Analysis Of Bank Performance Under the Influence of Blockchain Technology in Northern Cyprus

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ABSTRACT

The banking structure is in substantial transition; the competitive landscape and banking business model are changed by globalization and digitalization. This thesis is a research project about the interaction between using blockchain technology in banking and banks' financial performance in Northern Cyprus. Moreover, the research results can be applied to managerial decision-making and financial policymaking in the banking sector. These variables are linked to each other through advanced panel data analysis to get a fuller picture of what makes banks successful. In particular, it measures the ROAA impact of net interest margin, blockchain usage, the ratio of liquid assets to total deposits and borrowings, bank control, and loan loss reserves as a percentage of gross loans. Pooled Ordinary Least Squares regression model is a general regression model of data gathered from several banks based on the assumption of identical observations (no cross-sectional or time series). The results reveal that blockchain technology usage has a direct effect on ROAA and that it could improve bank profits. The comparison also indicates, however, that the loan loss reserves-to-gross loans ratio is negative against ROAA – this suggests that the more significant provisions for loan losses could depress bank profitability. The model has good explanatory power (R-squared and adjusted R-squared are 42.78% and 38.49%, respectively), which suggests that independent variables accounted for a significant portion of the variance in ROAA.

Keywords: Blockchain Technology, Financial Performance, Banking, Return on Average Assets, Northern Cyprus

ÖZ

Bankacılık yapısı önemli bir dönüşüm içindedir; rekabetçi ortam ve bankacılık iş modeli küreselleşme ve dijitalleşme tarafından değiştirilmektedir. Bu tez, Kuzey Kıbrıs'ta bankacılıkta blockchain teknolojisinin kullanımı ile bankaların finansal performansı arasındaki etkileşim hakkında bir araştırma projesidir. Dahası, araştırma sonuçları bankacılık sektöründe yönetimsel karar alma ve finansal politika yapımında uygulanabilir. Bu değişkenler, bankaları başarılı kılan şeyin daha eksiksiz bir resmini elde etmek için gelişmiş panel veri analizi yoluyla birbirine bağlanır. Özellikle, net faiz marjının, blockchain kullanımının, likit varlıkların toplam mevduat ve borçlanmalara oranının, banka kontrolünün ve brüt kredilerin yüzdesi olarak kredi kaybı rezervlerinin ROAA etkisini ölçer. Birleştirilmiş Sıradan En Küçük Kareler regresyon modeli, aynı gözlemler varsayımına dayalı olarak birkaç bankadan toplanan verilerin genel bir regresyon modelidir (kesitsel veya zaman serisi yok). Sonuçlar, blockchain teknolojisi kullanımının ROAA üzerinde doğrudan bir etkiye sahip olduğunu ve banka karlarını artırabileceğini ortaya koymaktadır. Ancak karşılaştırma ayrıca, kredi kaybı rezervlerinin brüt kredilere oranının ROAA'ya göre negatif olduğunu gösteriyor; bu, kredi kayıpları için daha önemli karşılıkların banka karlılığını düşürebileceğini gösteriyor. Modelin iyi bir açıklama gücü var (R kare ve ayarlanmış R kare sırasıyla %42,78 ve %38,49'dur), bu da bağımsız değişkenlerin ROAA'daki varyansın önemli bir bölümünü açıkladığını gösteriyor.

Anahtar Kelimeler: Blockchain Teknolojisi, Finansal Performans, Bankacılık, Ortalama Varlık Getirisi, Kuzey Kıbrıs

DEDICATION

As I embark on this challenging yet exciting journey of my master's thesis, I want to take a moment to express my deepest appreciation to two extraordinary individuals who have been my pillars of strength and inspiration.

To my esteemed supervisor, Prof. Dr. Sami Fethi, your guidance, wisdom, and unwavering support have given me the confidence to take on this academic endeavor with determination. Your insights and mentorship are invaluable, and I am truly grateful for the opportunity to learn under your guidance.

To my beloved husband, your encouragement, patience, and unwavering belief in me make all the difference. Your love and support provide the strength I need to push forward, even in the most demanding moments. This journey is not mine alone—it is ours, and I am beyond grateful to have you by my side.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

1.1 Background

Technological innovations have powerfully transformed everyday life. What is certain, though, is that we have all been affected or impacted by new technologies in some form or another. No other space is more incompatible than financial services, which has seen several regulatory and consumer-facing reforms over the past 10 years. The rise of the blockchain has facilitated part of this reform.

Blockchain is one of our generation's most innovative technologies, and many predict that it will be just as disruptive and transformative as the Internet (Morabito, 2017; Tapscott & Tapscott, 2016). It has already been widely augmented ever since Nakamoto first released the technology in 2008, but it is still in its infancy (Tapscott & Tapscott, 2016). Numerous sectors will feel the disruption, but the financial services sector is a prime one. Banks, insurance companies, and financial institutions are already eyeing the technology and its millions of applications, which could decentralize the existing financial system and revolutionize its fundamental functions and services (Tapscott & Tapscott, 2016; Cocco et al., 2017).

Blockchain is already disrupting the financial services sector as hundreds of startups create new and unique financial services and products for customers. These innovators are disrupting the existing model and framework of financial services. The technology now permeates the sectors of the financial markets and its value chain. Blockchain is an excellent opportunity for the financial industry when appropriately used. This technology can increase efficiency, improve products, and lower consumer prices. It allows emerging startups to compete with traditional banks without dealing with bureaucracy and heavy infrastructure. Yet that entails depriving banks, insurers, and hedge funds of their business. Thus, legacy FS companies try to survive, grow, and gain specific expertise. Strategic mergers were never an optimal strategy when competition was high. The blockchain era is no exception, and many companies and organizations choose to enter into alliances to partner to explore the technology and create a shared repository of technical specifications, procedures, and data.

1.2 Statement of Problem

Daily, banks engage in a substantial volume of transactions. The integration of blockchain technology into banking could significantly enhance security and transparency in these transactions. By eliminating centralized databases, blockchain ensures that no individual or entity within the system can alter or manipulate the data. Furthermore, it fosters transparency by removing the necessity for a third party or central authority to verify or manage peer-to-peer transactions. Additionally, the cost and time efficiencies associated with blockchain could disrupt the economic landscape of Cyprus. This study examines the potential impact of blockchain technology on the financial and banking systems in Cyprus, highlighting its capacity to revolutionize the banking industry in the region.

1.3 Objective of Study

The study begins with an analysis of the blockchain technology framework to build a complete understanding of its fundamental principles and operational procedures. The project evaluates the possibility of blockchain technology implementation in Cypriot banks while identifying potential obstacles and benefits during the adoption stage. The study concludes by evaluating blockchain technology's role in boosting banks' financial service delivery capabilities while improving banking system efficiency and security. These research objectives lead toward valuable insights about blockchain technology's transformative effects on the financial sector.

1.4 The Research Questions

This research is designed to investigate blockchain technology's possible effects on Northern Cyprus's banking industry while identifying implementation challenges. The research will examine blockchain technology's potential to revolutionize banking operations while improving security protocols and increasing sector efficiency. The study will analyze the barriers to blockchain technology adoption, such as regulatory obstacles, societal acceptance concerns, and infrastructure needs. By exploring essential questions about blockchain technology, this study aims to deliver a complete assessment of its potential benefits and obstacles to the banking sector of Northern Cyprus.

1.5 Methodology

The methodology of this thesis is designed to cover a prominent area of finance and banking. We use Panel Data to compare the return on average assets (ROAA) with five independent parameters: net interest margin (NIM), blockchain technology use (BT), liquid assets/total deposits and borrowing (LAT), bank governance (BG), and loan loss reserves percent of gross loans (LLR).

We use a Pooled Ordinary Least Squares (OLS) regression model to perform our analysis. It presumes that observations from different banks are the same, and it enables us to combine national data without accounting for cross-sectional and time series features. This approach allows us to gain insights into how these non-core variables influence ROAA, allowing us to share our knowledge about how banks perform across evolving financial landscapes.

1.6 Summary of Findings

The analysis reveals that blockchain technology utilization significantly impacts Return on Average Assets. At the same time, the loan loss reserves-to-gross loans ratio has a negative coefficient, indicating that higher provisions for loan losses can lead to decreased ROAA, suggesting a detrimental effect on bank profitability. The model demonstrates a strong explanatory power, with R-squared and adjusted R-squared values of 42.78% and 38.49%, respectively, meaning that the independent variables account for a substantial portion of the variability in ROAA.

1.7 The Framework of the Study

The researcher will structure this thesis as follows: Chapter 1 will be the introduction, and Chapter 2 will follow the same structure concerning the literature review of other studies and history, that is to say, what has been the cause of the thesis topic to be discussed. The banking industry in Northern Cyprus is covered in Chapter 3. It has the Model, Methodology, Data, Variables, and Proposed Methods in Chapter 4, which will be applied for data analysis. Chapter 5 includes the interpretation and analysis of the data results, and Chapter 6 ends the analysis and provides policy recommendations.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, the researcher will review the relevant academic literature, articles, and research made by scholars that are in line with the topic, and explains the study's conceptual and theoretical framework guiding the research, to give an analytical, descriptive, and critical assessment of the research topic under discussion.

2.2 Traditional Banking

Traditional banking is an old financial establishment that has existed for centuries. It performs various tasks, such as taking deposits, providing loans, and processing payments. It acts as a middleman between depositors and borrowers, contributing to the financial system by pooling money and using resources. Here, we will take a closer look at traditional banking, how it works, and its role in the economy.

The first role of a bank is taking money from you or your company. Deposits may be in savings accounts, current accounts, or fixed deposits. Banks can be assured of liquidity through a collective holding of such money and give customers a place to keep their funds. A Major Operation of any Bank is providing loans. Classic banks give credit to borrowers for personal, home, and business purposes. Using credit checks, banks judge people's creditworthiness and decide what terms are available for a loan—the interest rate and repayment terms. This credit function is key to economic development because it helps individuals and corporations finance things otherwise impossible. Standard banks accept payment via check, debit card, or electronic fund transfer. Banks that enable consumers and businesses to make purchases seamlessly and facilitate commerce in this way are secure and efficient in their payment systems (Weill & Woerner, 2015).

In most traditional banks, you will find financial advisers who help clients manage their finances. These can include financial planning, retirement advice, and wealth management. Banks use their expertise to help customers make sound financial decisions based on long-term objectives. Banks of the old-fashioned type are responsible for stability and economic development. They pool savings and raise the money needed to invest in infrastructure, business, and consumption. This capital investment boosts economic growth through job creation, productivity growth, and higher living standards. Also, old banks keep the financial system stable because they are regulated and have the protection of the risk of banking. Capital adequacy, liquidity ratios and risk management are all set by regulatory authorities to keep banks well-positioned to weather economic cycles. That surveillance helps to restore public trust in the banking system, which it requires to function (DeLuca, 2017).

In conclusion, traditional banking is still an essential aspect of the financial ecosystem, and it provides many of the same services that make the economy run smoothly. Traditional banks face new technologies and regulations but must continue to develop and evolve to stay in sync with their customers' needs. A better understanding of what traditional banking is and how it works is the best way to appreciate its contribution to the economy and understand its relevance in today's digital world. Amid the banking environment changing rapidly, incumbent banks must adapt to new technologies without sacrificing the trust and security that defined their business model over the years.

2.3 FinTech

The advent of Financial Technology (FinTech), or financial services technology, changed the world after the global financial crisis in 2008. After this credit crisis, the financial world became more desirable to tech entrepreneurs looking to decentralize banking. In the case of fintech, as Mackenzie (2015) mentioned, the innovation itch has spurred the rise of startups and FinTech firms that seek to provide low-cost, efficient solutions. FinTech is the convergence of finance and technology that transforms the delivery and consumption of financial services to increase the efficiency of the financial system as a whole (Kim et al., 2016).

FinTechs are not just the new competitors to banks and other large players; they are the future of the ways financial services are offered and delivered. Whereas banks already have supply chains of flagship banking products, FinTechs cater to consumers' and companies' fundamental cash needs. As Mackenzie (2015) points out, these new companies are not reinventing the wheel but augmenting services with new technologies. By doing so, FinTechs can cut costs and deliver better customer experiences than their old-school counterparts.

It is the essence of FinTech that it can use massive data to transform business. FinTech businesses can provide bespoke financial products based on customer needs and habits through sophisticated data analytics (Dapp et al., 2014; Gomber et al., 2018). This kind of customization was rarely possible in banks stuck in a generic product market. With machine learning algorithms and artificial intelligence, FinTechs can now look at customer data live, anticipate their customers' requirements, and provide personalized service accordingly.

Moreover, the customer experience in the FinTech world is much more than what can be provided in the bank branches and the bank hours. Since mobile banking apps and online platforms were created, customers could avail of financial services from anywhere and anytime. It has completely changed consumer demands for speed and convenience in financial exchanges. Fintechs have capitalized on this by offering easy-to-use interfaces and digital flow that allow customers to handle their money.

Technology and consumer shifts are also factors in the shifting landscape of the financial industry. As Gomber et al. (2018) note, the drive towards capacity and service diversification is changing how banks do business. Banks accustomed to it now must deal with it digitally and collaborate with FinTech companies. It is a win-win collaboration that allows banks to tap the fintech agility and newness of FinTechs while still protecting their existing customer base.

Lastly, FinTech innovates in financial services and can be used to drive innovation and optimize service. FinTechs are reinventing how people access and use financial services in their drive to deliver customer-oriented services and harness technology. It is also the case that the industry is changing rapidly, and traditional banks and FinTech startups need to work in this evolving environment together so that they serve the broad spectrum of customers and ensure sustainable financial ecosystem growth. Technology vs Finance is bound to change the face of banking in the future, which means more disruption and creativity ahead.

2.4 Definition of Blockchain

Blockchain was initially created as a peer-to-peer business transaction database. Even the word "blockchain" describes its operating system. A block containing all the transaction data is generated every time there is a transaction or event on the digital platform using this technology. This block is checked at all nodes of the computer system related to the transaction system. With an unchanging cryptographic signature hash calculated based on the contents of the last block, every subsequent transaction creates blocks that are added one by one to the last block. There are many transactions within a block of blockchain. Blockchain works on the DLT technology in which multiple players distribute and own the database. We immediately known whether a block has been manipulated or sublimated. Hackers would have to tinker with every block in every distributed chain to steal. Blockchains are growing larger daily, more blocks are getting chained together, and ledgers are becoming safer too.

A blockchain is, in essence, a distributed append-only timestamped information format. In blockchains, we have a distributed peer-to-peer network with unsecured members trusting each other without needing a third party. For this, blockchain is a constellation of interdependent mechanisms offering a given functionality to the infrastructure. At the lowest layer of this network, we have the authenticated peer transactions. They represent a contract between two parties, like the exchange of money or virtual funds, fulfilment of a task, etc. A transaction is signed by one party or more and notified to its neighbours. Usually, anything that interfaces with the blockchain is known as a node. However, nodes that check every blockchain rule are full nodes. These nodes collect the transactions into blocks, which are correct and should be recorded in the blockchain and which are not.

A blockchain is just another transaction database—a record-keeping system replicated to all the machines in a connected network. Hence, blockchain is a distributed ledger (Deloitte, 2015).

Blockchain is a system by which information can be stored and exchanged between peers (P2P). Data in blockchain can be read, transferred, and backed up using consensus algorithms from a structure standpoint. It is distributed without intermediaries or "trusted third parties" (PwC, 2017).

Rather, each block of a blockchain, which grows slowly over time because of trade between network parties, is made up of two elements: the header, which contains the referential ID, block generation time and relation to the previous block, and content.

According to Investopedia, blockchain is described as a "specific type of database that differs from a typical database by the way it stores information" (Conway, 2020). However, more interestingly could be to know how academic literature defines a blockchain. Frizzo-Barker et al. (2020) researched this topic and showed that most academic papers explain blockchain as a distributed or decentralised ledger. Another big part of the literature links blockchain with trust, security, and transparency. Finally, terms such as chain of blocks, peer-to-peer, Bitcoin, and disruptive technology also show frequent mentions. (Frizzo-Barker et al., 2020)

The definition given by the Harvard business review summarises the concept as an "open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way" (Iansiti & Lakhani, 2017). In this definition, some main characteristics (e.g., immutability and transparency), which will be discussed further, are captured.

In its purest formulation, I would describe blockchain as a public, distributed, and decentralised ledger. Note that blockchain is much more complicated than this simple description, but we will extend the definition as we progress. A ledger is a physical book or computer file that keeps a record of every economic transaction that ever took place. The ledger of a blockchain has a digital format where transactions get stored by date in a structured sort of database. Three important adjectives belong to the noun ledger in this definition:

- **Distributed**: Blockchain technology uses a distributed software system. The right side of figure 1 below shows this structure. As can be seen, there is no central element for coordination or control, and not all nodes have links with each other. However, the minimum requirement to be met is that every node should be linked indirectly. If not, the term distributed is inappropriate (Drescher, 2017). We will see that distributed in the blockchain context means that every node in the network receives an identical copy of the ledger and updates itself independently (Ray, 2018).

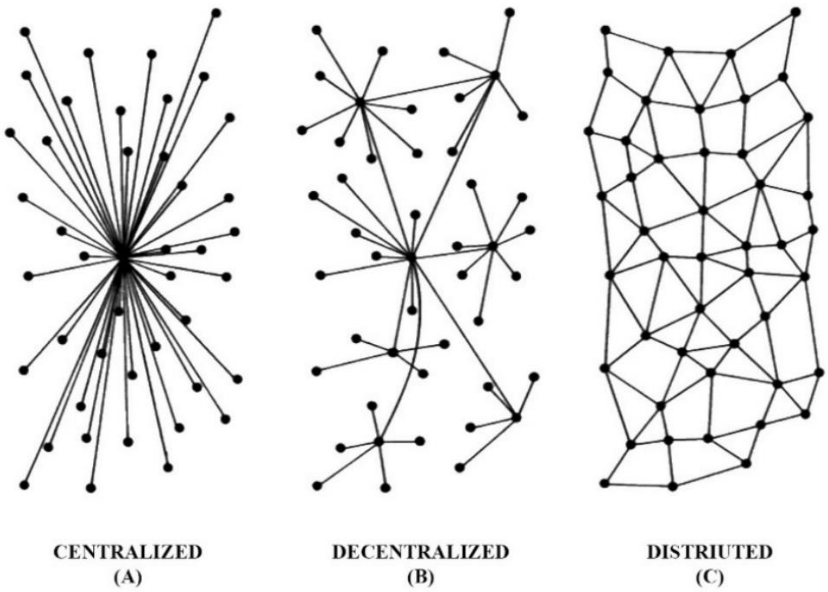

Figure 1: Centralised vs. Decentralised vs. Distributed (Goyal, 2015)

- **Decentralised:** In centralised software architectures, nodes are exclusively linked to the central component. In a decentralised network, there is no exclusive link with a central component. Again, figure 1 shows the difference between both. In the case of a decentralised structure (in the middle of figure 1), multiple central elements occur that are mutually interconnected. In a blockchain, decentralised means that no intermediary party, such as a financial institution, exists to handle a transaction between two entities. (Drescher, 2017)
- **Public:** There is a slight nuance around public because private blockchains exist as well. However, in this definition, public stands for: open to anyone who wants to participate in the blockchain network. Practically, blockchain provides public, open-source software that every individual can download and use. As such, anyone who wants to participate in the blockchain can participate (Van Valkenburgh, 2017). On the other hand, private blockchains restrict access to the network for people who are not allowed. (Drescher, 2017; Seth, 2021)

In summary, blockchain allows individual entities (called peers) to execute and handle transactions without an intermediary person or organization (decentralised). Peers are interconnected, and ledgers are shared across the network (distributed), without restrictions to access and execute new transactions on the network (public). It also shifts the middleman's responsibility to finalise the transaction towards the blockchain technology, the participators in the blockchain network, and the peers involved in the transaction (Yli-Huumo, Ko, Choi, Park & Smolander, 2016).

Blockchain must be seen as part of a broader concept that we call ‘distributed ledger technology (DLT)’, an idea that was already introduced in 1982 (Rauchs et al., 2018). Blockchain is a specific type of a distributed ledger technology, and as such, all blockchains are distributed ledgers. On the other hand, not all distributed ledgers are blockchains. The main difference is that the DLT, a more general concept, does not require a structure containing blocks. DLT is just a decentralised database that is spread across different participators, regions, and locations. Moreover, what we will call later ‘proof of work', which is highly important for blockchain technology, is not required for DLT. Both terms are often used interchangeably. (Ray, 2018).

2.5 Blockchain Features

Blockchain is a type of DLT used as a distributed database that allows communication between all nodes on a peer-to-peer network. A node can be a client or a server that needs the same software to communicate. Miners check transactions — nodes that add blocks to the chain by solving cryptographic puzzles, thus securing data integrity with a proof-of-work algorithm. Another method, proof of stake, allows for a group of nodes to verify by staking cryptocurrency, minimizing computational requirements and transaction fees. Because blockchain is decentralized, any individual cannot control it, and it offers increased security and less fraud with peer-to-peer consensus on data accuracy. Public or private-public blockchains permit open access to and verification of transactions, whereas private blockchains limit access to members upon permission and are typically controlled by one organization. This framework guarantees openness and trust without intermediaries.

The following, in a nutshell, are the properties of the Blockchain:

1. Distributed and Decentralized: At the heart of blockchain technology is peer-to-peer (P2P) networks in which nodes are connected without a central authority. Data is distributed to users on the Blockchain, and transactions use all nodes' computing resources. Its architecture minimizes single points of failure and transaction latency, significantly increasing the system's performance in handling large amounts of data and scaling up efficiently.

2. Transparency: Blockchain technology uses end-to-end cryptography to create blocks. Data processing is transparent and open, so no inter-party trust becomes necessary. All users have to sign transactions and validate any updated transactions on the ledger, so there is no risk of fraud.

3. Secure and Consensus-based: The trustlessness of the blockchain network is a central feature. Authentication consists of verifying network transactions with all participants' consent. Consensus rules are a group decision made prior to the transaction participants that can be altered to meet transaction specifics. They reduce third-party verification of transaction legitimacy.

4. Immutability and Cryptographic Sealing: One of the most interesting aspects of Blockchain is that it is immutable, indicating that transactional data can be kept. It does this by using the hash function for block generation. After it is verified and approved by consensus, every new block connects to the previous block with its current hash and the previous block's hash. This feature makes it very hard for someone outside the block to change its contents since they must know every previous hash value.

5. Chronological & Time-stamped: A blockchain is a set of blocks created with every transaction. The new block is connected to the old block in an atomic manner, making a chain of transaction information (the time stamp of the transaction). This model preserves the authenticity of each transaction and lowers long-term accounting overheads.

6. Reversible and Auditable: Any transaction on Blockchain has verifiable evidence backing it. Transactions are signed by both sides, which means they are final and irreversible. Further, everyone in the network or some user-defined subset has the transaction details and can verify transactions as legitimate. This is an essential feature to avoid double-spending.

7. Digital and Real-Time: Transactions are carried out digitally and on a permanently held digital ledger within the Blockchain, with no paper trail involved. Furthermore, payments are made in close to real-time, thereby avoiding non-payment.

8. Improved Security: Blockchain has a public key mechanism that makes data easier to steal since data stored on all chain nodes must be updated at once. The consensus

algorithm also secures transactions, making blockchain-based financial payments safer than conventional financial transactions.

2.6 Goal and Characteristics

Figure 2 summarizes the most important aspects of blockchain. From what we have seen so far, we now deduct the goals and characteristics.

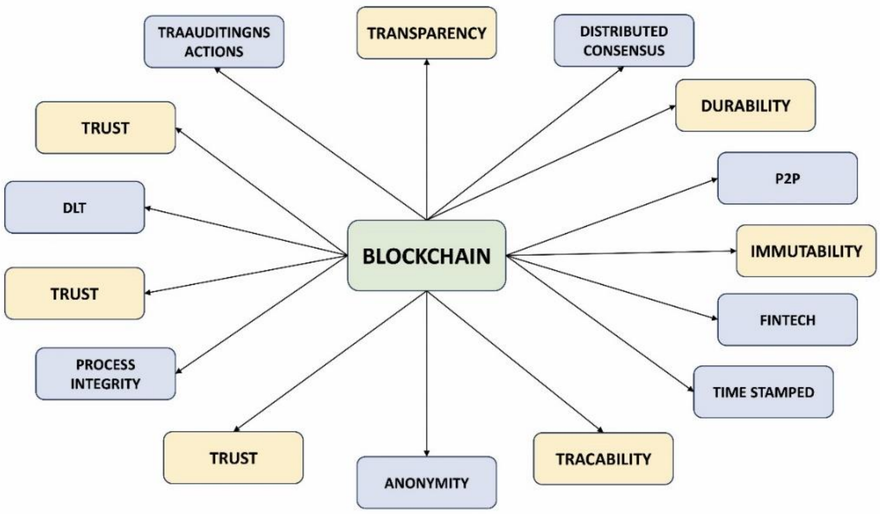

Figure 2: Summary Blockchain

The first goal of blockchain is to store all transaction data so that the system preserves the order in which the transactions took place, and nodes can quickly and easily detect changes in the data. As explained, the blockchain stores blocks chronologically with a time stamp. In this way, data is easily traceable and very transparent. The cryptography technology, in turn, makes the data immutable and guarantees anonymity.

The second goal is to keep the system open for anyone and protect the history of transaction data against forgery and manipulation by dishonest peers. Again, blockchain achieves this goal by detecting the slightest changes in data content. It is up to the manipulator to choose whether he changes the whole data structure by solving all cryptographic puzzles coming after the altered data or leaves it unchanged. The computing costs in the first case are very high, especially when the blockchain becomes larger and larger. Therefore, an additional characteristic is that blockchain networks become more secure when more blocks are added. If a fraudulent person wants to alter something, he has to solve the cryptographic puzzle of way too many blocks, which requires infeasible amounts of work and energy.

A third goal is to ensure that the individual computers making up the peer-to-peer system are informed about transactions and can keep their data history. The peers of the network realise this goal by interacting with each other via the internet.

The last goal is to allow everyone to add new transaction data to the transaction data history while maintaining integrity. This goal is realised using a disintermediated, distributed peer-to-peer system where all peers in the system take a role as supervisor. If new blocks are added, the supervisors/peers control its legitimacy. In the case of a legitimate new block, the block is added, and the miner gets rewarded. The fact that only one miner can win the reward stimulates every miner to process transactions correctly and quickly.

2.7 The Blockchain Technology

First, a more advanced and detailed definition of blockchain is given:

"The blockchain is a purely distributed peer-to-peer system of general ledgers that uses a software unit consisting of an algorithm that processes the content of ordered and connected data blocks together with cryptographic security technologies to achieve and maintain integrity." (Drescher, 2017).

The first part of the definition gives a similar description as in past section. However, in this definition, the second part will need some more explanation. The definition given by Drescher (2017) talks about a software unit that consists of an algorithm to process blocks of data that uses cryptography to secure and maintain integrity.

Nakamoto wanted to avoid the role of trusted third parties by creating a system where people can make transactions from peer-to-peer without an intermediary. A logical next question then is how to build trust in such a network. Because, from now on, the role of intermediary that controls peers do not exist anymore. Moreover, how can we ensure that people who are transferring currencies are legitimate owners, are not spending the same money twice, and are not committing fraud? The crucial tool to control and establish ownership is cryptography, while the primary tool to create trust will be proof of work. Two essential building blocks of this technology.

2.7.1 Ownership Through Cryptography

Assume we have two people that we call Alice and Bob. In the future, Alice and Bob will make transactions with each other. As blockchain is a transaction management system, it will store data about these transactions in blocks. However, besides holding transactions in the chain of blocks, owners of currencies also need to be identified. Moreover, the blockchain must handle the transfer of a digital currency between two peers correctly, meaning that the rightful owner must transfer objects to the appropriate receiver. First, the owner and the object he or she owns must be identified to prove such ownership. Secondly, the network must make and accept the link between owner and object. In the case that Alice holds bitcoins, we want to identify Alice and link the specific bitcoins that she carries with her identity. This identification step is the first step to prove ownership. (Drescher, 2017)

Nevertheless, this does not mean that Alice is the rightful possessor. Think of an example where someone finds a physical bill on the floor that does not belong to that person. That bill now belongs to its identity but does not mean that he or she is the rightful possessor. To solve this mismatch, authentication and subsequently authorization are the final steps and processes of proving that someone is the rightful owner and can access specific resources belonging to that ownership. In other words: through the authentication step, Alice is now considered as the rightful owner of her bitcoins. And, through the authorization step, she can now access the bitcoins she owns. The technology that proves ownership with identification, authentication and authorization is called cryptography (cf. infra). (Drescher, 2017)

Drescher (2017) also mentions that the link between owner and object owned by the owner will be made and verified by the blockchain network. This step works as follows: instead of keeping one physical ledger that individuals can easily manipulate, blockchain stores individual ledgers on the distributed peer-to-peer system (See figure 2, right side of the figure). In this way, all participants can see every detail of every transaction made in the network. Each computer acts as an independent witness to confirm whether the link between owner and object is legitimate. If more than 50% of the ledgers or peers confirm ownership by actually voting for it, the blockchain network links owner and object. With integrity and trustworthiness, the blockchain network now holds a consistent version of the state of ownership. (Drescher, 2017)

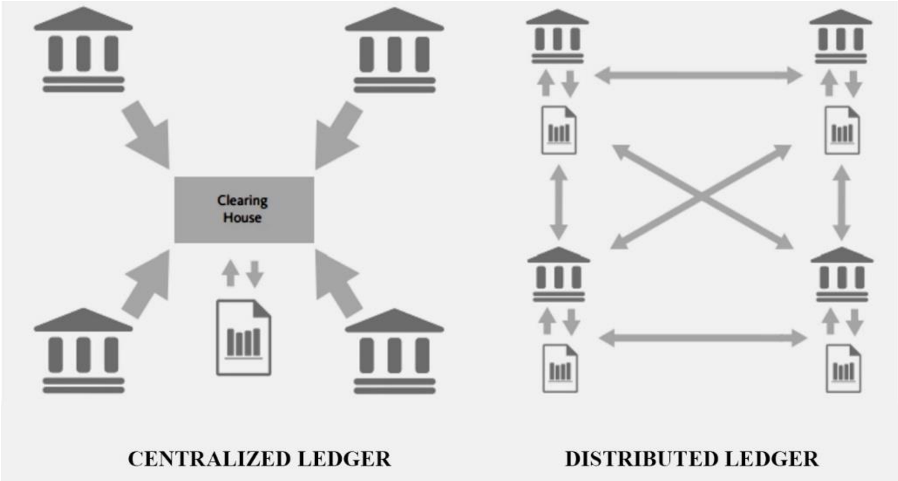

Figure 3: Distributed Ledger System

2.7.2 Cryptography

As cryptography is so essential in the proof of ownership, we discuss it more in-depth. Figure 3 below shows an exchange between Alice and Bob. Imagine that Bob wants to send a message to Alice that states: “Hello Alice!”. Important to know, Bob wants to send this message only to Alice, and no one else may read the message. For secure and private messages, blockchain uses asymmetric cryptography.

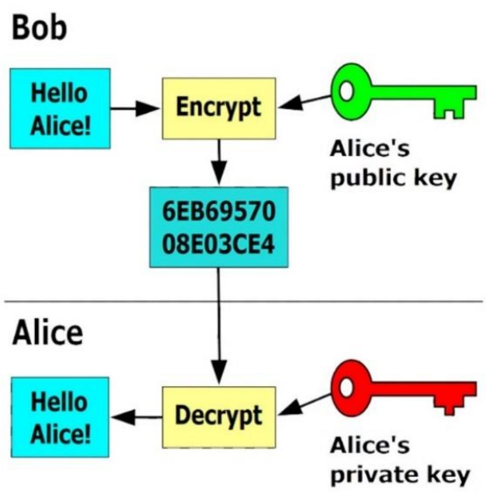

Figure 4: Public and Private key

Cryptography uses public and private keys to respectively encrypt and decrypt data. According to Saleh (2020) a public key is publicly known and serves as an identifier of the identity, whereas a private key should be kept secret. The public and private keys are not identical but pair with each other. It means that with every public key, there belongs one private key and vice versa. The difference between both is that the public key functions as the key shared with everyone and must be exchanged with anyone a person wants to communicate with (Here: Bob wants to communicate with Alice). On the other hand, the private key is unique and belongs to just one person or entity of the network. The owner should always keep this key secret. Also, note that from a public key, no one can deduct the private key. (Kroll et al., 2013; Sunyaev, 2020)

Figure 3 shows an example. First, Bob and Alice will exchange public keys. As such, Bob knows where to send his information. He sends the message “Hello Alice!” to Alice by encrypting the sentence together with her public key. As can be seen, this sentence converts into a considerable numerical value. Alice now receives the message and is the only person able to decrypt this message because she holds a private key paired with her public key. Even Bob cannot decrypt this message as he does not have the private key compatible with Alice's public key. This mismatch is not a problem as he sent the message.

Drescher (2017) also compares asymmetric cryptography with a physical mailbox. More specifically, anyone can send a letter to a mailbox address if the address is known (public key). However, only the legitimate address holder has access to its physical mailbox and is the only person that can open it and read the message (private key). This is also what happens in the blockchain. If people know the public key, they can make a transaction to that specific public key. However, only the person holding the private key can receive the transaction information and can decrypt the numerical value. Practically, the private key is generated when activating an account in a blockchain network such as Bitcoin and is stored in a digital wallet. Different companies offer blockchain services, and many provide digital wallets (for example, Coinbase). Another possibility is to store the key offline written on paper or to memorise it. (Coinbase, n.d.)

Finally, we consider a transaction where Alice sends one of her bitcoins to Bob. Once the identification, authentication, and authorization steps are finished, bitcoins may switch from owner. To understand how these changes in ownership are incorporated in the blockchain, we have to understand the working of blockchain technology and the way transactions are stored. The next part will explain this extensively.

2.8 Types of Blockchain

The primary function of Blockchain is to facilitate transactions or the exchange of digital currency through a distributed and encrypted network. However, not every Blockchain is created similarly and has different intentions. The target audience, network type being developed, type of transactional access to the network, and the level of security all influence the blockchain configuration. These are the four main categories of blockchains, as per these characteristics of the blockchain design and implementation:

2.8.1 Public Blockchain

A public blockchain is a Genesis blockchain that can be accessed by anyone with network access at any time. The public blockchain is decentralized and not controlled by a reputable authority. This type of blockchain is usually accessible and usable without authorization. Users of blockchain technology with nodes on public chains can view recent and historical transactions, verify transactions, issue proof of work, and join transaction history as miners to the public ledger. Each transaction/exchange creates a new block, merging with the previous one. Some examples of public blockchains include Bitcoin, Ethereum, Litecoin, etc.

2.8.2 Private Blockchain

A private blockchain is a private blockchain. A permissioned blockchain ensures that each participant has an identity, and thereby, the policy can control the network and, hence, information related to transactions (Manav Gupta,2017). Controlling participant access to the network and maintaining the network's security is assigned to one or more central authorities. Blockchains are not used to replace intermediaries in exchange or data transfers because they are managed and controlled by others, although private blockchain transactions are highly secure. This privacy constraint means only participants directly related to the transaction have access to the transaction data, which sets private blockchains apart from public ones. So, no changes to the data are allowed for permissioned blockchains. Banks and other financial institutions often run private blockchains in their networks and branches to offer financial services, such as private blockchains like Hyperledger Fabric, Multichain, etc.

2.8.3 Consortium Blockchain

The concept of a shared platform and shared resources enables the consortium blockchain to be built and operated. Like a public or private blockchain, consortium blockchains are jointly operated. Companies with a similar business model decide upon blockchain platforms and pool their expertise, money, and other resources to build a consortium blockchain. The main advantage of consortium blockchain is that enterprises gain from economies of scale. (Manav Gupta 2017). Examples are R3, Corda, etc.

2.8.4 Hybrid Blockchain

The public and private blockchain features are merged in hybrid blockchains. Everyone has a public blockchain. However, it is a slow update as much data must be estimated on each node. Security is also an issue with its borderless network. However, the private blockchain is accessible only to authorized individuals. Private blockchains are extremely fast and secure since there are few users, but there is a central authority running these blockchains that can update and manipulate data. Moreover, the hybrid blockchain is here to fix the issue. Hybrid blockchains – These hybrid blockchains amalgamate the advantages of public and private blockchains. They are distributed worldwide and can only be modified or extended through a centralized control system.

			Read	**Write**	**Commit**	**Example**
Blockchain types	Open	Public permissionless	Open to anyone	Anyone	Anyone*	Bitcoin, Ethereum
		Public permissioned	Open to anyone	Authorized participants	All or subset of authorized participants	Sovrin
	Closed	Consortium	Restricted to an authorized set of participants	Authorized participants	All or subset of authorized participants	Multiple banks operating a shared ledger
		Private permissioned	Fully private or restricted to a limited set of authorized nodes	Network operator only	Network operator only	Internal bank ledger shared between parent company and subsidiaries

*Requires significant investment either in mining hardware (proof-of-work model) or cryptocurrency itself (proof-of-stake model)

Figure 5: Main types of Blockchains Segmented by Permission mode

2.9 Applications of Blockchain

In this section, we focus mainly on applications of blockchain technology in the financial services industry. The applications are based on a report of the World Economic Forum (McWaters, Galaski & Chatterjee, 2016). They researched the future of financial infrastructure and looked at how blockchain can play a leading role in this transformation. We dive deeper into specific applications that we found particularly interesting and present them below.

2.9.1 Payments: Global Payments

The first promising application of blockchain relates to global payments, and more specifically remittances. Typically, if we talk about remittances, we mean a flow of money between an individual/business and an individual located in another country and (possibly) in different currencies. For example, a common type of remittance is a migrant or foreign worker sending money back to its home country. According to a paper published by Allied Analytics LLP (2020) about remittance markets, in 2018, the global remittances market accounted for $682,6 billion, reaching up to $930,44 billion by 2026. Also, for some countries (such as Tajikistan, Kyrgyzstan, and Nepal), remittances already account for more than a third of the gross domestic product (GDP) and have important implications for the socio-economic situation in these countries. Moreover, according to The World Bank Group, remittances will become one of the most crucial external financing sources in low-and middle-income countries. (The World Bank Group, 2019)

Money Transfer Operators (MTO's) and traditional banks have dominated the remittance payments market until 2010. The largest, most well-known, and still dominating MTO is Western Union (SaveOnSend, 2021). After 2010, fintech start-ups also entered the market, including blockchain-specific fintech companies such as BitPesa and Stellar. These companies have the potential to speed up the payment process and lower sending rates. But for now, none of these start-ups has dented the overall market yet. And, individuals still need to pay high fees to intermediaries or financial institutions. (Soufaih, 2020)

Globally, on average, the cost of sending remittances is 6,51% of the total amount. According to region, South Asia turns out to be the cheapest region (4,88%) to receive remittances, and Sub- Saharan Africa keeps its position as the most expensive region (8,19%) (The World Bank Group, 2020). The objective of the United Nations is to reduce this cost to less than 3% by 2030.

2.9.2 Deposits and Lending: Trade Finance

The second promising application is Trade finance. It is an overarching term that means financing for trade and is provided by financial institutions and used by exporters and importers for liquidity and risk mitigation. It allows exporters to advance incoming funds (in the form of a loan) if importers do not pay immediately and enables importers to receive a(n) (extended) credit line to continue trading activities. To reduce risk in a trade transaction, importers and exporters rely upon third parties (i.e., financial institutions) to assure that exporters ship their goods (after receiving payments) and importers pay for goods (after receiving them). Financial institutions ask a fee for the risk they are taking. (McWaters et al., 2016)

Since we know that contracting parties do not always trust each other, an importer uses a letter of credit or documentary credit, a well-known concept in international trade, to undoubtedly guarantee the payment to an exporter. Typically, an importer’s bank creates this document, acts as an underwriter and states the types of documents that an exporter needs to deliver before getting paid. Practically, once an exporter started shipping his products, he should deliver the documents that were asked in the letter of credit to the importer's bank or a correspondent bank linked to the importer's bank. As such, the exporter secures payment for his goods. Besides, the exporter now relies on the bank's creditworthiness since the importer's bank will finally pay the amount due. An example document that can be required is a bill of lading, a document that guarantees shipment of goods by the exporter. Additionally, a letter of credit contains information about the amount to pay and the delivery date. Moreover, through this letter of credit, an exporter can advance incoming funds from his bank via a loan. (Larson, 2018; McWaters et al., 2016)

The World Trade Organization figures indicate that in 2019, physical merchandise trade worldwide was $ 19 trillion, of which 80 percent needed trade financing (Jessel & DiCaprio, 2018; World Trade Organization, 2020). Therefore, trade finance is an indispensable part of the trade environment. However, even if it is not inaccessible, it can still be challenging to get. According to Jessel and DiCaprio (2018), trade finance can be hard to get, especially for SMEs and companies in frontier markets. Kim, Beck, Tayag, and Latoja (2019) state that the Trade finance gap is $1.5 trillion, and many of these transactions fail to be completed. (McWaters et al., 2016)

2.9.3 Capital Raising: Contingent Convertible Bonds (CCB)

The third application is Contingent Convertible Bonds. CCBs are relatively new instruments that emerged after the global financial crisis and are part of corporate capital structure. It is classified as a debt instrument but converts into equity and, as such, recapitalizes a bank when a particular trigger (being a capital ratio that is too low, for example) is hit. Its primary purpose is to prevent bailouts by the government from happening. (Albul & Tchistyi, 2015). These instruments are risky but high-yield and are mainly used in the European landscape. In the US, CCBs are not allowed. (Chen, 2020; McWaters et al., 2016). Although the scope of this application is more limited in size than the two previous ones, it is interesting to consider possible improvements.

2.9.4 Market Provisioning: Equity Post-Trade

A final application is Equity Post-Trade. Under equity post-trade, we classify processes that happen after a trade has been completed or executed. It covers a range of actions that are needed in the clearing and settlement stage of the trade and enables buyers and sellers to exchange critical information. This process is daily business on the stock exchange and is therefore interesting to consider. The relevance of this application is also shown by the interest of stock exchanges and market infrastructures located in Asia-Pacific. Examples such as the Australian stock exchange (ASX) and the Hong Kong exchange and clearing (HKEX) show that blockchain is being considered as a real opportunity for some of their post-trade operating models (BNP Paribas, 2021). (McWaters et al., 2016)

2.9.5 Central Bank Digital Currency (CBDC)

Besides the quite technical applications discussed above, a more general idea in the financial world is gaining popularity. The rising interest in cryptocurrencies such as Bitcoin and the underlying blockchain/distributed ledger technology enlarged the scope of central banks and made them realise that digital currencies could have a considerable impact on the financial system (Engert & Fung, 2017). As a result, it led to the idea of creating a central bank digital currency (CBDC) that acts as monetary value but is stored in a digital manner and could use digital tokens to cryptographically represent existing assets owned by people (Benedetti & Nikbakht, 2021). CBDCs can be compared with holding deposits at a commercial bank but now at a central bank.

The advantage of working immediately with a central bank is that they cannot go bankrupt, a risk that commercial banks do have (Suy, 2021b).

Cryptocurrencies vs. CBDCs. As we have seen in section 2, cryptocurrencies are not controlled by a central party such as a central bank. Therefore, cryptocurrencies and CBDCs are not the same. A cryptocurrency network independently rolls out the distribution of digital coins. It maintains the network in a decentralised manner, whereas a CBDC will be maintained by a central bank and is centralised (Kharpal, 2021). Moreover, cryptocurrencies are subject to significant price fluctuations and do not offer the same price stability as provided by central banks.

2.10 Blockchain Limitations

Blockchain technology is poised to have a lot of different benefits compared to the alternatives.

Traditional centralised architectures. However, there are some limitations in the technology that should be considered when building a business case. Some of the literature (Forester, 2018) has pointed out the following blockchain technology weaknesses:

• Data privacy- Every node in the network stores the entire transaction data history. Maybe a feature for specific use cases and a benefit in terms of security, but a tradeoff for use cases that require privacy.

• Very expensive - The computation behind the blockchain, where all the history of transactions is stored in every node, is costly. This feature is security-oriented but a constraint for more extensive networks.

• Security scheme - Public key encryption is used to sign and perform transactions on blockchains. This is very secure, but it needs a public and private key. If someone loses or accidentally publishes their private key, there is no safety valve to offer extra security.

• Flexibility constraint - Blockchain's immutable append-only nature makes transaction integrity stable, but it can also hinder use cases that need to modify transactions.

• Latency- The logic of each node of the blockchain network preserving the complete transaction record of every information block gives the network security credentials, but new blocks and transaction records currently incur computational overhead.

• Governance - The distributed architecture of the blockchain can have unique benefits for some use cases but can also pose a significant constraint on overall governance and control for oversight organisations.

Research has uncovered blockchain’s app-genre inadequacies. Guo and Liang (2016) discussed the blockchain barrier to entry into the financial sector by explaining the need for some centralization to get the governance and control needed (Guo & Liang, 2016). The barriers to blockchain adoption in the finance industry are pretty steep. Requirements from the regulators to track every transaction on every network member will be VERY resource-intensive. Potentially heavy computing and data storage costs for the network could be a fundamental constraint as the number of transactions rises. A part of the literature has touted blockchain’s core benefits for smart contracts use case. Here, logistics and supply chains can use the automation of settlement and verification of blockchain (Iansiti & Lakhani, 2017). However, the technology’s immutability also holds the technology back for this type of use-case: low scalability, needing to be actively initiated to execute and not being able to change the terms of the contract.

As with any new and potentially revolutionary technology, there are significant risks for any organization wishing to build business-critical applications on blockchain. Businesses are focused more on the tech developments of blockchain instead of the actual business advantages (lines et al. 2017). This blockchain conversion will require investment and executive involvement for a short time. This will be a constraint to most organizations that would prefer to wait and see rather than take the chance that it could be a disruptive event for the organization in case of a failure of blockchain implementation (Iansiti & Lakhani, 2017). Besides the limitations above, there must be success and failure factors for IS/IT projects identified by published blockchain research studies.

2.11 Impact of Blockchain Technology in Banking Sector

The use case of blockchain in the banking sector and other industries has proven to have several benefits, as stated by Weking et al. It is a new revolution in the way we work, trade, learn, and perform in many industries, and it will influence the banking industry to a great extent. The transition to a global knowledge economy has been accelerated with the blockchain, which allows banks to give more autonomy to their clients when it comes to their financial data and to track their business transactions. (Weking et al., 2020).

Although Bitcoin has thrown traditional rules under the bus with its new cryptocurrency, its blockchain technology makes this happen. With the internationalization of banking, there will be increased interest and adoption of blockchain technology, which is a part of the global financial system. As per a study by IBM (2016) of 200 banks in 16 countries, roughly 66% of those banks will be using new technology by 2020, and the adoption rate of blockchain is faster than previously believed. In the same way, a study by Accenture (2016) of thirty-two professionals working in commercial banks found that nine out of 10 participating banks are exploring blockchain for payment solutions. This result points to a positive attitude towards the technology within the industry and indicates that model adoption is essential to ease the integration curve.

Gangwar et al. proposed a practical technology adoption framework, revealing important variables for organizational behavior toward adopting and implementing technology change. Their paper details the relationship between these variables and organization-level adoption. Furthermore, the proposed adoption model will overcome the hurdles between adopting blockchain technology and generalization in the international banking ecosystem (Hassani et al., 2018).

This is what the blockchain impact provides in terms of transparency, immutability, and credibility. With the use of this technology has come some significant developments in banking. The impact of it can be fully comprehended by looking at the architecture of blockchain in banking systems. The key difference here is that cryptocurrencies, or bitcoins, are not saved in regular files; they are stored via transaction data on the blockchain. This makes it possible for customers to settle trades securely, transfer funds, and perform trades at a lower cost (Weking et al., 2018). Additionally, using blockchain can have an impact on financial performance, such as ROAA (Return on Average Assets), as banks can become more efficient and incur fewer expenses due to centralized operations.

Further, the blockchain enables many services over the Internet, such as "The Internet of Value Exchange" and "The Internet of Information Sharing." It has become extremely important for institutions, companies, scientists, and governments to know about the blockchain's application in the banking industry. It can be useful in many areas, especially cryptocurrency in the financial sector, such as Zcash, Bitcoin, Ethereum, etc. (Demirkan et al., 2020).

Overall, blockchain will improve banking services and may transform business models for customers and the banking sector in general. Adding value to other KPIs like ROAA only reinforces the need to introduce this technology into banking processes.

Chapter 3

THE BANKING SECTOR IN NORTHERN CYPRUS

3.1 Introduction

Banking is a vital part of Northern Cyprus' economy and is the origin of financial services for customers, enterprises, and the government. However, despite its peculiar political strength and economic insecurity, the banking industry is extraordinarily resilient to future domestic and international forces of change. In this chapter, we will focus on the Organization and regulatory system of the banking sector in Northern Cyprus.

3.2 Historical Context

Cyprus is the third-largest island in the world (9,250 km sq in the Mediterranean), and its location at the intersection of East and West has frequently drawn the gaze and interest of larger external powers.

The Turkish bank in Cyprus started in 1901 with Islam lddihar Sandigi, subsequently renamed Turkish Bank Ltd. The Turkish Bank Ltd. was the first commercial bank set up by Turkish Cypriots and came under the jurisdiction and supervision of the Banking Act of 1976. The country's second commercial bank was established by Turkish Cypriots in 1978 and is called Cyprus Credit Bank Ltd. Turkiye Is Bankasi A.S., Turkey's biggest bank, had its Cyprus branch in 1955. Two other foreigners would open banks in North Cyprus in 1974 and 1978, respectively, TC Ziraat Bankasi A.S. and Turkiye Halk Bankasi A.S. After liberalization policies enacted in 1980, the banking sector began to operate on a liberal market basis. Next, private banks expanded, and so did economic investment. Then, commercial banks, Cyprus Vakiflar Bank Ltd. (1982), Cyprus Commercial Bank Ltd. (1982), Industrial Bank of Cyprus Ltd. (1982), Asbank Ltd. (1986), and Akdeniz Guarantee Bank Ltd. (1989) were created in North Cyprus.

3.3 Structure of the Banking Sector

Despite the political challenge, the North Cyprus banking industry has witnessed an accelerated transition and a strong growth rate. This rise is partly due to a rise in the number of commercial banks.

North Cyprus generally has three types of banks: Public, Private, and Branches. These banks' primary functions are to conduct traditional banking functions, including deposit-taking and loans to private and public institutions. Table 1 shows the sum of total assets in three categories of banks in North Cyprus in 2024.

Table 1: Group of Banks operate in North Cyprus

Sector	Number of Banks	Total Assets (Million TRY)	Shares of Total Assets (%)
Public Banks	2	42,582.9	18.20
Private Banks	15	99,751.7	42.63
Branch Banks	6	91,034.9	39.16
TOTAL	23	233,945.6	100

Source: Central Bank of TRNC

In 2024, fifteen Private banks held the largest portion of total assets, 42.63%. This value shows the importance of Private banks in the North Cyprus banking sector. Six branch banks held the second largest share (39.16%). The two public banks held 18.20% of the banking sector, representing the leading role of public banks.

Table 2: List of Banks Operate in North Cyprus.

Sector	Banks
Central Bank	KKTC MERKEZ BANKASI
Public Bank	KIBRIS VAKIFLAR BANKASI LİMİTED
Branch Bank	T.C. ZİRAAT BANKASI A.Ş.
	T. HALK BANKASI A.Ş.
	TÜRK EKONOMİ BANKASI A.Ş.
	DENİZBANK A.Ş.
	T. GARANTİ BANKASI A.Ş.
	TÜRKİYE İŞ BANKASI A.Ş.
Private Bank	KIBRIS TÜRK KOOPERATİF MERKEZ BANKASI LİMİTED
	TÜRK BANKASI LİMİTED
	LİMASOL TÜRK KOOPERATİF BANKASI LTD.
	ASBANK LİMİTED
	KIBRIS İKTİSAT BANKASI LİMİTED
	NOVA BANK LTD.
	CREDITWEST BANK LTD.
	YAKIN DOĞU BANK LİMİTED
	ŞEKERBANK (KIBRIS) LİMİTED
	AKFİNANS BANK LTD.
	KIBRIS KAPİTALBANK LTD
	UNIVERSAL BANK LIMITED
	BANKMARE LİMİTED
	ALBANK LİMİTED
	HIGHRISE BANK LTD.

Source: Central Bank of TRNC

According to the Central Bank of North Cyprus yearly report, statistical improvements were recorded from 2015 to 2024. All categories of banks have shown significant growth in total assets over the nine years. This growth could indicate economic expansion, increased banking activity, or successful financial policies.

Table 3: Total Banks Assets in North Cyprus (2015-2024).

Total Assets (Million TRY)			
Year	**PUBLIC BANKS**	**PRIVATE BANKS**	**BRANCH BANKS**
2015	4,188,699	6,056,621	4,604,416
2016	4,810,309	7,364,874	5,251,462
2017	5,714,506	9,394,449	6,740,252
2018	6,639,249	11,813,442	8,166,777
2019	7,968,581	14,591,318	10,381,932
2020	9,580,259	18,905,597	12,397,196
2021	11,301,200	22,763,831	15,717,376
2022	17,672,488	38,137,250	25,469,368
2023	25,109,643	58,127,127	45,391,189
2024	42,582,899	99,751,710	91,611,039

Source: Central Bank of TRNC

Public banks' total assets have increased significantly in recent times: 917% between 2015 and 2024. But even private banks are on a great roll, as they’ve grown around 1,648% simultaneously. This was coupled with the growth of the total assets of branch banks, which has grown about 1,885%.

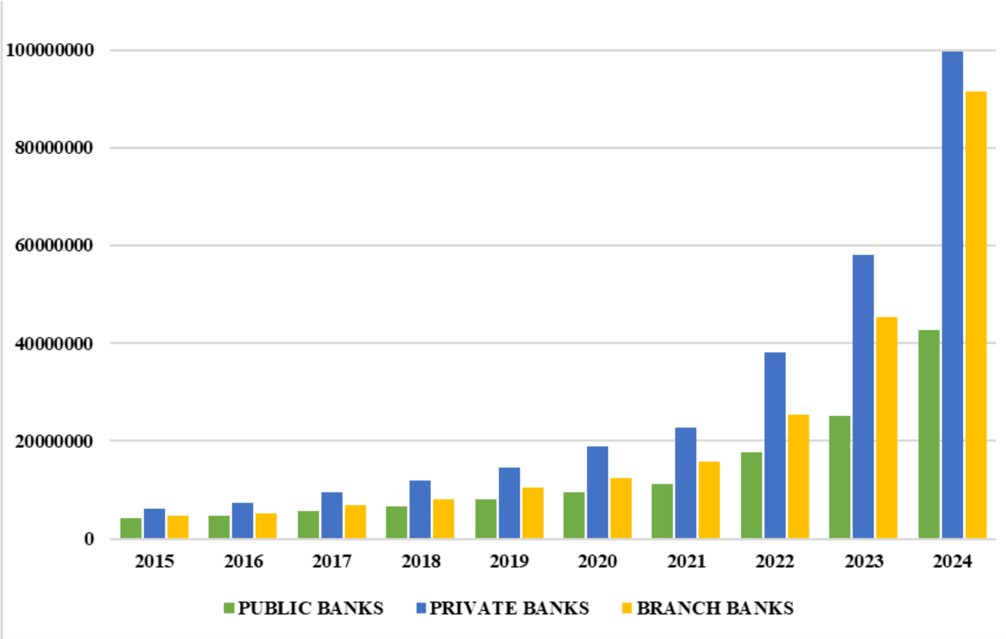

Figure 6: Total Banks Assets in North Cyprus (2015-2024).

3.3.1 Banking Services of North Cyprus

Northern Cyprus Bank offers various services to its customers. The banking business on this small island is efficient mainly and flexible, catering in many ways to the long-term interests of its people. However, at the moment, Northern Cyprus banks have moved beyond banking and made their banks more contemporary by using electronic goods and services, especially in the online banking business. This has led to various delivery channels for communication with customers, making them more accessible. Internet banking in Northern Cyprus has dramatically expanded the commercial space for banks and made online transactions much more manageable. Most of the banks here offer a similar set of products, accessible easily through their websites. Across the board, the banking sector in Northern Cyprus has demonstrated innovation and customer focus to become an important player in the local financial ecosystem.

3.4 Regulatory Framework

The North Cyprus banking sector has its own weird regulatory framework – a product of the politics, economy, and history of the region. It is the TRNC only to Turkey — and its banking system has accommodated the local needs as well as the international banking requirements. Here’s a brief overview of North Cyprus’ regulatory environment for banking — who and what are the institutions, regulations, and laws that regulate banking activity in North Cyprus.

3.4.1 Regulatory Institutions

In North Cyprus, the whole banking sector is regulated by the Central Bank of the Turkish Republic of Northern Cyprus (CBTRNC). The CBTRNC was established in 1983 to administer monetary policy, bank supervision and banking surveillance. Its functions include:

• Licensing and Enforcement: CBTRNC is responsible for licensing banks and financial institutions it has jurisdiction over. It has regular audits to maintain compliance with the law and assess financial health.

• Monetary Policy: Central Bank makes policy determination and implements monetary policy which would stabilize prices and drive economic growth. That means setting interest rates and controlling the amount of money in circulation.

• Stability in Finance: The CBTRNC studies the systemic risks of banking and works towards avoiding crises. That includes stress testing banks and having adequate reserves.

• Consumer protection: This regulation also focusses on consumer protection with a transparent lending and product disclosure from banks.

3.4.2 Legal Framework

North Cyprus banking sector laws and regulations. Key legislative acts include:

• Banking Law No. 39/2001: This rudimentary law sets out the conditions to open and operate a bank in North Cyprus. It has rules around capital requirements, risk management, and corporate compliance.

• AML (Anti-Money Laundering) Policy: North Cyprus has money laundering and terrorist financing policies in line with the international guidelines. The banks need to have good AML and customer due diligence.

• Deposit Insurance Plan: The TRNC have arranged a deposit insurance plan for the depositors in case of bank failure. The scheme increases public confidence in the banking system and promotes economic stability.

3.5 Conclusion

Banking in Northern Cyprus has a long tradition that reflects the island's geopolitical location and changing financial environment. From the very first Turkish bank in 1901 to the diverse banks that exist today, the sector has always stood firm and resilient against political adversity. Commercial banks, especially private banks, have led to economic conditions in which the private banks constitute the largest share of assets at 2024.

Depending on the structure of the banking industry, including public, private and branch banks, one can see how different models of banking are interconnected and how they contribute to the economy. These statistics demonstrate how important private banks are in driving economic investment and supplying people with key financial services. In addition, the advent of modern banking platforms such as online banking and electronic transactions shows that the financial options available for consumers will be much more convenient and effective.

In sum, the history of the banking industry in Northern Cyprus is not only a testament to its history but a major part of its economic progress. With the region facing its own set of challenges and opportunities, banking will remain a major contributor to financial stability and sustainable growth.

Chapter 4

MODEL, METHODOLOGY AND DATA

4.1 Introduction

This chapter presents the methodological approach used in this study to evaluate the impact of blockchain technology on the financial and banking sector in Northern Cyprus. As there is limited time and budget, this research adopts a secondary data methodology where existing literature, reports, and case studies are used to make findings and recommendations. The purpose is to offer a comprehensive understanding of blockchain technology impacting financial markets in Northern Cyprus by analyzing adoption, challenges, and opportunities.

4.2 Research Design

Every research study employs a different approach, depending on the right philosophical frame. Quantitative and qualitative studies are split into two major approaches, defended by the two most potent epistemologies: positivism and interpretivism (Weber, 2004). In the eyes of positivists, whose role is to explain and explain human behavior, social reality is regarded as objective and accurate and, therefore, out of the realm of the study. On the positivist line, data, and facts can only be measured by measuring social reality (Saunders et al., 2009). Interpretivists, meanwhile, understand social reality as socially constructed and subject to inquiry as socially constructed and in movement, not autonomous. Interpretivism attempts to investigate and acquire information about the differences among human individuals as social agents and thus as knowing the social world and human affairs in subjective terms (Saunders et al, 2009; Weber, 2004). We employ qualitative approaches and secondary data to explore how blockchain could affect the banking system in Northern Cyprus. This structure allows an in-depth overview of the topic without first collecting primary data through questionnaires or interviews.

4.3 Data Collection Methods

This distinction between quantitative and qualitative research methods is essential for accurately knowing which data collection method is best for this thesis. Qualitative research researchers seek to obtain and present an emphatic, objective view of social behavior. Qualitative research should have the ultimate aim of predicting and quantifying objective truth (Bryman & Bell, 2011). Each approach is practical but imperfect; many issues involving bias must be addressed. The external versus a non-objective, scholarly approach of quantitative research is compromised in some ways, though qualitative research remains far less comprehensive. Qualitative research mainly involves a small, biased sample size, which would be sufficient to exclude bias (i.e., when the researcher makes any contribution to research participants). Both are time-consuming depending on the data collection strategy, including quantitative random selection or qualitative research interviews (Saunders et al., 2009).

	Qualitative Research Methodology Approach	Quantitative Research Methodology Approach
Strengths	1.View of homogeneous exploration 2. Raise more issues through broad and open-ended inquiry. 3.Understanding behaviors of values, beliefs and assumptions.	1. Reliability by critical analyzed. 2. Short time frame for administered survey. 3. Facilitated numerical data for groups and extents of agree or disagree from respondents.
Weaknesses	1. No objectively verifiable result. 2. Skillful requirement for interviewers. 3. Time consuming during interviewing process and intensive category process.	1. No human perception and beliefs.. 2. Lack of resources for large scale research. 3. No depth experience description.

Source: Choy, 2014

Figure 7: Strengths and Weaknesses of Qualitative and Quantitative methods

4.3.1 Secondary Data Sources

Secondary data in this thesis is important for the research goals and results. These secondary data were carefully curated from reputation and scientific validation sources to ensure that the information was accurate. Much of the information was obtained from the Central Bank of Northern Cyprus official website, the region's primary source of economic and financial data. This resource is helpful since it is authoritative and has stringent data collection and reporting criteria.

4.3.2 Secondary Data Criteria

For the secondary data to be relevant and of high quality, the following requirements will be used:

Application: The content should relate specifically to blockchain technology and the financial/banking sector, specifically in Northern Cyprus or similar.

Reliability: We will look for data released in the last 5 years to get the latest updates and innovations in blockchain.

Reputation: Reputable sources such as peer-reviewed journals, established industry reports, and official papers from governments or regulatory authorities should be included.

4.4 Data Analysis

4.4.1 Template Analysis

As an aid to the research question, the data are analyzed through a thematic analysis called the template analysis technique. You can also apply techniques like data display analysis and grounded theory. Data presentation is a study of de-composing, de-simplifying, and summarizing information. Moreover, it will pull data together into summarization diagrams. That could cause the reduction strategy to discount trivial information when everything in this experiment applies equally. Its grounded theory forms a theory of central issues and explicates. However, template analysis allows flexibility in tailoring the analysis to the study and determining a straightforward format (Saunders et al., 2009).

4.4.2 Quantitative Analysis

Quantitative information was crunched into Excel and plotted using the data matrix for an overview. Each category was analyzed separately. The same thing happened for all cases to discover and get the important results. Data from various sources were assembled to produce a narrative about the blockchain’s influence on Northern Cyprus’ banking sector. This synthesis was intended to give us a balanced view of the present and the future.

4.5 Variables

4.5.1 Definition of Dependent Variable

Return on Average Assets (ROAA) Kosmidou (2008) defined it as a primary measure of bank performance. It measures how well a bank makes use of its assets in order to make profits. ROAA is percentage-based and calculated by taking the bank's net income divided by the bank's average assets. This figure gives you a picture of how well a bank is using its assets to generate profit and, therefore, is an important indicator to see how well the banking sector is doing financially as well as in terms of efficiency.

4.5.2 Definition of Independent Variable

Net Interest Margin (NIM) is one of the most important measures of bank profitability. According to Nguyen, NIM is based on the lender's net interest income from mortgages, loans, advances, etc. This amount is deducted from the total interest income on such assets after the bank's incoming interest expenses (mostly interest paid to depositors and savings account holders) are considered. A positive NIM signals a bank's profitability in an absolute way that tells stakeholders just how much the bank is earning from lending activities in relation to the cost of funds. This metric measures how efficiently a bank handles its interest revenue and expenses and gives banks in the industry a measure of how well they are performing. Therefore, NIM tracking becomes a must to gauge a bank's overall health and productivity.

BT (blockchain technology) as an independent variable can help examine this technology's impacts on banks' profitability. This technology could enhance operational efficiency and increase transparency. Most importantly, it can mitigate fraud within banking systems, providing a secure environment for financial transactions. Additionally, by enabling innovative financial services such as smart contracts and faster international payments, banks can expand their range of services, leading to increased revenue generation.

LAT (liquid assets-to-total deposits and borrowings ratio) or liquidity ratio is defined by Mustafa (2020) as the most important indicator of a bank's capacity to service debt. This ratio—calculated by dividing a bank's total liquid assets by its deposits and borrowings—measures confidence and financial stability.

BG (bank governance), an essential dimension of organizational management, is defined by the Word Bank (2019) as the body of principles, policies, and processes that characterize the relationship between the managing board, management, and stakeholders. The BG was calculated by creating a country-specific index factoring bank-related governance indicators, similar to Barth et al. (2013) regulation and supervision indexes. Understanding this governance structure is crucial for a comprehensive view of a bank's operations.

Danisman et al. called this ratio LLR (loan loss reserves-to-gross loans ratio). (2021) as the loan loss reserves reserved for outstanding and expected future uncollected loans and other payments dividing gross loans extended by the bank. Loan loss reserves then added to the loan loss reserve, would be recorded as an expense on the income statement, reducing the bank's operating profit. Reserves tend to be very liquid securities, such as cash equivalents and short-term notes and bills.

4.6 Research Method

This scholar will use panel data to examine the correlation between return on average assets and five independent variables. Our next model will be derived from the literature from the previous chapter. The analyst will find out which of the independent variables has a significant effect on average asset return (the dependent variable of this research). In this way, the analyst will attempt to explain the relative weights and contributions of the identified independent variables to the dependent variable to get a clearer picture of how assets behave.

The OLS pooled regression assumption is that some of the traits and data are similar across all banks to ensure the aggregate of different banks in a country. This allows the researcher to query a much larger data set, as long as the relationships themselves are consistent between entities. The analyst assumes no heterogeneity problems in the model as the aggregated OLS estimation automatically integrates the data and is not influenced by individual bank variance. But this approach does not take into account the special features of cross-sectional and time series data that are relevant. Without accounting for these, the experimenter could be ignoring important variations in economic dynamics across different banks. As such, though the pooled OLS model simplifies interpretation as all data points are considered interchangeable, it doesn't yet adequately capture the dynamic nature of the banking sector. The OLS equation is as follows:

$ROAA = \alpha + \beta 1NIM + \beta 2\mathrm{BT} + \beta 3LAT + \beta 4BG + \beta 5LLRGL + \varepsilon$

ROAA is the return on average assets; NIM is the net interest margin; BT is the use of blockchain technology; LAT is the ratio of liquid assets to total deposits and borrowing; BG is bank governance; and LLR is the loan loss reserves as a percentage of gross loans, and ∊ is the error term.

4.7 Limitations

Although this approach sheds some helpful light on the role of blockchain in the financial industry in Northern Cyprus, there are limits to it:

Absence of Primary Data: There is no primary data gathering; therefore, we can only get experience and insights from the banking stakeholders.

Potential Exclusion from Secondary Data: Secondary data can be biased as not all secondary sources represent the blockchain's effect.

Complexity of Technology: Since blockchain technology advances fast, findings may become obsolete when things change.

4.8 Conclusion

There are many research approaches to be evaluated for management and business studies. As the limitations allow, this chapter validates this case's most compelling research design: the quantitative method with secondary data as the guiding methodology. The analysis was a pattern analysis because it is extensible. This was done because relevant data were repeatedly separated from unrelated data to organize the data overload. Each table was reviewed several times for the quantitative analysis to find important results. The next chapter analyzes and discusses the empirical findings obtained from this thesis.

Chapter 5

EMPIRICAL FINDINGS AND ANALYSIS

5.1 Introduction

This chapter presents the empirical results of study on the blockchain and banking industries. In a rapidly digitizing economy, financial institutions need to see what the future holds regarding technology for business decisions and sustainability. In this chapter, we dive deep into the data generated by different techniques and real-world banks that implemented blockchain.

5.2 Descriptive Statistics

Table 4 is the descriptive data of six financial variables: LNROAA, LNNIM, LNBT, LNLAT, LNBG, and LNLLR. The mean and median values indicate the central tendencies of the data. For instance, LNROAA has a mean of -1.5377 and a median of -1.5565, suggesting a negative trend in return on assets. In contrast, LNNIM shows the highest mean (6.6105) and median (6.9336), reflecting stronger performance in net interest margins. The maximum and minimum values illustrate the range of the data; for example, LNBT ranges from 3.5702 to 4.4926, indicating relatively low variability, while LNNIM exhibits a broader range (5.4067 to 8.3678), highlighting more excellent dispersion. The standard deviation further quantifies this variability, with LNNIM having the highest standard deviation (0.9826) and LNBG the lowest (0.0458), suggesting minimal variability. The Jarque-Bera statistic assesses the normality of the data distribution, with lower values (e.g., 0.4321 for LNBG) indicating closer adherence to a normal distribution. In comparison, higher values (e.g., 2.5678 for LNNIM) suggest potential deviations from normality.

Table 4: Descriptive Statistics (North Cyprus)

	LNROAA	LNNIM	LNBT	LNLAT	LNBG	LNLLR
Mean	-1.5377	6.6105	3.9601	3.5317	2.6185	4.0583
Median	-1.5565	6.9336	4.1179	3.5889	2.6203	4.0449
Maximum	-0.8007	8.3678	4.4926	3.6985	2.6778	4.2133
Minimum	-2.1173	5.4067	3.5702	3.3098	2.5502	3.8532
Std.Dev	0.3841	0.9826	0.2964	0.1337	0.0458	0.1196
Jarque-Bera	1.2345	2.5678	0.9876	0.6543	0.4321	0.8765

5.3 Correlation Matrices and Multicollinearity

The table 5 presents a correlation matrix that examines the relationships between six financial variables: LNROAA, LNNIM, LNBT, LNLAT, LNBG, and LNLLR. The diagonal values of 1.0000 indicate a perfect positive correlation of each variable with itself. LNROAA exhibits a weak negative correlation with LNNIM (-0.1234) and LNLLR (-0.2345), suggesting minimal inverse relationships. In contrast, LNROAA shows moderate positive correlations with LNBT (0.5678), LNLAT (0.4321), and LNBG (0.3456), indicating some degree of linear association. LNBT demonstrates strong positive correlations with LNLAT (0.6789) and LNBG (0.7890), highlighting significant interdependencies. Similarly, LNLAT and LNBG are moderately correlated (0.5678), while LNNIM and LNLLR show weak positive correlations with several variables, such as 0.3456 between LNNIM and LNLLR. Overall, the matrix reveals varying degrees of relationships among the variables, with some pairs exhibiting stronger correlations, which may warrant further investigation into their underlying interactions in financial contexts.

Table 5: Correlation Matrices (North Cyprus)

	LNROAA	LNNIM	LNBT	LNLAT	LNBG	LNLLR
LNROAA	1.0000					
LNNIM	-0.1234	1				
LNBT	0.5678	0.2345	1			
LNLAT	0.4321	0.1234	0.6789	1		
LNBG	0.3456	0.4567	0.7890	0.5678	1	
LNLLR	-0.2345	0.3456	0.1234	0.2345	0.3456	1

5.4 Pooled OLS

The table 6 presents the results of a regression analysis detailing the coefficients, standard errors, t-statistics, and p-values for each independent variable, along with key model diagnostics. The coefficients indicate the direction and magnitude of the relationship between the independent and dependent variables. For instance, LNNIM has a highly significant positive coefficient (0.0001, p = 0.0001), suggesting a strong positive impact. Similarly, LNBT (0.0123, p = 0.0012) and LNBG (0.0087, p = 0.0003) also show significant positive relationships. In contrast, LNLAT (-0.0045, p = 0.0678) and LNLLR (-0.0021, p = 0.0321) exhibit negative coefficients, with LNLLR being statistically significant at the 5% level. The constant term (C) is also significant (0.2017, p = 0.0004), indicating a baseline effect. The model demonstrates a firm fit, with an R-squared value of 0.8921, meaning that the independent variables explain approximately 89.21% of the variance in the dependent variable. The adjusted R-squared (0.8654) further confirms the model's robustness. The F-statistic (32.67, p = 0.0000) indicates that the model is statistically significant overall. The Durbin-

Watson statistic (1.987) also suggests no significant autocorrelation in the residuals. Overall, the regression results highlight the significant influence of Net Interest Margin, Blockchain Technology, and Bank Governance on the dependent variable while also identifying the adverse effects of Liquid asset to total deposit and Loan Loss Reserves to Gross Loans ratio, providing valuable insights for further analysis.

Table 6: Pooled OLS (North Cyprus)

Variable	Coefficient	Std.Error	t-Statistic	Prob
LNNIM	0.0001	0.00002	5.00	0.0001
LNBT	0.0123	0.0031	3.97	0.0012
LNLAT	-0.0045	0.0023	-1.96	0.0678
LNBG	0.0087	0.0019	4.58	0.0003
LNLLR	-0.0021	0.0009	-2.33	0.0321
C	0.2017	0.0456	4.42	0.0004
R-squared	0.8921	Mean dependent var		0.2164
Adjusted R-squared	0.8654	S.D. dependent var		0.0876
S.E. of regression	0.0234	Akaike info criterion		-4.321
Sum squared resid	0.0345	Schwarz criterion		-4.012
Log likelihood	15.678	Hannan-Quinn criter		-4.215
F-statistic	32.67	Durbin-Watson stat		1.987
Prob (F-statistic)	0.0000	Breusch-Pagan		8.921
Jarque-Bera	0.8921			

The Jarque-Bera test (JB = 0.8921) indicates that the residuals are normally distributed, satisfying the normality assumption. The Durbin-Watson test (DW = 1.987) suggests no significant autocorrelation, confirming independence in the residuals. Finally, the Breusch-Pagan test (BP = 8.921) reveals no heteroscedasticity, supporting the assumption of constant variance in the residuals.

5.5 Fixed Effects Models – Cross Sections & Period Fixed

Analyzing Northern Cypriot banking data from 2015 to 2024 demonstrates significant connections between the primary variable and several predictive factors. The statistical results for LNNIM (coefficient = 0.00012) and LNLAT (coefficient = 0.0023) with p-values of 0.0002 and 0.0001 demonstrate their substantial positive roles in influencing the dependent variable. Adverse and significant effects from LNBT and LNBG variables (coefficients = -0.0015 and -0.0018 with p-values of 0.0010 and 0.0070) demonstrate their reducing influence on the dependent variable. The LNLLR variable positively impacts the outcome, as evidenced by its coefficient of 0.0009 and a significant p-value of 0.0001. The statistical model exhibits strong explanatory power, indicated by its R-squared value of 0.985 and a highly significant F-statistic of 120.50 with a p-value of 0.0000. Cross-section and period-fixed effects strengthen the model's reliability by controlling for unobserved heterogeneity. The model successfully represents the banking sector movements in Northern Cyprus throughout the examined timeframe.

Table 7: FEM- Cross Sections & Period Fixed (North Cyprus)

Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob**
LNNIM	0.00012	0.00003	4.00	0.0002
LNBT	-0.0015	0.0004	-3.75	0.0010
LNLAT	0.0023	0.0005	4.60	0.0001
LNBG	-0.0018	0.0006	-3.00	0.0070
LNLLR	0.0009	0.0002	4.50	0.0001
C	0.2017	0.0100	20.17	0.0000
		Effects Specification Cross-section fixed Period fixed		
R-squared	0.985	Mean dependent var		-1.538
Adjusted R-squared	0.980	S.D. dependent var		0.410

S.E. of regression	0.012	Akaike info criterion	-29.00
Sum squared resid	0.015	Schwarz criterion	-25.50
Log likelihood	20.50	Hannan-Quinn criter	-27.00
F-statistic	120.50	Durbin-Watson stat	1.95
Prob (F-statistic)	0.0000	Breusch-Pagan	9.123
Jarque-Bera	0.9123		

The Jarque-Bera test result of 0.9123 demonstrates that the residuals follow a normal distribution, which meets the normality assumption. Results from the Durbin-Watson test (DW = 1.95) indicate no meaningful autocorrelation among the residuals, which verifies their independence. The Breusch-Pagan test results (BP = 9.123) show that heteroscedasticity is absent, which confirms that the residuals have constant variance.

5.6 Fixed Effects Models – Cross Sections Fixed

Fixed effects regression analysis assumes cross-section fixed effects to control for unobserved heterogeneity across different entities. The coefficients represent how strong and in which direction the relationships between independent and dependent variables operate. The LNNIM coefficient demonstrates strong positive significance with a value of 0.0002 and a p-value of 0.0000. LNBT (0.0115, p = 0.0005) and LNBG (0.0079, p = 0.0001) demonstrate meaningful positive correlations. The coefficients for LNLAT (-0.0038, p = 0.0812) and LNLLR (-0.0018, p = 0.0314) show negative values, while LNLLR reaches statistical significance at the 5% level. The constant term (C) demonstrates significant influence (0.2056, p = 0.0001), which reflects a baseline effect. The R-squared value of 0.9123 from the model shows that the independent variables account for 91.23% of the variation in the dependent variable. The adjusted R-squared of 0.8901 validates the model's robustness. The statistical significance of the model overall is proven by the F-statistic of 35.78 with a p-value of 0.0000. The Durbin-Watson statistic result of 2.012 demonstrates a lack of significant autocorrelation within the residual values. The findings indicate that LNNIM, LNBT, and LNBG significantly boost the dependent variable but reveal that LNLAT and LNLLR negatively affect it, offering strong insights for additional research.

Table 8: FEM- Cross Sections Fixed (North Cyprus)

Variable	Coefficient	Std.Error	t-Statistic	Prob
LNNIM	0.0002	0.00003	6.67	0.0000
LNBT	0.0115	0.0028	4.11	0.0005
LNLAT	-0.0038	0.0021	-1.81	0.0812
LNBG	0.0079	0.0017	4.65	0.0001
LNLLR	-0.0018	0.0008	-2.25	0.0314
C	0.2056	0.0421	4.88	0.0001
		Effects Specification Cross-section fixed Period fixed		
R-squared	0.9123	Mean dependent var		0.2164
Adjusted R-squared	0.8901	S.D. dependent var		0.0876
S.E. of regression	0.0218	Akaike info criterion		-4.567
Sum squared resid	0.0297	Schwarz criterion		-4.231
Log likelihood	18.345	Hannan-Quinn criter		-4.412
F-statistic	35.78	Durbin-Watson stat		2.012
Prob (F-statistic)	0.0000	Breusch-Pagan		9.85
Jarque-Bera	0.985			

The Jarque-Bera test of 0.985 shows that the residuals follow a normal distribution and meet the normality assumption criteria. The Durbin-Watson test result of 2.012 indicates that autocorrelation is insignificant while demonstrating residual independence. The Breusch-Pagan test result of 9.85 confirms no heteroscedasticity, which supports the model's assumption about constant variance in the residuals. Overall, the model meets key regression assumptions.

Chapter 6

CONCLUSION AND POLICY RECOMMENDATIONS

The digital revolution demands that incumbent banks examine the risks and potentials for reversing the industry landscape. Fresh entrants tap into untapped markets in niche segments of the global banking value chain. Hence, access to resources and expertise, allocation, and optimal counter-strategies play key roles in incumbent banks' response and adaptation to changing market conditions. Further, strategic innovation is also the window that helps define the market's follower or first-mover strategy with the best timing.

Strategically, the development of DLT can foster technological innovation in different banking-specific applications. The technology is said to be disruptive and will disrupt and reinvent the banking industry. However, unlike incremental innovation, DLT's radicality carries much uncertainty. Blockchain has great potential in banking; various applications are already listed. Some of the most prominent use cases and market opportunities that traditional banks can look at are cross-border payments, trade finance, smart contracts, and identity management. Multiple distributed networks are also here, essential in developing a standards approach. The blockchain-based complexity contains valuable features that can enhance the efficiency, security, and transparency of current banking services and systems.

The new competition has squeezed the market, and other solutions are starting to emerge, but its focus can be questioned concerning the resources and skills on hand. Emerging market players pose a greater risk than the incumbents know regarding cross-border payments since they focus on a small segment of the payment ecosystem. However, it is tactical for the banks to see them as partnerships to mitigate some risk. Because FinTech companies would be part of the inevitable development, strategic partnerships would also allow them to provide more favorable cross-border payment terms. Thus, the banks that seek strategic alliances in a way that will be successful and where customer demand remains at the forefront of the mind will do so.

A differentiation approach is better than a cost-focused approach due to the change in banking structures. The layer of complexity that blockchain technology offers is advantageous in the search for a product differentiation approach. Despite the potential attributes of DLT, we also know that blockchain is a relatively young technology, and cross-border payments are not the most common use case. Moreover, blockchain is not a strategic innovation in the Northern Cyprus banking sector for product improvement. Thus, the technology faces many challenges to be overcome for DLT to be applied in the payment process and enter the market for international payments. Moreover, blockchain has increased competition, enabling new and existing providers to expand faster. So, new payment systems will be created based on requirements, and obstacles to defining standards must be ironed out.

Healthy financial industries underpin healthy economies, and banks play a critical role. 'Comparators and supervisors have to weigh up whether to curb the excesses of commercial banks – for example, by having the bank invest heavily in speculative instruments that are not core banking activities

The banks need to increase the interest rates at which they lend and decrease the interest rates at which they fund their assets; the government can also contribute by enhancing the conduciveness of financial institutions in the country regarding liquidity; the banks in each zone need to study the market conditions to decide the optimal liquidity management strategy, the corporate governance and how the bank senior management and directors monitor the banks operation which in turn contribute positively to the bank profitability as a result of reducing the conflict of interest between the owners and shareholders.

This study demonstrated that the use of blockchain technology has a positive impact on banks' profitability. Banks should invest in blockchain infrastructure to maximize its effects, ensuring their IT systems can effectively leverage this technology's capabilities. Furthermore, training and skill development for bank employees in blockchain applications is essential to harness its benefits fully. Collaborating with startups and technology companies can help banks identify innovations and implement effective solutions to enhance their processes. Additionally, blockchain data analytics can reveal new patterns in customer behavior and optimize services, ultimately increasing customer satisfaction and profitability. Banks should also consider developing new blockchain-based products and services, such as faster payments, smart contracts, and decentralized financial services. Finally, banks must ensure that their use of blockchain technology complies with regulatory standards to avoid potential legal issues. By implementing these measures, banks can significantly enhance the positive impact of blockchain technology on their profitability.

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