment of how many micro-single loans and macro-groups of loans a company can detect risks or risky lending patterns that it may engage in, which ultimately helps the corporation maintain a healthy debt-to-capital ratio and competitively price its lending products accordingly (Bandyopadhyay, 2016).
- **Credit default risk management platforms:** Technology meets credit risk head-on on credit risk management platforms. Conversely, a growing number of lending providers have opted to develop such systems for the analysis of credit risk within their businesses. Often, they will work with a software provider or purchase a ready-made system to integrate into their overall operations and utilize it for analysis. These may include some very specialized features customized to the lender's exact specifications or may use more generalized software as well (Anderson, 2007).
- **Artificial Intelligence AI and Machine Learning tools:** Technology meets credit risk head-on on credit risk management platforms. Conversely, a growing number of lending providers have opted to develop such systems for the analysis of credit risk within their business. Often, they will work with a software provider or purchase a ready-made system to integrate into their overall business

and utilize it for analysis. These may include some very specialized features customized to the lender's exact specifications or may use more generalized software as well (Anderson, 2007).

## 2.10. ALTMAN'S Z SCORE MODEL

- The Altman Z-Score model is used to assess the financial strength of a firm and the possibility of bankruptcy based on three key variables: current assets, which are the short-term instruments held by an organization; total assets, which are the sum of all assets held by an organization; and net sales, reflecting revenue from the sale of goods minus returns and allowances. Interest is another significant variable representing the cost of borrowing faced by the firm. Total liabilities include all debts and financial obligations owed by the firm, whereas current liabilities denote those that are payable within a year. The market value of equity is also a crucial variable as it indicates the overall value of the corporation's stock, based on the general perception of the market. It also includes the ratio of earnings before taxes, which provides an indication of the profitability of a firm before deducting taxes, and retained earnings, which are the earnings accumulated over time that have been reinvested into the business rather than distributed to shareholders in the form of dividends. Collectively, this set of variables provides an overview of the financial health of a company and its bankruptcy risk (Altman et al., 2017).
- $Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$
- Where,
  - $X_1$  = working capital/Total assets
  - $X_2$  = Retained earnings/Total assets
  - $X_3$  = Earnings before interest and taxes/Total assets
  - $X_4$  = Market value of equity/Book value of total liabilities
  - $X_5$  = Sales/Total assets
- Z score of the firm is
  - 3 or more – Safe
  - Below 1.8 – Highly likely headed for bankruptcy

- 2.8 to 3 – Probably safe
- 1.8 to 2.7 – Likely to be bankrupt within 2 years



## CHAPTER 3. METHODOLOGY

Mark Saunders' Onion research methodology will be adopted for this study. This is a multi-layered research method that attempts to delve deep into a research topic. A study of different layers or other dimensions would be done for depth and complexity.

### 3.1. RESEARCH DESIGN

As we attempt to follow the research design of Mark Saunders, which consists of six layers describing all aspects of the research as follows: Saunders et al. (2023)

**1. Research Philosophy:** Due to the fact that this research falls under the banking and finance science discipline, which focuses on numeric data in the banking sector and financial technology applications in Iraq, Saunders' approach outlines that this research applies a positive philosophy; in other words, it is concerned with the very reality of the financial and banking data in one of the developing countries, specifically Iraq. This can only be done objectively and cannot include the opinions or personal viewpoints of the researcher, who does not interpret but merely observes. Positivism maintains that reality is singular and meaning is constant across subjects. Knowledge can only be gained through empirical research based on measurement and observation.

**2. Research Approach:** In general, the research approach contains two ways, first as an inductive approach—involving the derivation of theories from research rather than a theory that may be used to found a research project, whereas second deductive approaches start with a theory with an effort for research to extend the theory.

**3. Research Methodological Choice:** This layer simply describes how many data types—the qualitative or quantitative—the researcher will use in his or her research. Basically, there are three options: mono, mixed, and multi-method. In this research, we are going to use data from the financial sector in Iraq; thus, the methodological choice for our research will be the quantitative choice.

**4. Research Strategies:** This layer of the research onion outlines how, based on the aims of the study, research can be conducted. Because a quantitative option has been chosen, actual data published by the Central Bank of Iraq on financial

technology applications and banks' credit risks in Iraq is archival research and is published monthly for a couple of years to test the hypothesis and achieve the most accurate results of the variables used.

**5. Research Time Horizon:** The time horizon simply describes the number of times the researcher intends to go out and collect data. In general, three options exist: cross-sectional, longitudinal, and time series as horizons. It is the nature of research, along with its aims and objectives, that serves as essential determining factors when deciding on the time horizon.

**6. Research Techniques & Procedures:** In this layer, the researcher will decide which data to collect and which methods of collection to adopt; in this research, the most relevant data is empirical. In sampling the population, this study will use financial sector data as a whole, so a holistic approach will be applied. Regarding the analysis of data, this study will apply financial and statistical methods to answer the questions, starting with simple financial analysis supported by a few statistical procedures such as correlation and regression analysis

### 3.2. RESEARCH VARIABLES

This study will use actual data from the financial sector in Iraq by measuring financial technology applications, as shown in the table below.

Table 3.1: Variables its Measurements

| <b>Independent Variable</b> | <b>Measurement</b>                 |          |
|-----------------------------|------------------------------------|----------|
|                             | Total Electronic Payment by Mobile | EPayment |
|                             | No. of Nass Pay Transactions       | NassT    |
|                             | Nass Pay Volume (IQD)              | NassV    |
|                             | No. of Asia Hawala Transactions    | HawalaT  |

|                                                     |                                         |           |
|-----------------------------------------------------|-----------------------------------------|-----------|
|                                                     | Volume of Asia Hawala (IQD)             | HawalaV   |
|                                                     | No. of Zain Cash Transactions           | ZainT     |
|                                                     | Volume of Zain Cash (IQD)               | ZainV     |
| <b>Dependent Variable</b><br><br>Banks Credit Risks | Total Cash Credit (Millions IQD)        | CCredit   |
|                                                     | Overdraft Account (IQD)                 | Overdraft |
|                                                     | Paid Capital for Commercial Banks (IQD) | PaidC     |
|                                                     | Late debit payments (IQD)               | LateP     |
|                                                     | Loans and Advanced (IQD)                | LoansA    |

### 3.3. DATA COLLECTION

Iraqi Central Bank's website (<https://cbiraq.org/DataValues.aspx?dtFrm=01/31>) totaling 72 observations (12 months \* six years).

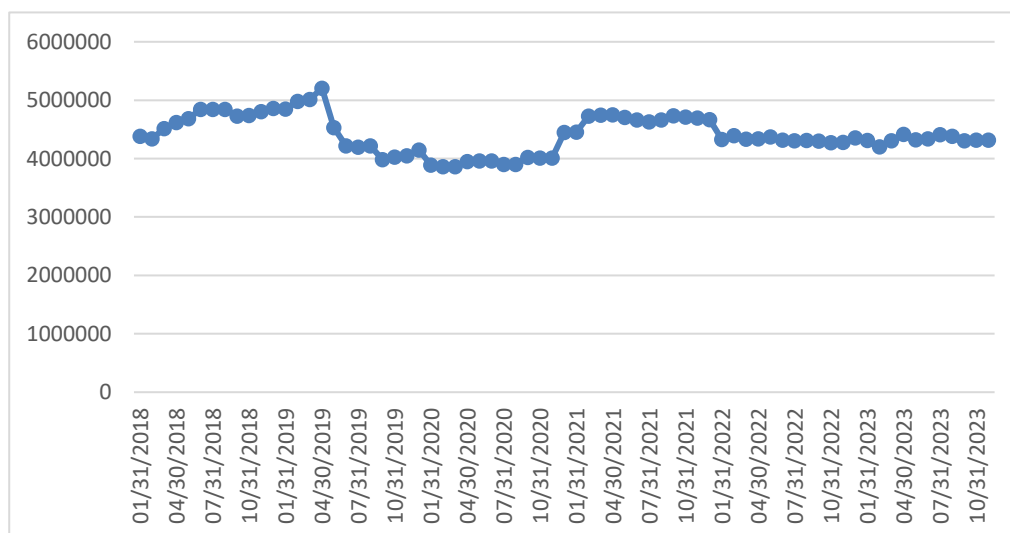


Figure 3.1: Late Debit Payments in Iraq - – Monthly Basis for the period 2018-2023

Source: Central Bank of Iraq official website - <https://cbiraq.org/Default.aspx>

### 3.4. SAMPLING

Since we have relied on the archival research strategy, the data will be collected from the Iraqi Central Bank's website on a monthly basis for both variables and their measurements.



## CHAPTER 4. RESULTS

### 4.1. DATA ANALYSIS

This study will go through three types of analysis: first, a financial analysis; then, a statistical analysis; and finally, an empirical analysis.

#### 4.1.1. Financial Analysis

Owing to the fact that this research's dependent variable is banking credit risks, prior to the empirical analysis, a financial analysis must be conducted to better appreciate the fluctuations in its measures. As shown in Figure 4.1, the total cash credit in the financial sector in Iraq demonstrates an increasing trend, confirming the Iraqi economy's transition toward the digital banking system. It highlights how each year witnesses further advancements in the digital banking system in Iraq, a result of the attraction to the digital era and developments in technological services and products

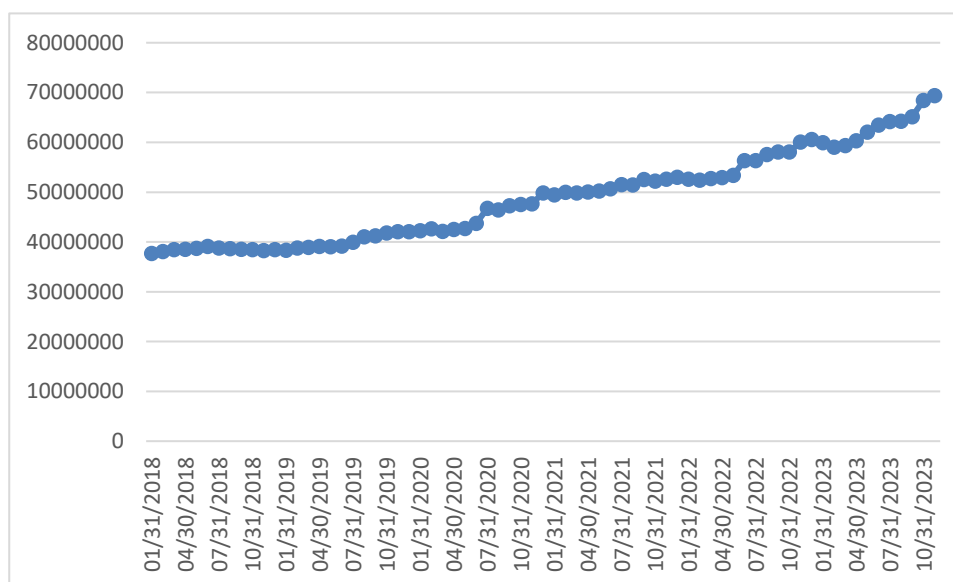


Figure 4.1: Total Cash Credit in Iraq (IQD Millions), Monthly Basis for the period 2018-2023.

Source: Central Bank of Iraq official website - <https://cbiraq.org/Default.aspx>

The total of loans and advances in Iraq also shows a steadily increasing trend from 2018 to 2023, indicating that the banking system supports the economy by providing the necessary funds to sustain growth. This points to the increase in funding resources needed for a sustainable private sector in Iraq.

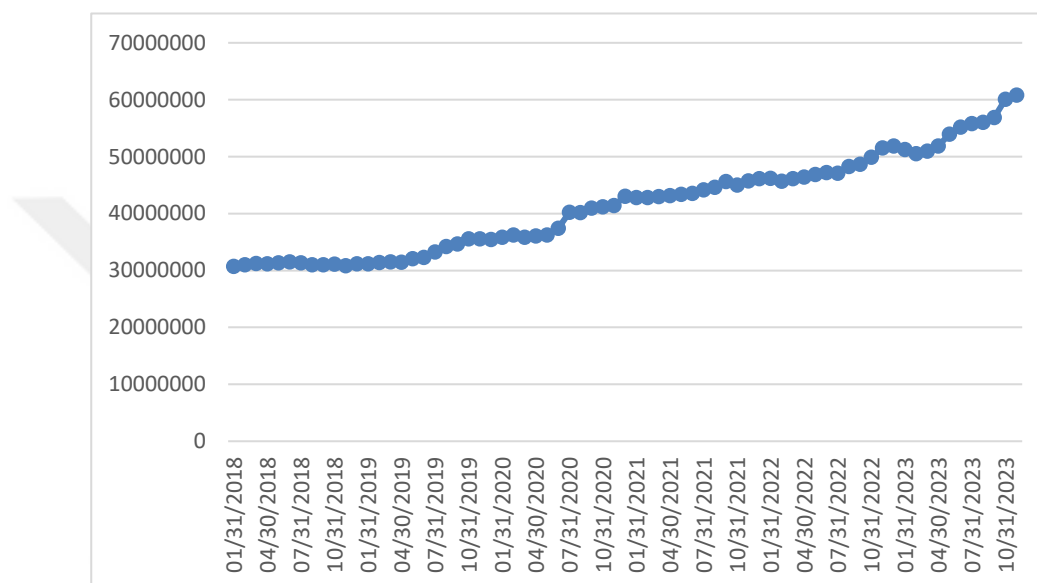


Figure 4.2: Total loans and advances in Iraq (IQD Millions), Monthly Basis for the period 2018-2023

Source: Central Bank of Iraq official website - <https://cbiraq.org/Default.aspx>

Figure (4.3) illustrates that the total paid capital of commercial banks increasing sharply which indicates the liquidity capabilities of these banks in terms of cash under control.

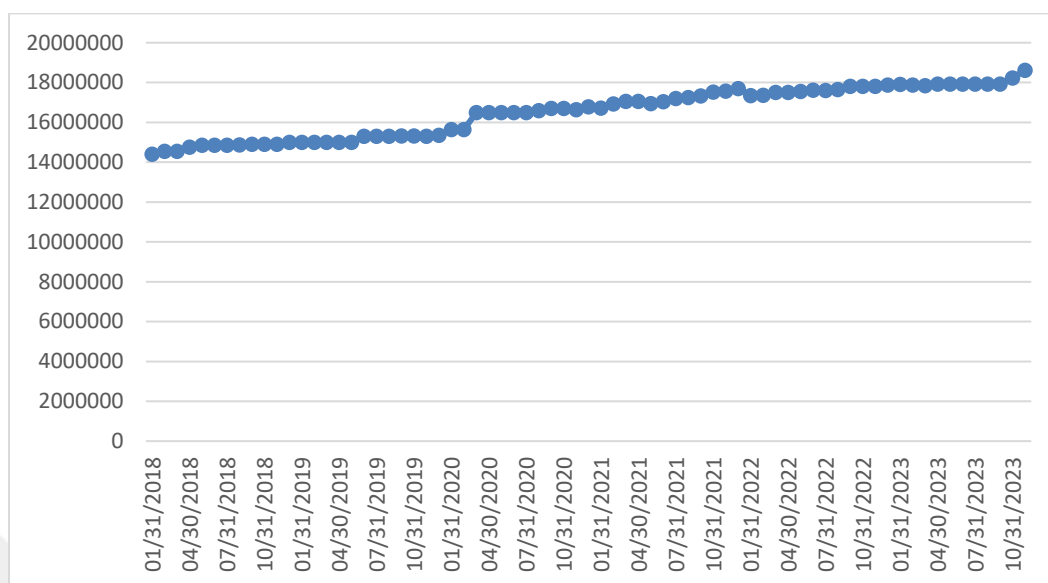


Figure 4.3: Total Paid Capital of Commercial Banks in Iraq (IQD Millions) – Monthly Basis for the period 2018-2023.

Source: Central Bank of Iraq official website - <https://cbiraq.org/Default.aspx>

Table 4.1: Descriptive Statistics for Variables

|                       | N  | Minimum        | Maximum          | Mean            | Std. Deviation  |
|-----------------------|----|----------------|------------------|-----------------|-----------------|
| Epayment              | 72 | 16049878138.00 | 1100855457695.35 | 136871709653.20 | 185828516907.33 |
| NassT                 | 36 | 820            | 16989            | 4830.03         | 3260.60         |
| NassV                 | 36 | 775648467.11   | 16428211533.00   | 4253057073.78   | 3471450689.54   |
| HawalaT               | 72 | 962            | 1063292          | 75902.64        | 163502.78       |
| HawalaV               | 72 | 841564510.00   | 115496109264.00  | 15381987382.23  | 20643768587.72  |
| ZainT                 | 72 | 27752          | 1227514          | 349684.71       | 331739.78       |
| ZainV                 | 72 | 6292961459.00  | 1098136131734.00 | 119363193734.06 | 187568279937.21 |
| CCredit               | 72 | 37704631       | 69364648         | 49082714.08     | 9237819.16      |
| Overdraft             | 72 | 1991313        | 5060946          | 2770353.57      | 898922.60       |
| PaidC                 | 72 | 14401124       | 19068375         | 16552018.42     | 1258857.63      |
| LateP                 | 72 | 3864544        | 5205957          | 4409777.44      | 315695.01       |
| loansA                | 72 | 30710856       | 60812306         | 41745948.36     | 8746604.77      |
| Valid N<br>(listwise) | 36 |                |                  |                 |                 |

Source: Researcher's preparation based on SPSS outcomes

The trend of electronic payables was very erratic throughout the 72-month period, reflecting a wide variation in the volume of transactions. The minimum value of activity during this period was recorded at 16,049,878,138 IQD, while the maximum value was a staggering 1,100,855,457,695.35 IQD, reflecting periods of extreme ramp-up in electronic transactions. An average could be determined for a more precise understanding at 136,871,709,653.20 IQD. This average statistic is of great use since it depicts the overall transaction volume for the whole period and sheds light on the average volume level of electronic payment activity. The difference between the smallest and largest figures gives an indication of the fluctuation in transaction volumes that could be influenced by several market, seasonal, or economic factors. These statistics are far superior to any other indicators of the trends and patterns of electronic

payments across a longer period. From the descriptive statistics in the number of Nass pay transactions over a period of 36 months, many important conclusions can be drawn. For instance, the minimum number of transactions recorded was 820, showing the lowest level of activity in the dataset. This means that, in its worst case, there were at least 820 transactions. Determining the causes would help to decide if this lowered activity was an isolated incident or recurring. On the other hand, 16,989 was the highest number of transactions, which was considered the peak in transaction activities. Knowing what caused this spike—whether it was due to a certain occasion, seasonal patterns, or other factors—can be very informative regarding consumer behavior and what external variables affect the volumes of transactions. Secondly, the average number of transactions for the 36-month period was 4,830. This provides the mean transaction activity and, thus, establishes an average against which normal volumes of transactions might be benchmarked. This helps carry out trend analysis and forecasting by pointing out the periods of above or below-average activity when compared with the transaction counts for specific months. Such a comparison will provide a better perspective on the transactions over time by helping to identify notable deviations and investigate the causes.

In providing an analysis of the variable "Nass pay volume," descriptive statistics must be interpreted as they give insight into the transactional activities for specific periods of time. The lowest transaction activity level in this dataset is represented by the smallest pay volume recorded at 775,648,467 IQD. This minimum is important because it represents the threshold volume of transactions, and studying the causes of such low volume would contribute to discovering the factors that increase the quantity of transactions. On the other hand, the 16,428,211,533 IQD represents the highest recorded volume of pay in Nass, which indicates the pinnacle of activity concerning transaction activity. This may be useful for understanding the reasons for this increase—whether it is seasonal, how the markets function, or specific events that impact customer behavior and external factors affecting the volume of transactions. The mean volume of 4,253,057,073 IQD is the average of the Nass pay volume, and this figure refers to the number of transactions averaged for the given period. The mean acts as a benchmark for the average volume of transactions. The ability to identify fluctuations from normal

levels of activity—by developing the mean and comparing transaction volumes for specific periods against this—allows for trend analysis and forecasting. This provides a better view of the transaction trends over time through the lens of significant variances and sheds light on their root causes. Descriptive statistics will analyze the variable "number of Asia hawala transactions" for vital insights into their transactional trends over a 72-month period. The minimum number of transactions reported, 962, represents the lowest level of activity in this dataset. It is important to understand this minimum value, as it provides the baseline from which transactional activity can begin building, thus encouraging research into any causes for decreased activities, such as external influences or seasonal variations. On the other hand, the maximum recorded number of transactions is 1,063,292, an amount that highlights the peak of the activity. Investigating the causes of such a rise—what was the situation in the economy, what was happening in the world, or even if regulation changed—could be enlightening regarding how markets work and what kinds of models appear in transactions. The mean number of transactions, 75,902, indicates the average number of transactions for the period. The obtained average acts as a benchmark for the common volumes of transactions. Complementing that, one can also argue for some form of trend analysis and forecasting due to the detection of fluctuations in average activity level ratios upon comparing the transaction counts for specific periods against the mean. It provides a better view of the trends taking place in transactions over time due to large variances, which will help highlight their causes.

Descriptive data for the variable "Volume of Asia hawala" over a 72-month period provide specific insight into the transactional activity. The minimum volume reported, 841,564,510 IQD, represents the lowest transactional volume of the dataset. This extremely low figure is important because it forms the benchmark for a minimum recorded level of activity; consequently, it allows for an examination of potential variables that could have led to such low volumes, such as economic recessions, political strife, or seasonal factors. In sharp contrast, the peak volume of Asia hawala transactions ever recorded was 115,496,109,264 IQD. This peak volume represents the maximum amount of transactional activity found in the sample. An ability to gain a deeper understanding of what causes such an uptick in activity—whether it be booming

economic times, major geopolitical events, or shifts in market conditions—provides greater context and understanding of the dynamics of the Asia hawala system. Also, over the 72-month period, the mean amount of Asia hawala transactions was 15,381,987,382 IQD. This mean value serves as a reference level that helps to understand typical levels of transaction activity. Analysts, by comparing volumes of specific months against this mean, are able to identify when activity is well above or well below average. These identified differences can then be studied further to determine causes, thus aiding in the research of trends and forecasts. Further analysis of these numbers could reveal some significant trends and patterns. For example, low periods of activity may be associated with external factors such as changes in regulations or economic decline, while high activity periods may be related to favorable market conditions or an economic boom. It is also important for these trends to be known by the stakeholders so informed decisions may be made about the past.

These descriptive statistics will finally provide a proper understanding of the patterns and transactional trends of "Asia hawala transactions" over a period of 72 months: the lowest level of activity, reflected in the very minimal volume of transactions, may be indicative of a slowing economy, changes in regulation, or other causes that have affected transactional activity. These abnormally low levels of activity might have underlying reasons, which could provide clues about the state of the market and the associated risks. On the other hand, the highest transaction volume could highlight peak activity within the dataset. Understanding the conditions—a period of economic growth, legislative change, or geopolitical shift—that led to this peak can help provide insight into the dynamics affecting market conditions and the trends governing transactional volumes. The mean transaction volume acts as a standard for average volumes of transactions. Trend analysis and forecasting become easier, as deviations from the norm allow for comparison of transaction volumes of different periods to the mean. This, in effect, enables the identification of periods of extremely high or low activity, thereby allowing for a better understanding of the variables causing

such variations, facilitating appropriate judgments regarding past results and projected future trends.

Descriptive statistics for the "Number of Zain cash transactions" variable over a period of 72 months provide insight into transactional activity in great detail. The lowest recorded number of transactions, 27,752, reflects the minimum level of activity in the dataset. On the other hand, the high point of activity is reflected by the maximum number of transactions, which is 1,227,514. The mean number of Zain cash transactions is 349,684. This therefore means that 349,684 was the average volume of transactions for this company during the 72 months under consideration. These descriptives provide insight into the transactional trends and patterns of Zain cash transactions. The minimum number of transactions signals the lowest activity level, which could indicate certain declines in consumer demand, changes in regulations, and other factors that might impact transactional activity. Understanding why such low levels of activity exist may provide insight into market conditions as well as directions for further development. In contrast, the maximum number of transactions describes the peak activity of the dataset. Understanding what drove this growth—whether through marketing efforts, economic growth, or changes in consumption habits—will provide very valuable information on both the dynamics and trends that influence transaction volumes within the market. Common transaction volumes are determined in relation to the average number of transactions. Identifying deviations from mean levels of activity facilitates easier trend analysis and forecasting. Through the comparison of data, periods when activity was notably high or low can be cited. This can help clarify the variables responsible for these differences and allow for well-informed decision-making based on past performance and projected future patterns.

Descriptive statistics for the variable "Volume of Zain cash" over a period of 72 months summarize transactional activity. The lowest reported volume of Zain cash transactions reflected the lowest level of activity in the dataset, which was 6,292,961,459 IQD. On the contrary, the highest level of transactional activity was represented by the largest volume, which reached 1,098,136,131,734 IQD. The mean volume of Zain cash transactions is 119,363,193,734 IQD. This refers to the volume of a typical transaction during the 72-month period. Key examples of descriptive data to

analyze for insights into the transactional trends and patterns of Zain cash transactions include these. The minimum transaction volume draws attention to the minimum level of activity that occurred, which may be indicative of periods of low economic activity, changing habits among customers, or other variables that may affect transaction volumes. Investigating the causes for such low levels of activity could yield information on the state of the market and viable directions for development. Contrasting the highest transaction volume is the peak activity of the dataset. Identifying the reasons for this increase—such as economic growth, changes in legislation, or promotions—will provide vital insight into market dynamics and the trends affecting transactional volumes. In addition, average transaction volume serves as a benchmark for understanding typical transaction volumes. Trend analysis and forecasting are facilitated by identifying deviations above and below average activity. This is achieved by comparing transaction volumes of distinct periods to the mean, which may reveal when activities had been unusually high or low. This may go a long way in explaining the variables driving these differences and enable decision-making informed by previous performance and expected future trends.

The lowest total cash credit, reported as 37,704,631 IQD, is the minimum for this time. Conversely, the maximum recorded total cash credit of 69,364,648 IQD represents the height of cash credit within this time period. The average total cash credit is 49,082,714 IQD, which defines the cash credit amount for the average over the course of the 72-month period. Analyzing these descriptive statistics allows for analysis in terms of the general trend and pattern in cash credit. The minimum level draws attention to the lowest level of activity that has been recorded, which could indicate slow economic growth, changes in lending standards, or other variables related to cash credit levels. Analyzing the reasons for such low levels may provide a meaningful view of both the current situation in the market and likely ways of its further development.

By contrast, the peak cash credit represents the highest level of activity in the dataset. Understanding which variables contributed to this peak—whether it was economic growth, changes in interest rates, or evolving credit practices—can yield

valuable insights into the functioning of the market and the variables affecting cash credit. Additionally, normal levels of cash credit are projected using the average cash credit value. The ability to deviate from the average level of activity when comparing cash credit statistics of relevant periods to the mean enables trend analysis and forecasting. This comparison is helpful in identifying variables that may explain times of abnormally high or low activity and myriad other uses, thus best informing decision-making based on both past and projected trends.

These descriptive statistics allow one to understand the trend and pattern of an "overdraft account" over a 72-month period. The minimum availability of the overdraft account during this period was 1,991,313 IQD, the lowest balance ever reported. It is imperative that the causes of such low balances are understood, as in some instances they may indicate symptoms of financial difficulties or liquidity constraints.

On the other hand, the maximum balance of 5,060,946 IQD represents the peak amount of money in the overdraft account. The reasons for this peak should be established, as it may indicate effective money management, an infusion of cash, or other factors that contributed to such an amount. The average balance of 2,770,353 IQD reflects the average liquidity maintained within the overdraft account over the 72-month period. This average may be used as a benchmark from which individual account balances can be compared to identify periods of below or above-average liquidity. The comparison allows for understanding how changes in account balance correlate with larger financial trends and situations. It offers insight into cash flow management and overall stability.

These descriptive statistics will provide important information on the trends and patterns of "Paid Capital" of commercial banks over 72-month periods. The minimum paid-up capital was 14,401,124 IQD, reflecting a low level of capitalization. Understanding why some banks have lower levels of capital is crucial, as this may indicate monetary problems or other corporate tactics.

Conversely, the banks with a maximum Paid Capital of 19,068,375 IQD are highly capitalized. Additionally, it is necessary to investigate the sources of higher levels of capital in certain banks, as these might result from smart investments, strong financial performance, or successful fundraising. Moreover, the average size of capitalization for the commercial banks over the 72-month period is represented by the mean paid-up capital of 16,552,018 IQD. To contextualize various capitalization strategies utilized within the industry, comparable graphs for individual banks could be set against the average capitalization size. Such a comparison may highlight which banks fall into one category or another, reflecting the underlying strategic emphasis of each bank and its comparative financial health.

This descriptive data analysis provides Congress with detailed insights into the trends and developments of "Late Debt Payment" over a 72-month period. The late debts vary from a minimum value of 3,864,544 IQD, which is reported as the minimum late debt payment. Understanding why there was a period with fewer late payments may provide insight into financial management strategies, changes in payment patterns, or economic conditions.

Contrastingly, the peak overdue amount during this period is represented by the maximum late debt payment: 5,205,957 IQD. Identifying the causes of these peaks should take into consideration the identification of certain risks, such as economic decline, lack of liquidity, or changes in credit policy. The mean of late debt payment is 4,409,777 IQD, representing the average amount of payments that are overdue over all 72 months. Plotting the average of the late debt payments against individuals may reveal a pattern in the behavior of late payments and hot spots that are anomalies from the mean. This can be useful in comparing different payment patterns and assessing the generalized stability of debt repayments.

From these descriptive statistics, one can make sense of the trends and patterns in "Loans and Advances" over a 72-month period. The minimum recorded figure, 30,710,856 IQD, shows the lowest quantity of advances and loans witnessed. Considering the reasons for this minimum value can help determine lending practices,

the state of the economy, and shifting behavior of borrowers.

On the other hand, the maximum value of 60,812,306 IQD represents the highest number of advances and loans made within the period. Being at the pinnacle of such loan dispensations drives the need to understand the factors that contribute to such heights of credit facilities for the purpose of ascertaining growth opportunities, market trends, or possible modifications of lending policies. The mean is 41,745,948 IQD and represents the average value of advances and loans over the 72 months. Comparing the levels of loans and advances in specific periods with this norm helps to indicate points of deviation from normal lending activities and highlights certain patterns in the demand for loans. Therefore, the changes in lending behavior and general market conditions would be more appropriately represented. All other variables, except NASS Pay transaction and volumes, have 72 observations over six years, while the NASS Pay transaction and volume have only 36 observations because their operations started in 2021.

Table 4.2: Correlations

|          |                     | EPayment | NassT | NassV | HawalaT | HawalaV | ZainT  | ZainV |
|----------|---------------------|----------|-------|-------|---------|---------|--------|-------|
| EPayment | Pearson Correlation | 1        | .145  | .245  | .726**  | -.075   | .334** | .153  |
|          | Sig. (2-tailed)     |          | .399  | .150  | .000    | .529    | .004   | .201  |
|          | N                   | 72       | 36    | 36    | 72      | 72      | 72     | 72    |
| NassT    | Pearson Correlation | .145     | 1     | -.101 | .023    | .266    | .215   | .030  |
|          | Sig. (2-tailed)     | .399     |       | .558  | .895    | .117    | .208   | .860  |
|          | N                   | 36       | 36    | 36    | 36      | 36      | 36     | 36    |

|         |                     |        |       |       |        |        |        |        |
|---------|---------------------|--------|-------|-------|--------|--------|--------|--------|
| NassV   | Pearson Correlation | .245   | -.101 | 1     | .180   | .043   | .126   | .370*  |
|         | Sig. (2-tailed)     | .150   | .558  |       | .293   | .804   | .463   | .026   |
|         | N                   | 36     | 36    | 36    | 36     | 36     | 36     | 36     |
| HawalaT | Pearson Correlation | .726** | .023  | .180  | 1      | .525** | .269*  | .104   |
|         | Sig. (2-tailed)     | .000   | .895  | .293  |        | .000   | .022   | .383   |
|         | N                   | 72     | 36    | 36    | 72     | 72     | 72     | 72     |
| HawalaV | Pearson Correlation | -.075  | .266  | .043  | .525** | 1      | -.160  | -.162  |
|         | Sig. (2-tailed)     | .529   | .117  | .804  | .000   |        | .179   | .174   |
|         | N                   | 72     | 36    | 36    | 72     | 72     | 72     | 72     |
| ZainT   | Pearson Correlation | .334** | .215  | .126  | .269*  | -.160  | 1      | .815** |
|         | Sig. (2-tailed)     | .004   | .208  | .463  | .022   | .179   |        | .000   |
|         | N                   | 72     | 36    | 36    | 72     | 72     | 72     | 72     |
| ZainV   | Pearson Correlation | .153   | .030  | .370* | .104   | -.162  | .815** | 1      |
|         | Sig. (2-tailed)     | .201   | .860  | .026  | .383   | .174   | .000   |        |
|         | N                   | 72     | 36    | 36    | 72     | 72     | 72     | 72     |

\*\*. Correlation is significant at the 0.01 level (2-tailed).

\*. Correlation is significant at the 0.05 level (2-tailed).

Source: Researcher's preparation based on SPSS outcomes

The following correlation matrix shows that most of the independent variables, FinTech measures, are correlated, with generally low strength; further testing will be necessary. This suggests that a change in one metric may be influenced by changes in another metric. However, it is also important to establish that this correlation is low and, therefore, if any relationship does exist, it is neither strong nor conclusive. Given the weak strength of these connections, further statistical testing and analysis are necessary. Conducting these additional tests will help determine whether the associations are significant and relevant to the study's framework, providing a deeper understanding of their nature. Moreover, further investigation can identify any potential confounding variables or interactions that may influence the observed associations. In conclusion, while the correlation matrix provides initial insight into the relationships between FinTech metrics, its results are not conclusive. To achieve more reliable and comprehensive findings, further in-depth testing is essential. According to Appendix no. 1, six of the measurements of the independent variables for this study have remained after using an enter-remove test, with only electronic payments being removed from the equation. Therefore,  $R^2$  was 55%, which is quite good for this kind of study.

## Appendix

### Model 1

$$Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e_i$$

$b_0$ : This is the constant of the equation (the intercept or initial value). It represents the expected value of the dependent variable  $YY$  when  $X=0$ .  $B_1$ ----- $B_6$  = parameters of the independent's variables

$X_1$ -  $X_6$  independent variables

Y1= Total cash credit(dependent)

X1 = No. of Nas pay transaction

X2 = Nass pay volume

X3 = No. of Asia hawala transaction

X4 = Volume of Asia hawala

X5 = No of zain cash transaction

X6 = Volume of zain cash

$$Y1_{it} = -0.103 X1_{it} - 0.013 X2_{it} - 0.897 X3_{it} + 0.320 X4_{it} + 0.752 X5_{it} + 0.404 X6_{it} + e_{it} \quad (1)$$

The analysis of Regression Model No. 1, which has total cash credit as the dependent variable, indicates that the volume of Zain Cash, the number of Nass Pay transactions, the volume of Asia Hawala, the number of Asia Hawala transactions, and the number of Zain Cash transactions serve as significant predictors (independent variables). The significance level is 0.000, which is less than 0.05, and the calculated F-value is 7.437, as shown in Appendix 2. The number of Zain Cash transactions affects the dependent variable, with a significance value of 0.047, which is also less than 0.05, along with a T-test value of 2.071. Additionally, the number of Asia Hawala transactions affects total cash credit, with a significance value of 0.003, which is less than 0.05, and a T-test value of -3.310, as shown in Appendix 3.

According to the analysis of Regression Model No. 1, where the dependent variable is total cash credit, it is evident that the volume of Zain Cash, the number of Nass Pay transactions, the volume of Asia Hawala, the number of Asia Hawala transactions, and the number of Zain Cash transactions all significantly impact the model.

The overall model's p-value is 0.000, which is less than the cutoff of 0.05; hence, this implies that the dependent variable, total cash credit, is jointly and

significantly affected by all independent factors. Indeed, Appendix 2 also indicates the F-statistic at 7.437, which further validates the significance of the model.

By analyzing each individual predictor in isolation, it is noticeable that the number of Zain Cash transactions significantly affects the total cash credit. The significance value for this predictor, or Sig, is 0.047, which is below 0.05. Additionally, the T-test value for the number of Zain Cash transactions is 2.071, indicating a positive relationship between the number of Zain Cash transactions and the dependent variable.

The number of transactions occurring under Asia Hawala also significantly affects total cash credit. The significance value of this variable is 0.003, which is well below 0.05, demonstrating that the effect is highly significant. The T-test value is -3.310, indicating a negative relationship between the number of Asia Hawala transactions and the dependent variable. Further elaboration on these results can be found in Appendix 3.

In other words, the regression model demonstrates that the total number of transactions via Zain Cash and Asia Hawala significantly influences total cash credit, as both variables exhibit clear patterns in their impact.

Model 2

$$Y_2 = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + e_i$$

$B_1$ ----- $B_6$  = parameters of the independent's variables

$X_1$ ----- $x_6$  independent variables

$Y_2$ = over draft account(dependent)

$X_1$  = No. of Nas pay transaction

$X_2$  = Nass pay volume

X3 = No. of Asia hawala transaction

X4 = Volume of Asia hawala

X5 = No of zain cash transaction

X6 = Volume of zain cash

$$Y_{2it} = -0.041 X_{1it} + 0.168 X_{2it} + 0.428 X_{3it} - 0.483 X_{4it} + 0.749 X_{5it} - 1.114 X_{6it} + e_{it}$$

..... (2)

By the analysis of regression model number 2, which consists of an overdraft account as a dependent variable and the volume of Zain Cash, the number of Nas Pay transactions, Nas Pay volume, the volume of Asia Hawala, the number of Asia Hawala transactions, and the number of Zain Cash transactions as predictors (independent variables), there is no significant influence, as Sig equals 0.130, which is greater than 0.05, and the calculated F is equal to 1.820, as shown in Appendix 4. Additionally, the volume of Zain Cash impacts the dependent variable, as Sig is equal to 0.023, which is less than 0.05, alongside the T-test of -2.397, as shown in the appendix. This is regression model number 2, which takes into account the overdraft account as the dependent variable. In this model, the following are considered independent variables: the volume of Zain Cash transactions, the number of Nas Pay transactions, the volume of Nas Pay transactions, the volume of Asia Hawala transactions, and the number of Zain Cash and Asia Hawala transactions. The significance of the overall model in predicting overdraft account behavior was determined.

This regression result indicates that the model as a whole does not have a significant effect on the dependent variable, at a significance level of 0.130. This exceeds the conventional threshold currently set at 0.05. Therefore, it would seem that this model does not attain statistical significance in describing changes in the overdraft account. Also, the F-statistic obtained for this model is 1.820, which is elaborated on in detail in

Appendix 4. The F-statistic value also supports that the overall model is not statistically significant.

Although the general model is not significant, individually speaking, this predictor shows that the volume of transactions handled by Zain Cash significantly influences the account in overdraft. The significance of this predictor is 0.023, which is less than 0.05, indicating that it is significant. In addition, it follows that, in Appendix 5, the T-test value of the volume of Zain Cash transactions is -2.397. This means the negative T-value implies that the higher the volume of Zain Cash transactions, the lower an overdraft account appears.

In summary, although the overall regression model number 2 does not significantly predict the overdraft account, within this model, the volume of Zain Cash transactions is an individually significant predictor. From this result, one can observe the importance of considering the impact of particular variables within the general model that may not be significant as a whole. Other factors and possible interactions among variables would require further analysis to fully understand what constitutes the predictors of overdraft accounts.

### Model 3

$$Y3 = b_0 + b_1X1 + b_2X2 + b_3X3 + b_4X4 + b_5X5 + b_6X6 + e_i$$

B1-----B6 = parameters of the independent's variables

X1-----x6 independent variables

Y3= Paid capital(dependent)

X1 = No. of Nas pay transaction

X2 = Nass pay volume

X3 = No. of Asia hawala transaction

X4 = Volume of Asia hawala

X5 = No of zain cash transaction

X6 = Volume of zain cash

$$Y_{3it} = -0.008X_{1it} - 0.060X_{2it} - 0.538X_{3it} - 0.080X_{4it} + 0.942X_{5it} + 0.337X_{6it} + e_{it} \dots\dots$$

(3)

The No. 3 regression model included Paid Capital as a dependent variable while the volume of Zain in cash, the number of Nass Pay transactions, Nass Pay volume, the volume of Asia Hawala, the number of Asia Hawala transactions, and the number of Zain cash transactions served as predictors (independent variables). The model shows a significant influence, with significance equal to 0.000, which is less than 0.05, and a calculated F equal to 10.607, as shown in Appendix 6. Furthermore, the number of Zain cash transactions affects the dependent variable, with significance equal to 0.007, which is also less than 0.05, and the T-test is 2.909, as shown in Appendix 7.

From the analysis of Regression Model No. 3, which takes Paid Capital as the dependent variable while considering the following independent variables, we can identify several significant conclusions: volume of Zain cash, number of Nass Pay transactions, Nass Pay volume, volume of Asia Hawala, number of Asia Hawala transactions, and number of Zain cash transactions.

There is an overall significant influence of the entire model on Paid Capital, the dependent variable. This is asserted by the significance level, which is well below the 0.05 criterion at 0.000. A model with a significance level of 0.000 implies that the probability of the correlations represented in the model occurring by chance is extremely low. It is important to note that the computed model F-statistic also equals 10.607, as shown in Appendix 6. Such a large F-statistic supports the statistical significance of the regression model and the strong influence of independent variables on Paid Capital in general.

Among the dependent factors, the individual impact that the independent factors have is substantial. Its significance level, again less than 0.05, is 0.007. This suggests that it is a meaningful predictor of Paid Capital. Additionally, for this variable, the T-test value, as per Appendix 7, is 2.909. This predictor's T-test value indicates the predictor as

significant in the model, thereby justifying that Paid Capital significantly associates statistically with the number of Zain cash transactions.

In summary, Regression Model No. 3 presents sufficient evidence to state that the selected independent variables, taken as a whole, significantly jointly affect Paid Capital. More specifically, the number of Zain cash transactions is an excellent predictor that contributes a noticeable amount to the model's explanatory power.

#### Model 4

$$Y_4 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e_i$$

B1-----B6 = parameters of the independent's variables

X1-----x6 independent variables

Y4= Late debit payments(dependent)

X1 = No. of Nas pay transaction

X2 = Nass pay volume

X3 = No. of Asia hawala transaction

X4 = Volume of Asia hawala

X5 = No of zain cash transaction

X6 = Volume of zain cash

$$Y_{4it} = 0.085X_{1it} + 0.012X_{2it} + 0.344X_{3it} + 0.312X_{4it} - 0.399X_{5it} - 0.731X_{6it} + e_{it} \dots\dots$$

(4)

According to the regression model no. 4 analysis, which consists of Late Debit Payments as the dependent variable and Volume of Zain Cash, No. of Nas Pay Transactions, Nass Pay Volume, Volume of Asia Hawala, No. of Asia Hawala Transactions and the number of Zain Cash transactions as predictors (independent variables) demonstrate a significant influence with a significance value of 0.003, which is less than 0.05, and a calculated F value of 4.245, as shown in Appendix (8). However, none of the independent variables appear to be statistically significant individually.

The frequency of late debit payments is the dependent variable under examination, based on the analysis of Regression Model No. 4. The number of transactions made with Zain Cash, the volume of transactions made with Nas Pay, the volume of transactions made with Asia Hawala, the number of transactions made with Asia Hawala, and the volume of transactions made with Zain Cash are all included in the model as predictors.

Regression analysis was performed, and the findings show that these independent factors have a significant overall impact on late debit payments. The model's significance level (Sig), which is 0.003, provides proof of this. This result indicates that the model is statistically significant overall because it is less than the traditional cutoff of 0.05.

Furthermore, the model's F-statistic is computed to be 4.245. In statistical tests, the F-statistic is a metric used to assess how well the regression model fits the data overall. A better fit is typically indicated by a higher F-statistic score. In this instance, the model's importance is further reinforced by the F-statistic of 4.245.

Although all the individual independent variables (volume of Zain Cash transactions, number of Nas Pay transactions, volume of Asia Hawala transactions, number of Asia Hawala transactions, and number of Zain Cash transactions) were not found to be statistically significant on their own, the model was statistically significant overall. This indicates that no single predictor stands out as having a substantial individual influence, even while the combined effect of these variables considerably increases the frequency of late debit payments.

#### Model 5

$$Y_5 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e_i$$

B1-----B6 = parameters of the independent's variables

X1-----x6 independent variables

Y5= Loans and Advances(dependent)

X1 = No. of Nas pay transaction

X2 = Nass pay volume

X3 = No. of Asia hawala transaction

X4 = Volume of Asia hawala

X5 = No of zain cash transaction

X6 = Volume of zain cash

$$Y5_{it} = -0.103X1_{it} - 0.015X2_{it} - 0.871X3_{it} + 0.265X4_{it} + 0.698X5_{it} + 0.500X6_{it} + e_{it} \dots\dots (5)$$

The analysis of regression model no. 5, which consists of loans and advances as dependent variables, and the volume of Zain cash, the number of Nas Pay transactions, Nas Pay volume, the volume of Asia Hawala, the number of Asia Hawala transactions, and the number of Zain cash transactions as predictors, shows that there is a significant influence with a significance level of 0.000, which is less than 0.05, and a calculated F value of 7.964, as shown in Appendix (9). Meanwhile, the number of Asia Hawala transactions has affected the dependent variable with a significance level of 0.003, which is less than 0.05, and a T-test value of -3.280, as shown in Appendix 10.

The dependent variable being considered is the quantity of loans and advances, according to the analysis of regression model no. 5. The independent variables (predictors) included in the model are the volume of Zain cash transactions, the number of Nas Pay transactions, the volume of Asia Hawala transactions, the number of Asia Hawala transactions, and the volume of Zain cash transactions.

These findings from the regression analysis signify that the independent variables significantly affect, overall, the sum of loans and advances. The p-value that represents the model's overall significance is 0.000, which is less than the conventional cut-off level of 0.05. Thus, the model is statistically significant; this means that the independent factors are jointly contributing significantly to the variation in the dependent variable.

The F-statistic computed by the model stands at 7.964. Normally, the F-statistic is used to measure the overall goodness of fit of a regression model, and it generally holds true that the higher the statistic is, the better the fit. In this case, the F value of 7.964 provides substantial evidence that this model fits the data fairly well and emphasizes the combined effect of the independent variables on loans and advances. These results have been recorded in Appendix (9).

The study further shows that, besides the significance of the model, only one single independent variable—that is, the volume of Asia Hawala transactions—has a statistically significant individual contribution in influencing the dependent variable. This is because the significance level presented by that variable is 0.003, which is below 0.05, meaning that the volume of Asia Hawala transactions independently influences the volume of loans and advances.

Also, the T-test value for the number of Asia Hawala transactions is -3.280. The T-test is a procedure used to assess the effect each independent variable has on the dependent variable; therefore, values further away from zero indicate greater influence. The negative value of -3.280 indicates a strong negative relationship between the number of Asia Hawala transactions and the total of all the loans and advances. These findings are presented in Appendix 10.

In conclusion, the overall regression model is significant in explaining the deviation of loans and advances, while only the number of Asia Hawala transactions stands out as the only influential variable that is significant.

## DISCUSSION AND CONCLUSIONS

The Iraqi financial system is improving day by day. It actually started to develop much after 2021 because, as one of the world's largest oil producers, Iraq has seen increased oil revenues due to high oil production, ensuring that, for the first time since 2021, the financial system may start to be positively affected. High income generated in Iraq has been further bolstered by the expectation of a rise in global oil prices after 2021, allowing for increased spending on infrastructure and public services. Modernization within the banking industry has been realized through the adoption of international financial standards, modern rules, and programs designed to reduce corruption and increase transparency. The Central Bank of Iraq has been at the forefront of achieving financial system stability, employing several strategies such as maintaining currency stability, controlling inflation, and improving monetary policy. Additionally, this has ensured, in its own way, quite fair development in the area of digital banking, increased utilization of mobile banking, electronic payments, and financial technology solutions in the pursuit of better access to and efficiency of financial services. Greater diversification in the economy and less reliance on oil revenues are also outcomes of increased foreign investment in various sectors, including banking, finance, and infrastructure, attracted by greater security and economic prospects. Improvements in the regulatory environment have been accompanied by heightened demands for compliance and supervision of financial institutions, all of which have contributed to making the sector even more stable and resilient. Given continued reforms, a stable oil price, and the resolution of concerns, cautious optimism is warranted regarding the outlook for Iraq's financial sector. The more diversified the economy becomes, and with further strengthening of the financial sector, the future in Iraq will be safer and more prosperous. Another aspect is related to the role of financial institutions in Iraq in sponsoring comprehensive training programs for their employees. After all, fully adapting state-of-the-art fintech technology requires not only a significant financial outlay but also staff who have received the appropriate training to operate these tools. They need to be structured with a clear core of knowledge and skills to manage new technologies, reduce risks, and benefit from fintech developments, enhancing operational efficiency and customer service. An investment in such human

capital will ensure that technological development ultimately converts into superior performance through lower risks and costs. The statistical analysis of independent variables measured by Total Electronic Payment, Number of Nass Pay Transactions, Nass Pay Volume, Number of Asia Hawala Transactions, Volume of Asia Hawala, Number of Zain Transactions, and Volume of Zain Cash Transactions, and dependent variables measured by Total Cash Credit, Overdraft Account, Paid Capital, Late Debit Payments, Loans, and Advances showed that there are many sub-variables that affect banking credit risks in Iraq. Loans and Advances, as the dependent variable in this study, seem to be affected by the number of Asia Hawala transactions. As evident from the T-test value of -3.280, the relationship has a significant negative correlation with total loans and advances. The values farther away from zero in this test signify that the dependent variable is being influenced by the predictor at a higher magnitude. Following Appendix 10, this negative sign indicates a strong negative association. The overall sum of the Asia Hawala transactions is statistically significant in their own right, though the regression model as a whole shows that the independent variables jointly express the variation of loans and advances. The study shows that the number of Asia Hawala transactions has a large effect on the dependent variable, with the independent variables collectively showing a strong influence that exceeds the significance of the entire model, as indicated by model number 5.

### **Scientific and Practical recommendations:**

These restrictions and risks highly recommend that the Iraqi financial establishment adopt the most advanced technology concerning financial services in order to minimize risks and costs, as well as improve performance and profits.

1. The Iraqi Central Bank must continuously issue new regulations and directives on FinTech. This sector changes very quickly in the world; it needs scientific and professional expertise to improve FinTech applications.
2. Awareness campaigns should be raised to increase understanding of FinTech among Iraqi users by increasing its marketing budget, publishing through new channels, and involving academic institutions to develop new curricula specialized in the application and uses of FinTech.

3. Knowledge of financial risks: It is essential for financial institutions in Iraq to train their employees regarding the dangers of FinTech, such as cyber-attacks or adherence to international regulations. According to experts, these risks will be identified more effectively by collaborating with international experts and training programs, thereby reducing these risks and ensuring safer financial transactions.
4. Awareness of credit risk will contribute to stability with fewer losses for Iraqi financial institutions. They should train their employees to evaluate the risks associated with total credit limits, overdraft accounts, paid-up capital, delayed debit payments, and other loan categories. By observing credit limits, monitoring factors that could impact borrowers' debt servicing capabilities, ensuring adequate capital buffer buildup, and deploying state-of-the-art risk assessment techniques, institutions can better ascertain and subsequently reduce defaults. This multidimensional approach will enhance financial well-being and also enable the construction of a safer financial system.

#### **Future Research:**

Due to this limitation of the research, the researcher recommends that future research manuscripts continue in this research direction. The following research ideas could provide a starting point for an excellent thesis in the future.

1. Future research on the impacts that fintech has on increasing banking credit risks in Iraq should consider extending the study period beyond the year 2023. It will also be worthwhile to compare it with other regions that have more developed fintech ecosystems to identify specific challenges and opportunities.
2. The micro-level analysis, through the case study of certain banks and customer segmentation, would provide evidence of the institutional adaptations and different impacts on retail and corporate clients

3. Furthermore, by analyzing the impact that fintech technologies have on cybersecurity, such as blockchain and AI, their responsibilities for credit risk management will become clear.
4. The political proposal, as well as the analysis of regulatory implications both locally and globally, can lead to the integration of the fintech industry. A comprehensive risk assessment can be derived from the analysis of the relationship between a) the state of the economy, b) financial inclusion, and c) the impact of fintech on credit risks, along with the attitudes and actions of users.
5. The investigations into state-of-the-art credit risk management techniques, such as stress testing and the use of advanced data analytics, also contribute to improving credit management; similarly, studies on the dynamics of fintech-bank alliances and cross-industry partnerships will also have a positive impact.
6. Finally, the development of quantitative models and the gathering of qualitative information from various stakeholders will better position us to understand how fintech fundamentally changes credit risks and support the full informativeness of financial intermediary and policymaker decisions.

## REFERENCES

- Agustin, G. (2023). The Rise of Financial Technology and Its Credit Risk in Indonesia. *International Journal of Accounting Finance in Asia Pacific* , 6(2), 98–109.
- Adrian, T., & Mancini-Griffoli, T. (2019). Central bank digital currencies: 4 questions and answers. IMF blog, 12.
- Alaeddin, O., Dakash, M. Al, & Azrak, T. (2021). Implementing the Blockchain Technology in Islamic Financial Industry: Opportunities and Challenges. *Journal of Information Technology Management*, 13(3), 99–115. <https://doi.org/10.22059/JITM.2021.83116>.
- Anderson, R. (2007). *The credit scoring toolkit (Theory and practice for retail risk management and decision automation)*. New York: Oxford University Press
- Altman, E. I., Iwanicz-Drozowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-score model. *Journal of international financial management & accounting*, 28(2), 131-171.
- Bhatore, S., Mohan, L., & Reddy, Y. R. (2020). Machine learning techniques for credit risk evaluation: a systematic literature review. *Journal of Banking and Financial Technology*, 4(1), 111-138.
- Beck, T., De Jonghe, O., & Mulier, K. (2022). Bank sectoral concentration and risk: Evidence from a worldwide sample of banks. *Journal of money, credit and banking*, 54(6), 1705-1739.
- Bandyopadhyay, A. (2016). *Managing Portfolio Credit Risk in Banks*. India: Cambridge University Press.
- Bin Zidane, Fatima Al-Zahraa, Boudia, Fatima (2019), “Analysis of the Islamic finance sector using the SWOT model,” research presented to the International Conference on Institutional Integration of the Islamic Financial and Banking Industry, Hassiba Ben Bouali University, Algeria.

- Banks, E. (1993). The credit risk of financial instruments. Springer.  
<https://shorturl.at/9itTF>
- Baker, H., Kaddumi, T. A., Nassar, M. D., & Muqattash, R. S. (2023). Impact of Financial Technology on Improvement of Banks' Financial Performance. *Journal of Risk and Financial Management*, 16(4).  
<https://doi.org/10.3390/jrfm16040230>
- Branzoli, N., Rainone, E., & Supino, I. (2024). The role of banks' technology adoption in credit markets during the pandemic. *Journal of Financial Stability*, 101230.  
<https://doi.org/https://doi.org/10.1016/j.jfs.2024.101230>
- Berman, S. J., & Bell, R. (2011). Digital transformation: Creating new business models where digital meets physical. *IBM Institute for Business Value*, 4.
- Bennett, N., & Lemoine, G. J. (2014). What a difference a word makes: Understanding threats to performance in a VUCA world. *Business horizons*, 57(3), 311-317.
- Bamberger, K. A. (2009). Technologies of compliance: Risk and regulation in a digital age. *Tex. L. Rev.*, 88, 669.
- Collier, B. L., Ellis, C., & Keys, B. J. (2021). The cost of consumer collateral: Evidence from bunching (No. w29527). National Bureau of Economic Research.
- Chatterjee, S. (2015). Modelling credit risk. Centre for Central Banking Studies, Bank of England,. Threadneedle Street, London, EC2R 8AH: Bank of England.
- Collin-Dufresne, P. and Goldstein, R. (2001): Do Credit Spreads Reflect Stationary Leverage Ratios?, *Journal of Finance* 56, 1929-1957.
- Cetin, U., Jarrow, R., Protter, P., & Yildirim, Y. (2004). Modeling credit risk with partial information. <https://shorturl.at/ETLVt>
- Chen, C. R., & Huang, Y. S. (2023). Special issue: Financial technology, innovation, and corporate finance. *The North American Journal of Economics and Finance*, 68, 101987. <https://doi.org/https://doi.org/10.1016/j.najef.2023.101987>

- Cheng, M., & Qu, Y. (2020). Does bank FinTech reduce credit risk? Evidence from China. *Pacific-Basin Finance Journal*, 63, 101398. <https://doi.org/https://doi.org/10.1016/j.pacfin.2020.101398>
- Cho, T.-Y., & Chen, Y.-S. (2021). The impact of financial technology on China's banking industry: An application of the metafrontier cost Malmquist productivity index. *The North American Journal of Economics and Finance*, 57, 101414. <https://doi.org/https://doi.org/10.1016/j.najef.2021.101414>
- Chiu, I., & Deipenbrock, G. (Eds.). (2021). *Routledge Handbook of Financial Technology and Law* (1st ed.). Routledge. <https://doi.org/10.4324/9780429325670>
- Caragea, Doina, Mark Chen, Theodor Cojoianu, Mihai Dobri, Kyle Glandt, and George Mihaila. "Identifying FinTech innovations using BERT." In 2020 IEEE International Conference on Big Data (Big Data), pp. 1117-1126. IEEE, 2020.
- Cornelli, G., Frost, J., Gambacorta, L., Rau, P. R., Wardrop, R., & Ziegler, T. (2023). Fintech and big tech credit: Drivers of the growth of digital lending. *Journal of Banking & Finance*, 148, 106742. <https://doi.org/10.1016/J.JBANKFIN.2022.106742>
- Cao, L., Yang, Q., & Yu, P. S. (2021). Data science and AI in FinTech: An overview. *International Journal of Data Science and Analytics*, 12(2), 81-99.
- Chesnais, F. (2016). Finance capital today: corporations and banks in the lasting global slump. In *Finance Capital Today*. Brill. <https://shorturl.at/kD4f1>
- Danisewicz, P., & Elard, I. (2023). The real effects of financial technology: Marketplace lending and personal bankruptcy. *Journal of Banking & Finance*, 155, 106986. <https://doi.org/https://doi.org/10.1016/j.jbankfin.2023.106986>
- Dasilas, A., & Karanović, G. (2023). The impact of FinTech firms on bank performance: evidence from the UK. *EuroMed Journal of Business*, ahead-of-p(ahead-of-print). <https://doi.org/10.1108/EMJB-04-2023-0099>
- Du, G., Liu, Z., & Lu, H. (2021). Application of innovative risk early warning mode under big data technology in Internet credit financial risk assessment. *Journal of*

- Computational and Applied Mathematics, 386, 113260.  
<https://doi.org/https://doi.org/10.1016/j.cam.2020.113260>
- Du, L., & Geng, B. (2024). Financial technology and financing constraints. *Finance Research Letters*, 60, 104841.  
<https://doi.org/https://doi.org/10.1016/j.frl.2023.104841>
- Elia, G., Stefanelli, V., & Ferilli, G. B. (2023). Investigating the role of Fintech in the banking industry: what do we know? *European Journal of Innovation Management*, 26(5), 1365–1393. <https://doi.org/10.1108/EJIM-12-2021-0608>
- Elsaid, H. M. (2023). A review of literature directions regarding the impact of fintech firms on the banking industry. *Qualitative Research in Financial Markets*, 15(5), 693–711. <https://doi.org/10.1108/QRFM-10-2020-0197>
- Frost, J., Gambacorta, L., & Gambacorta, R. (2022). On the nexus between wealth inequality, financial development and financial technology. *Journal of Economic Behavior & Organization*, 202, 429–451.  
<https://doi.org/https://doi.org/10.1016/j.jebo.2022.08.011>
- Frank, A. G., Mendes, G. H. S., Ayala, N. F., & Ghezzi, A. (2019). Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective. *Technological Forecasting and Social Change*, 141, 341, –351.
- George Burlakov. 2019. 10 Challenges for the Financial Services Industry.  
<https://technorely.com/insights/10-challenges-for-the-financial-services-industry>.
- Hosseini, Jazia and Imran, Qusay Jassim Muhammad. 2019. The extent to which financial technology contributes to enhancing green banking products, with reference to Doha Bank in Qatar. *Tikrit Journal of Administrative and Economic Sciences*, vol. 15, p. 48, c. 1, p. p. 149-163.
- Hamdoush Wafa, Omani Lamia, Bin Ali Somaya (2021). The role of financial technology in enhancing Algerian popular fuel consumption: motives and

- challenges. *New Economics Journal* Volume 12, Issue 4, Pages 540-557.  
<https://www.asjp.cerist.dz/en/article/166411>.
- Hasan, I., Kwak, B., & Li, X. (2024). Financial technologies and the effectiveness of monetary policy transmission. *European Economic Review*, 161, 104650.  
<https://doi.org/https://doi.org/10.1016/j.euroecorev.2023.104650>
- Iskandar, Z. J. H., M.D. (2020). The role of financial technology in enhancing the effectiveness of financial inclusion. *Journal of Management and Economics*, Volume 9, Issue 33, Pages 92-124.
- Jo, K., Choi, G., Jeong, J., & Ahn, K. (2022, June). Forecasting bank default with the Merton model: The case of US banks. In *International Conference on Computational Science* (pp. 682-691). Cham: Springer International Publishing.
- Kaposty, F., Kriebel, J., & Löderbusch, M. (2020). Predicting loss given default in leasing: A closer look at models and variable selection. *International Journal of Forecasting*, 36(2), 248-266
- Karaman, H. D., Savaser, T., Tiniç, M., & Tumer-Alkan, G. (2021). Financial technology in developing economies: A note on digital lending in Turkey. *Economics Letters*, 207, 110012.  
<https://doi.org/https://doi.org/10.1016/j.econlet.2021.110012>
- Khan, H. H., Khan, S., & Ghafoor, A. (2023). Fintech adoption, the regulatory environment and bank stability: An empirical investigation from GCC economies. *Borsa Istanbul Review*, 23(6), 1263–1281.  
<https://doi.org/https://doi.org/10.1016/j.bir.2023.10.010>
- Kharrat, H., Trichilli, Y., Abbes, B., Nguyen, L., Tran, S., & Ho, T. (2022). Relationship between FinTech index and bank's performance: a comparative study between Islamic and conventional banks in the MENA region. *Journal of Islamic Accounting and Business Research*, 14(1), 445–466.  
<https://doi.org/10.1108/JIABR-03-2022-0081>

- Lan, Y. (2024). Does Fintech development affect capital misallocation: A non-linear and spatial spillover perspective. *Finance Research Letters*, 60, 104847. <https://doi.org/https://doi.org/10.1016/j.frl.2023.104847>
- Łasak, P., & Gancarczyk, M. (2022). Transforming the scope of the bank through fintechs: toward a modularized network governance. *Journal of Organizational Change Management*, 35(1), 186–208. <https://doi.org/10.1108/JOCM-05-2021-0147>
- Le, T. D. Q. (2023). A shift towards household lending during the Fintech era: the role of financial literacy and credit information sharing. *Asia-Pacific Journal of Business Administration*, 15(3), 466–485. <https://doi.org/10.1108/APJBA-07-2021-0325>
- Li, pengjin. (2022). Fintech Application and Bank Risk-Taking: Evidence from Chinese City Commercial Banks. *Proceedings of the 2022 International Conference on Economics, Smart Finance and Contemporary Trade (ESFCT 2022)*, 850–859.
- Liang, F., Zhao, P., & Huang, Z. (2023). Financial technology, macroeconomic uncertainty, and commercial banks' proactive risk-taking in China. *China Economic Quarterly International*, 3(2), 77–87. <https://doi.org/https://doi.org/10.1016/j.ceqi.2023.04.001>
- Luz Martín-Peña, M., Díaz-Garrido, E., & Sánchez-López, J. M. (2018). The digitalization and servitization of manufacturing: A review on digital business models. *Strategic Change*, 27(2), 91-99.
- Liu, S., Wang, B., & Zhang, Q. (2024). Fintech regulation and bank liquidity creation: Evidence from China. *Pacific-Basin Finance Journal*, 84, 102276. <https://doi.org/https://doi.org/10.1016/j.pacfin.2024.102276>
- Martins, L. L., Rindova, V. P., & Greenbaum, B. E. (2015). Unlocking the hidden value of concepts: A cognitive approach to business model innovation. *Strategic Entrepreneurship Journal*, 9(1), 99–117.

- Metawa, N., Dogan, E., & Taskin, D. (2022). Analyzing the nexus of green economy, clean and financial technology. *Economic Analysis and Policy*, 76, 385–396. <https://doi.org/https://doi.org/10.1016/j.eap.2022.08.023>
- Mugane, G. M. (2018). Big data analytics and competitive advantage of commercial banks and fintech companies in Kenya (Doctoral dissertation, university of nairobi).
- Murtaza, G., Ansari, M. A. A., Hassan, W. ul, & Akhtar, M. (2023). Factors Affecting the Credit Risk Management in the Banking Sector of Pakistan: Moderating Effect of Financial Technology. *International Journal of Business and Economic Affairs*, 8(3). <https://doi.org/10.24088/IJBEA-2023-83007>
- Nicoletti, B. (2022). *Procurement finance*. Palgrave Macmillan.
- Nicoletti, B. (2021). *Banking: How Fintech Will Change Traditional Banks in the New Normal Post Pandemic*. Springer Nature. <https://shorturl.at/xBE08>
- Nguyen, L., Tran, S., & Ho, T. (2022). Fintech credit, bank regulations and bank performance: a cross-country analysis. *Asia-Pacific Journal of Business Administration*, 14(4), 445–466. <https://doi.org/10.1108/APJBA-05-2021-0196>
- Nie, Z., Ling, X., & Chen, M. (2023). The power of technology: FinTech and corporate debt default risk in China. *Pacific-Basin Finance Journal*, 78(C), S0927538X23000355-S0927538X23000355. <https://econpapers.repec.org/RePEc:eee:pacfin:v:78:y:2023:i:c:s0927538x23000355>
- Ozili, P. K. (2023). Determinants of interest in eNaira and financial inclusion information in Nigeria: role of FinTech, cryptocurrency and central bank digital currency. *Digital Transformation and Society*, 2(2), 202–214. <https://doi.org/10.1108/DTS-08-2022-0040>
- Paulet, E., & Mavoori, H. (2020). Conventional banks and Fintechs: how digitization has transformed both models. *Journal of Business Strategy*, 41(6), 19–29. <https://doi.org/10.1108/JBS-06-2019-0131>

- Phan, D. H. B., Narayan, P. K., Rahman, R. E., & Hutabarat, A. R. (2020). Do financial technology firms influence bank performance? *Pacific-Basin Finance Journal*, 62, 101210. <https://doi.org/10.1016/j.pacfin.2019.101210>
- Phan Thi Hang, N. (2023). Policy recommendations for controlling credit risks in commercial banks after the Covid-19 pandemic in Vietnam. *Cogent Economics & Finance*, 11(1), 2160044. <https://doi.org/10.1080/23322039.2022.2160044>
- Rahman, S. U., Faisal, F., Ali, A., Sulimany, H. G. H., & Bazhair, A. H. (2023). Do financial technology and financial development lessen shadow economy? Evidence from BRICST economies using heterogenous bootstrap panel causality. *The Quarterly Review of Economics and Finance*, 90, 201–210. <https://doi.org/10.1016/j.qref.2023.06.005>
- Rosdini, D., Wahyuni, E. T., & Sari, P. Y. (2024). The bane of P2P lending: credit scoring governance on the ASEAN fintech triumvirate. *Journal of Science and Technology Policy Management*, 15(2), 268–287. <https://doi.org/10.1108/JSTPM-02-2022-0043>
- Rashida, Z. (2019). Financial technology and its role in accelerating financial inclusion for sustainable development. Conference: A national forum entitled: The financial technology industry and its role in promoting financial inclusion in Arab countries, Medea University. [https://www.researchgate.net/publication/338968986\\_altknwlwjya\\_almalyt\\_wdwrha\\_fy\\_tsry\\_alshmw\\_l\\_almaly\\_mn\\_ajl\\_tnmyt\\_mstdamt](https://www.researchgate.net/publication/338968986_altknwlwjya_almalyt_wdwrha_fy_tsry_alshmw_l_almaly_mn_ajl_tnmyt_mstdamt)
- Shah, S. A. A., Fianto, B. A., Sheikh, A. E., Sukmana, R., Kayani, U. N., & Bin Ridzuan, A. R. (2023). Role of fintech in credit risk management: an analysis of Islamic banks in Indonesia, Malaysia, UAE and Pakistan. *Journal of Science and Technology Policy Management*, 14(6), 1128–1154. <https://doi.org/10.1108/JSTPM-06-2022-0104>
- Shehata, Muhammad Musa Ali (2019). A proposed accounting model for measuring and disclosing information about financial technology innovations as a basis for enhancing financial inclusion and its impact on banking performance rates:

“With an applied study.” *Journal of Accounting Research*, vol. 6, p. 1, c. 2, p. p. 602-666.

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2023). *Research Methods for Business Students*. (9th ed.) Pearson. <https://www.pearson.com/en-gb/subject-catalog/p/research-methods-for-business-students/P200000010080/9781292402727>

Sidaoui, M., Ben Bouheni, F., Arslankhuyag, Z., & Mian, S. (2022). Fintech and Islamic banking growth: new evidence. *The Journal of Risk Finance*, 23(5), 535–557. <https://doi.org/10.1108/JRF-03-2022-0049>

Tut, D. (2023). FinTech and the COVID-19 pandemic: Evidence from electronic payment systems. *Emerging Markets Review*, 54, 100999.

Tan, C., Mo, L., Wu, X., & Zhou, P. (2024). Fintech development and corporate credit risk: Evidence from an emerging market. *International Review of Financial Analysis*, 92, 103084. <https://doi.org/https://doi.org/10.1016/j.irfa.2024.103084>

Thomas, N. M., Mendiratta, P., & Kashiramka, S. (2023). FinTech credit: uncovering knowledge base, intellectual structure and research front. *International Journal of Bank Marketing*, 41(7), 1769–1802. <https://doi.org/10.1108/IJBM-01-2023-0039>

Thompson, B. S. (2017). Can Financial Technology Innovate Benefit Distribution in Payments for Ecosystem Services and REDD+? *Ecological Economics*, 139, 150–157. <https://doi.org/https://doi.org/10.1016/j.ecolecon.2017.04.008>

Tiwari, A. K., Abakah, E. J. A., Shao, X., Le, T.-L., & Gyamfi, M. N. (2023). Financial technology stocks, green financial assets, and energy markets: A quantile causality and dependence analysis. *Energy Economics*, 118, 106498. <https://doi.org/https://doi.org/10.1016/j.eneco.2022.106498>

Turki, A., & Rieg, R. (2023). On performance drivers of European Fintechs around venture capital: exploring the role of founders’ experience. *Review of Accounting and Finance*, 22(5), 682–699. <https://doi.org/10.1108/RAF-05-2023-0153>

- Urom, C. (2023). Time–frequency dependence and connectedness between financial technology and green assets. *International Economics*, 175, 139–157.  
<https://doi.org/https://doi.org/10.1016/j.inteco.2023.06.004>
- Wonglimpiyarat, J. (2017). FinTech banking industry: a systemic approach. *Foresight*, 19(6), 590–603. <https://doi.org/10.1108/FS-07-2017-0026>
- Yao, M., Di, H., Zheng, X., & Xu, X. (2018). Impact of payment technology innovations on the traditional financial industry: A focus on China. *Technological Forecasting and Social Change*, 135, 199–207.  
<https://doi.org/https://doi.org/10.1016/j.techfore.2017.12.023>
- Yu, J. (2024). Stabilizing leverage, financial technology innovation, and commercial bank risks: Evidence from China. *Economic Modelling*, 131, 106599.  
<https://doi.org/https://doi.org/10.1016/j.econmod.2023.106599>
- Zhang, Q., Que, J., & Qin, X. (2023). Regional financial technology and shadow banking activities of non-financial firms: Evidence from China. *Journal of Asian Economics*, 86, 101606.  
<https://doi.org/https://doi.org/10.1016/j.asieco.2023.101606>
- Zhu, K., & Guo, L. (2024). Financial technology, inclusive finance and bank performance. *Finance Research Letters*, 60, 104872.  
<https://doi.org/https://doi.org/10.1016/j.frl.2023.104872>
- Zheng, C., Sarker, N., & Nahar, S. (2018). Factors affecting bank credit risk: An empirical insight. *Journal of Applied Finance & Banking*, 8(2), 45-67.  
<https://shorturl.at/l3whx>

**Appendix 1:** Total cash credit regression results.

**Collinearity Diagnostics**

| Mode Dimension | Eigenvalue | Condition Index | Variance Proportions |                         |                |                                |                       |                             |                     |
|----------------|------------|-----------------|----------------------|-------------------------|----------------|--------------------------------|-----------------------|-----------------------------|---------------------|
|                |            |                 | (Constant)           | No. Nas pay transaction | Nas pay volume | No. of Asia hawala transaction | Volume of Asia hawala | No of zain cash transaction | Volume of zain cash |
| 1              | 5.368      | 1.000           | .00                  | .00                     | .00            | .00                            | .00                   | .00                         | .00                 |
|                | 1.010      | 2.305           | .02                  | .05                     | .03            | .04                            | .02                   | .00                         | .00                 |
|                | .256       | 4.578           | .16                  | .02                     | .41            | .07                            | .01                   | .01                         | .00                 |
|                | .150       | 5.992           | .36                  | .81                     | .07            | .01                            | .03                   | .00                         | .01                 |
|                | .130       | 6.433           | .23                  | .00                     | .00            | .08                            | .16                   | .12                         | .06                 |
|                | .066       | 9.049           | .17                  | .11                     | .22            | .80                            | .74                   | .00                         | .00                 |
|                | .021       | 16.053          | .06                  | .00                     | .26            | .00                            | .05                   | .87                         | .93                 |

a. Dependent Variable: Total cash credit

**ANOVA<sup>a</sup>**

| Model        | Sum of Squares      | df | Mean Square        | F     | Sig.              |
|--------------|---------------------|----|--------------------|-------|-------------------|
| 1 Regression | 237654383399974.940 | 6  | 39609063899995.820 | 7.437 | .000 <sup>b</sup> |
| Residual     | 154442754464755.750 | 29 | 5325612222922.612  |       |                   |
| Total        | 392097137864730.700 | 35 |                    |       |                   |

a. Dependent Variable: Total cash credit

b. Predictors: (Constant), Volume of zain cash, No. Nas pay transaction, Nass pay volume, Volume of Asia hawala, No. of Asia hawala transaction, No. of zain cash transaction

**Coefficients<sup>a</sup>**

| Model                         | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. | Collinearity Statistics |       |
|-------------------------------|-----------------------------|------------|---------------------------|--------|------|-------------------------|-------|
|                               | B                           | Std. Error | Beta                      |        |      | Tolerance               | VIF   |
| (Constant)                    | 37743202.839                | 904116.496 |                           | 41.746 | .000 |                         |       |
| No. Nas pay transaction       | -105.618                    | 144.996    | -.103                     | -.728  | .472 | .681                    | 1.469 |
| Nass pay valume               | -1.246E-005                 | .000       | -.013                     | -.078  | .938 | .493                    | 2.029 |
| No.of asia hawala transaction | -19.486                     | 5.888      | -.897                     | -3.310 | .003 | .185                    | 5.408 |
| Valume of asia hawala         | 4.088E-005                  | .000       | .320                      | 1.216  | .234 | .196                    | 5.093 |
| No of zain cash transaction   | 19.857                      | 9.591      | .752                      | 2.071  | .047 | .103                    | 9.722 |
| Volume of zain cash           | 4.045E-005                  | .000       | .404                      | 1.182  | .247 | .116                    | 8.618 |

a. Dependent Variable: Total cash credit

## Appendix 2: over draft account regression results

ANOVA<sup>a</sup>

| Model        | Sum of Squares   | df | Mean Square    | F     | Sig.              |
|--------------|------------------|----|----------------|-------|-------------------|
| 1 Regression | 40646087986.934  | 6  | 6774347997.822 | 1.820 | .130 <sup>b</sup> |
| Residual     | 107972278557.372 | 29 | 3723182019.220 |       |                   |
| Total        | 148618366544.305 | 35 |                |       |                   |

a. Dependent Variable: over draft account

b. Predictors: (Constant), Volume of zain cash, No. Nas pay transaction, Nass pay volume, Volume of Asia hawala, No. of Asia hawala transaction, No. of zain cash transaction

**Coefficients<sup>a</sup>**

| Model                         | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. | Collinearity Statistics |       |
|-------------------------------|-----------------------------|------------|---------------------------|--------|------|-------------------------|-------|
|                               | B                           | Std. Error | Beta                      |        |      | Tolerance               | VIF   |
| 1                             |                             |            |                           |        |      |                         |       |
| (Constant)                    | 2365348.669                 | 23905.441  |                           | 98.946 | .000 |                         |       |
| No. Nas pay transaction       | -.824                       | 3.834      | -.041                     | -.215  | .831 | .681                    | 1.469 |
| Nass pay valume               | 3.146E-006                  | .000       | .168                      | .743   | .463 | .493                    | 2.029 |
| No.of asia hawala transaction | .181                        | .156       | .428                      | 1.164  | .254 | .185                    | 5.408 |
| Valume of asia hawala         | -1.201E-006                 | .000       | -.483                     | -1.351 | .187 | .196                    | 5.093 |
| No of zain cash transaction   | .385                        | .254       | .749                      | 1.518  | .140 | .103                    | 9.722 |
| Volume of zain cash           | -2.169E-006                 | .000       | -1.114                    | -2.397 | .023 | .116                    | 8.618 |

a. Dependent Variable: over draft account

### Appendix 3: Paid capital regression results

| ANOVA <sup>a</sup> |                |                        |                            |        |       |
|--------------------|----------------|------------------------|----------------------------|--------|-------|
| Model              | Sum of Squares | df                     | Mean Square                | F      | Sig.  |
| 1                  | Regression     | 1376663032894<br>4.787 | 6<br>2294438388157.<br>464 | 10.607 | .000b |
|                    | Residual       | 6272907111945.<br>214  | 29<br>216307141791.2<br>14 |        |       |
|                    | Total          | 2003953744089<br>0.000 | 35                         |        |       |

a. Dependent Variable: Paid capital

b. Predictors: (Constant), Volume of zain cash, No. Nas pay transaction, Nass pay volume, Volume of Asia hawala, No. of Asia hawala transaction, No. of zain cash transaction

**Coefficients<sup>a</sup>**

| Model                         | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. | Collinearity Statistics |       |
|-------------------------------|-----------------------------|------------|---------------------------|--------|------|-------------------------|-------|
|                               | B                           | Std. Error | Beta                      |        |      | Tolerance               | VIF   |
| 1                             |                             |            |                           |        |      |                         |       |
| (Constant)                    | 14641151.800                | 182211.193 |                           | 80.353 | .000 |                         |       |
| No. Nas pay transaction       | -1.951                      | 29.222     | -.008                     | -.067  | .947 | .681                    | 1.469 |
| Nass pay valume               | -1.307E-005                 | .000       | -.060                     | -.405  | .688 | .493                    | 2.029 |
| No.of asia hawala transaction | -2.640                      | 1.187      | -.538                     | -2.225 | .034 | .185                    | 5.408 |
| Valume of asia hawala         | -2.323E-006                 | .000       | -.080                     | -.343  | .734 | .196                    | 5.093 |
| No of zain cash transaction   | 5.622                       | 1.933      | .942                      | 2.909  | .007 | .103                    | 9.722 |
| Volume of zain cash           | 7.622E-006                  | .000       | .337                      | 1.105  | .278 | .116                    | 8.618 |

a. Dependent Variable: Paid capital

|                             |             |       |       |        |      |      |       |
|-----------------------------|-------------|-------|-------|--------|------|------|-------|
| No of zain cash transaction | -1.289      | 1.365 | -.399 | -.944  | .353 | .103 | 9.722 |
| Volume of zain cash         | -8.955E-006 | .000  | -.731 | -1.838 | .076 | .116 | 8.618 |

a. Dependent Variable: Late debit payments

**Appendix 4:** Late debit payments regression results

**ANOVA<sup>a</sup>**

| Model        | Sum of Squares        | df | Mean Square          | F     | Sig.  |
|--------------|-----------------------|----|----------------------|-------|-------|
| 1 Regression | 2749020688860.<br>902 | 6  | 458170114810.1<br>50 | 4.245 | .003b |
| Residual     | 3130031065073.<br>402 | 29 | 107932105692.1<br>86 |       |       |
| Total        | 5879051753934.<br>305 | 35 |                      |       |       |

a. Dependent Variable: Late debit payments

b. Predictors: (Constant), Volume of zain cash, No. Nas pay transaction, Nass pay volume, Volume of Asia hawala, No. of Asia hawala transaction, No. of zain cash transaction

**Coefficients<sup>a</sup>**

| Model | Unstandardized Coefficients   |             | Standardized Coefficients | t      | Sig.  | Collinearity Statistics |       |
|-------|-------------------------------|-------------|---------------------------|--------|-------|-------------------------|-------|
|       | B                             | Std. Error  | Beta                      |        |       | Tolerance               | VIF   |
| 1     | (Constant)                    | 4753858.927 | 128710.788                | 36.934 | .000  |                         |       |
|       | No. Nas pay transaction       | 10.707      | 20.642                    | .085   | .519  | .681                    | 1.469 |
|       | Nass pay valume               | 1.473E-006  | .000                      | .012   | .949  | .493                    | 2.029 |
|       | No.of asia hawala transaction | .916        | .838                      | .344   | 1.093 | .185                    | 5.408 |
|       | Valume of asia hawala         | 4.889E-006  | .000                      | .312   | 1.021 | .196                    | 5.093 |

### Appendix 5: loans and advanced regression results

#### ANOVA<sup>a</sup>

| Model        | Sum of Squares          | df | Mean Square            | F     | Sig.              |
|--------------|-------------------------|----|------------------------|-------|-------------------|
| 1 Regression | 3010471080684<br>63.500 | 6  | 5017451801141<br>0.586 | 7.964 | .000 <sup>b</sup> |
| Residual     | 1827091799816<br>38.200 | 29 | 6300316551090.<br>972  |       |                   |
| Total        | 4837562880501<br>01.700 | 35 |                        |       |                   |

a. Dependent Variable: loans and advanced

b. Predictors: (Constant), Volume of zain cash, No. Nas pay transaction, Nass pay volume, Volume of Asia hawala, No. of Asia hawala transaction, No. of zain cash transaction

**Coefficients<sup>a</sup>**

| Model                         | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. | Collinearity Statistics |       |
|-------------------------------|-----------------------------|------------|---------------------------|--------|------|-------------------------|-------|
|                               | B                           | Std. Error | Beta                      |        |      | Tolerance               | VIF   |
| 1 (Constant)                  | 30269833.472                | 983378.725 |                           | 30.781 | .000 |                         |       |
| No. Nas pay transaction       | -117.396                    | 157.708    | -.103                     | -.744  | .463 | .681                    | 1.469 |
| Nass pay valume               | -1.588E-005                 | .000       | -.015                     | -.091  | .928 | .493                    | 2.029 |
| No.of asia hawala transaction | -21.007                     | 6.404      | -.871                     | -3.280 | .003 | .185                    | 5.408 |
| Valume of asia hawala         | 3.761E-005                  | .000       | .265                      | 1.028  | .312 | .196                    | 5.093 |
| No of zain cash transaction   | 20.462                      | 10.431     | .698                      | 1.962  | .059 | .103                    | 9.722 |
| Volume of zain cash           | 5.561E-005                  | .000       | .500                      | 1.494  | .146 | .116                    | 8.618 |

a. Dependent Variable: loans and advanced