Theoretical and Practical Research in Economic Fields

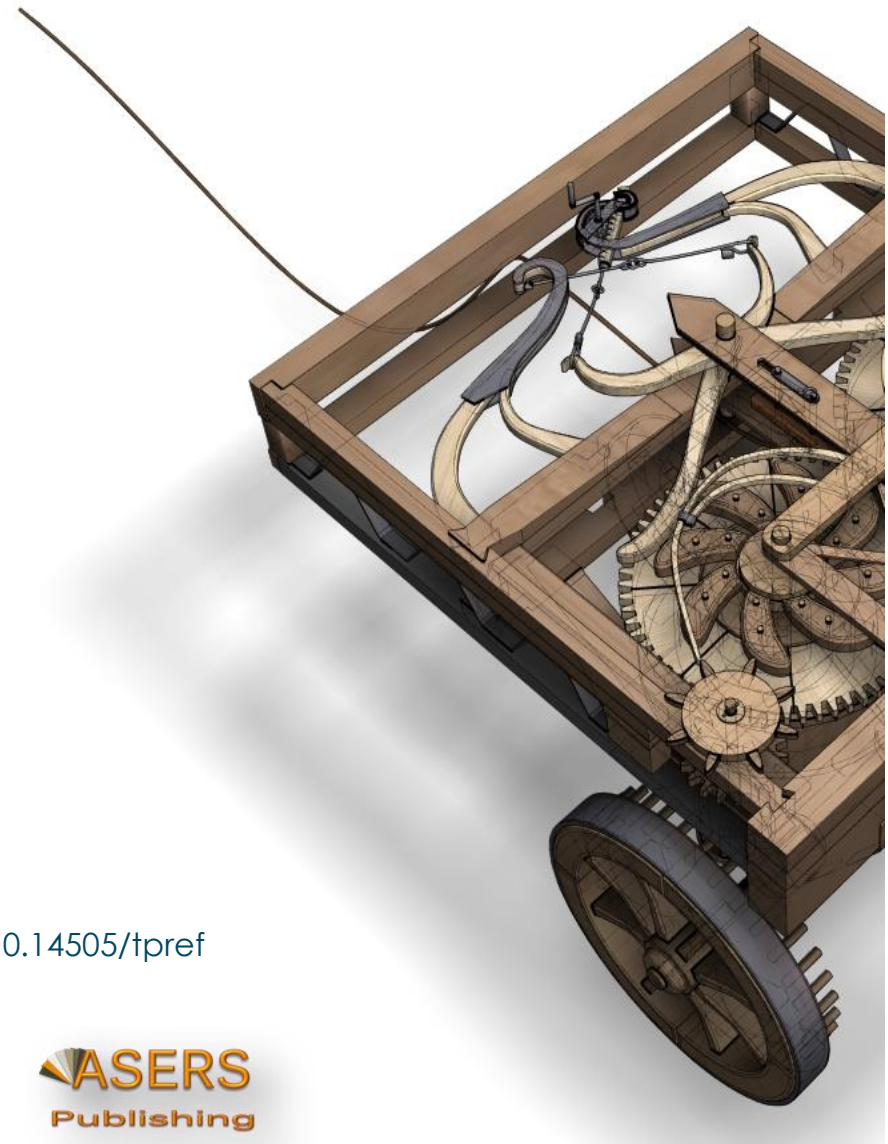

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Table of Contents

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Theoretical and Practical Research in Economic Fields

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Impact of Blockchain Adoption, Regulatory Environment, and Institutional Investor Participation on FinTech Innovation

Ahmad Abdel Rahim ALMESTAREHI
Department of Financial Technology
Faculty of Economics and Business Administrative Sciences
Zarqa University, Jordan
ORCID: 0009-0000-3296-4021
aalmestarehi@zu.edu.jo

Hassan Ali AL-ABABNEH
Department of Electronic Marketing and Social Media
Faculty of Economics and Business Administrative Sciences
Zarqa University, Jordan
ORCID: 0000-0003-1136-8911, Researcher ID: E-8754-2019
hassan_ababneh@zu.edu.jo

Eyad Mohammad MALKAW
Department of Finance and Banking Science,
Faculty of Administrative and Financial Sciences
Irbid National University, Jordan
ORCID: 0009-0009-9660-3140
eyad63jo@yahoo.com

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Abstract: This study investigates how blockchain integration, regulatory policies, and the participation of institutional investors impact fintech innovation in Jordanian fintech companies. A descriptive analytical approach was used to evaluate and summarize the effects of these factors on innovation in the sector. An electronic survey was conducted among 125 administrative personnel working in Jordan's fintech industry. The results indicate a strong presence of blockchain adoption, involvement of institutional investors, and overall fintech innovation in these companies. However, the regulatory landscape in Jordan's fintech sector was found to be moderate. Furthermore, the analysis reveals that both blockchain integration and the regulatory framework significantly influence fintech innovation, with a significance level of 0.05. In light of these findings, the study suggests the creation of strategies to promote blockchain adoption, aiming to enhance efficiency and innovation in the industry.

Keywords: blockchain; fintech; innovation; regulatory environment; investor.

JEL Classification: G20; G17; G18; G30; G38; C01.

Introduction

We go on to benefit from technology in a host of practical ways, thanks to researchers in diverse fields who are making new innovations more efficient, more effective, and more secure. A good example is network technology that gave rise to the Internet by allowing people to share information across time and space. Blockchain tech is relatively new but presents a wealth of opportunities in many domains. Within finance, blockchain is considered to improve financial management and encourages innovation in fintech (Rahim *et al.* 2024). Blockchain technology presents an innovative digital solution for ensuring data integrity by creating a unique data structure through a secure, immutable, and fault-tolerant distributed ledger (Chen, 2024). This technology utilizes encrypted blocks that store transactions and digital events in a sequential order. The fundamental characteristics of blockchain—

immutability, transparency, security, and traceability - position it as a powerful tool for ensuring data integrity, preventing unauthorized alterations, and fostering trust in business and financial transactions. Additionally, Kaur *et al.* (2024) highlighted that blockchain can enhance collaboration among supply chain participants, promoting more efficient cash flow management. Serving as a secure, trustless digital ledger, blockchain stores transactions in an irreversible and transparent manner, making alterations impossible without the consent of the entire network. This removes the necessity for intermediaries, lowering transaction costs, reducing errors, and minimizing the risks of human mistakes or delays. Meanwhile, the concept of the regulatory environment has gained considerable focus from businesses and institutions, as it includes external factors that directly influence an organization's performance, operations, and resources. These external influences can have a substantial impact on organizational outcomes and effectiveness, as highlighted by Al-Tamimi (2021). According to Claudia (2024), Organizations vary in terms of the environment in which they operate. Some organizations face a stable environment with only minor changes in external forces, while others are dominated by a dynamic and active environment. Additionally, the business environment can also influence the emergence of new competitors. It is important to note that the regulatory environment includes all elements outside the organization's boundaries, and these elements may affect the organization as a whole or parts of it.

The regulatory environment typically refers to a specific set of characteristics that shape the work environment within an organization, influencing how individuals perceive and interact with their surroundings and their roles within the organization. These features affect or affect their motivations and behaviours (Bouabidah & Zamouly, 2024). In addition, many researchers and studies have focused on the subject of institutional investors. As Chen & Ganti (2024) explained, pooled investments are organizations that manage investments conducted by individuals or other entities. They usually transact large amounts of financial assets such as stocks, bonds, and other securitized instruments on behalf of their members, executing large trades on the demand of their stakeholders. Institutional investors are favored more than retail investors, as they help by providing crucial information in the price discovery process, mostly via deeper insights into valuations and deeper analyses. Moreover, the fact that they can execute transactions on a vast scale, backed by substantial purchasing power, allows them to have a much greater impact on financial markets in comparison with individual investors (Papaioannou & Karagozoglu, 2017). All of these issues we've discussed have the potential to impact FinTech Innovation. The swift expansion of financial technology (FinTech) has recently attracted considerable focus within the financial industry (Chen *et al.* 2019). Experts widely recognize the transformative potential of FinTech in reshaping financial services by lowering transaction costs, increasing convenience, and enhancing security. Traditionally, FinTech involves the application of technology to efficiently process vast amounts of private or market data, thereby driving the creation, improvement, and evolution of financial products, services, and business models. The term "FinTech" merges "Finance" and "Technology," symbolizing a new era where these two domains intersect to foster innovation in financial institutions (Jain, 2024). As such, this study seeks to examine the impact of blockchain adoption, regulatory frameworks, and institutional investor involvement on the development of FinTech.

The novelty of this article lies in the integrated approach to studying the impact of three key factors - blockchain, regulatory environment and participation of institutional investors - on the development of innovations in the field of financial technologies (fintech). The authors explore the interaction between technological innovations and regulatory mechanisms that create new opportunities for the development of financial services, ensuring greater transparency, security and accessibility for users.

Particular attention is paid to the role of institutional investors, who, through their investments, contribute to the scaling of blockchain solutions in the real sector. The impact of blockchain technology regulation on the formation of innovations in financial markets, as well as the prospects for adapting new technologies in the conditions of globalized financial systems, is also considered. The article provides new insights into the mechanisms of interaction of these factors and their impact on the formation of financial innovations.

Problem Statement

The rapid expansion of FinTech can be attributed to several factors, including advancements in blockchain technology, the regulatory environment, and the involvement of institutional investors. Blockchain has considerable potential to improve transparency, security, and efficiency within financial markets. However, the broader focus of this study is on how blockchain integration within existing financial systems influences its practical value and innovation. Additionally, regulatory frameworks governing blockchain and FinTech will play a crucial role in determining the opportunities and challenges related to compliance, scalability, and market adoption. The involvement of institutional investors, with their substantial resources and development capabilities,

is also vital for supporting and driving the growth of FinTech innovation. However, the way these interconnected factors jointly impact the speed and direction of innovation in the FinTech sector remains not fully understood. This research aims to explore how blockchain adoption, regulatory policies, and institutional investor engagement interact to either promote or hinder innovation in FinTech. This leads me to the following two sub-questions related with:

- How widely is (Blockchain technology) implemented by (Fintechs in Jordan)?
- These are the level of the regulatory environment (Fintech companies in Jordan)
- How significant is institutional investors' participation at (Fintech companies in Jordan)?
- To what degree does (Identify the level of FinTech innovation at (Fintech companies in Jordan)?
- Does blockchain adoption, regulatory environment, and institutional investor participation have a statistically significant impact on fintech innovation (Fintech companies in Jordan)? To what extent is blockchain adopted at (Fintech companies in Jordan)?

As such, this study provides valuable scientific insight into the link between blockchain adoption, the regulatory environment, and institutional investor participation in FinTech innovation. This research adds to the body of literature by examining in detail how these factors affect the emergence of financial technology in the financial sector with a specific focus on Saudi Arabia. The paper, which looks at the effect of these features on FinTech innovation, contributes to the increasing amount of literature on how institution forces and emergent tech are shaping transformation in financial services. Moreover, practically, this research is useful for policymakers, financial institutions, and businesses seeking to adopt innovations based on blockchain technology and institutional investment. Example 2 References to the Regulatory Dynamics of Blockchain Technology: By understanding the regulatory dynamics in addition to the role of institutional investors in Saudi companies, more effective strategies for integrating blockchain into financial services can be determined. Moreover, it provides valuable insights for decision-makers to cultivate a conducive atmosphere for FinTech development and to address active regulatory issues. The findings could also help Saudi companies become more competitive and better equipped to navigate global financial headwinds. In order to achieve this aim, the study aims to explore how blockchain adoption, the regulatory landscape, and the involvement of institutional investors impact the degree of innovation in the fintech sector. To support this primary objective, the following sub-objectives are outlined:

- The level of blockchain adoption at (Fintech companies in Jordan)
- Determine the regulatory environment level: (Fintech companies in Jordan)
- To what extent do institutional investors engage at (Fintech firms in Jordan)
- Assess the degree of adoption of FinTech innovation (Fintech companies in Jordan).
- Assessing the effect of (block chain) adaptation, regulation atmosphere, and institutions investors' involvement on the fintech innovation at (Jordan Fintech firms). Identify the extent of blockchain adoption at (Fintech companies in Jordan).

1. Literature Review

Bhatnagar *et al.* (2024) will demonstrate how Customer Value Theory (CVT) and Protection Motivation Theory (PMT) can shed light on the key factors that influence customer experience, electronic trust, and the intention to recommend, while examining the relationship between perceived risk and the adoption of digital currencies. Methods: An online cross-sectional survey was conducted with 414 participants from India using purposive sampling. The relationships between the variables were analyzed through partial least squares structural equation modelling. The findings revealed that functional value, emotional value, and social value positively impacted customer experience, while perceived severity, perceived vulnerability, response efficacy, and self-efficacy positively influenced electronic trust. Results: A direct relationship between electronic trust and both customer experience and the intention to adopt digital currency was found. The study concluded that digital currencies driven by value could increase their adoption rates. Meanwhile, Khatwani *et al.* (2023) examined technological innovations within the global Banking, Financial Services, and Insurance (BFSI) sector, emphasizing both the advantages and challenges organizations face. The study mostly relied on secondary data sources YouTube channels and other social media platforms to present an overview of the state of technology and its promise. The first takeaway from the report showed that digital transformation is on the rise, and banks are speeding up their strategic updating in light of the latest innovations. The study predicts positive outcomes for the AI sector in the coming years, highlighting the increasing adoption of AI software by banking companies to lower costs, automate basic functions, and improve service quality, all through the use of personalized data Khan, S *et al.* (2025). Employing the theory of planned behavior (TPB), Ramachandran & Stella (2022) explored the

intentions of Generation Z postgraduate students have toward cryptocurrency investment, on the basis of perceived benefits vs. perceived barriers. Data from 480 respondents were collected using a structured questionnaire on a five-point Likert scale and then analysed with Smart PLS 3 along with structural equation modelling. It was also established that the intention to adopt cryptocurrency in distance education was positively influenced by attitude, awareness, and perceived behavioral control, whereas subjective norms have no impact. Kumari & Devi (2022) Alzahrani *et al.* (2023) examined the FinTech and blockchain applications of financing digital banking and financial services. Their literature review indicated that these technologies are revolutionizing the banking and finance industry and have a significant impact on the digitalization trends that are changing and updating digital banking services.

Rabbani *et al.* (2020) and Wijayanti *et al.* (2025) systematically reviewed Islamic financial technology, reviewing a total of 133 papers. They analysed the opportunities and challenges for Islamic financial institutions to adopt FinTech, with specific emphasis on Shari'ah compliance for cryptocurrency and blockchain. The authors conclude that Islamic FinTech needs to be perceived as a partner for the Islamic financial institutions as a tool for enhancing efficiency, transparency, and customer satisfaction. According to Ramzy (2024), Blockchain technology is composed of three primary types:

- Public Blockchain: A permission-less accessed distributed database. The data is public, and anyone can read it, help to verify transactions, and write new blocks.
- Private Blockchain: A database similar to the public blockchain, except access is limited to a set of authorized nodes run by one or several organizations that, in fact, control the network and the authority of validation of the blocks. Only authorized users are able to add data and perform transactions.
- Hybrid Blockchain: It can be considered as a mixture of public and private blockchain. Controlled by a network of sanctioned validators, it provides privacy, control, speed, and lower costs, and is well-suited for major financial institutions.

In contrast, Shahnaz *et al.* Emphasizing the need for encrypted data chains securely connected to blocks, (2019) illuminated the unique properties of blockchain technology. This technology works by utilizing a decentralized framework that allows information to be spread out across numerous nodes. In addition to that, every shared data has the collective ownership which makes the system more transparent and secure at the same time. What are Blockchains are batches of transactions that are hashed giving them security and that are maintained by peer-to-peer networks. Blockchain leverages P2P (peer-to-peer) distributed and decentralized consensus algorithms, immutability, and encryption. These features make the blockchain a unique technology with great promise in a number of fields (Shahnaz *et al.* 2019). Being in Financial domain, Blockchain Technology Theoretically is really providing the competitive edge that the Banking Industry have long Varied to solve out the pressures of the Digital Age. The technology is highly transparent to process due to its distributed nature, impressively eliminating the manual verification and authorization requirements (Khamis, 2023). Furthermore, Blockchain technology is a fundamental component behind the emergence of financial technologies, as it has been the basis for the emergence of digital currency (Bitcoin), which is the first financial technology. Some identified advantages of its use include (Mahna, 2023):

- Public Blockchain: A distributed database that requires no permission to access. Anyone can view information, participate in validating transactions, and add new blocks.
- Private Blockchain: A database similar to the public blockchain, but access is restricted and requires authorization from a central entity. Only authorized users can add data and conduct transactions.
- Hybrid Blockchain: Combines features of both public and private blockchains. Managed by a group of authorized validators, it offers privacy, control, speed, and lower costs, making it ideal for large financial institutions.

On the other hand, Shahnaz *et al.* (2019) highlighted blockchain's distinct characteristics, emphasizing its reliance on encrypted data chains securely connected to blocks. This technology operates through a decentralized framework, enabling information to be distributed across multiple nodes. Additionally, each piece of shared data maintains collective ownership, ensuring transparency and security within the system. Blockchains store groups of transactions, which are hashed for security, and are governed by decentralized peer-to-peer networks. Blockchain utilizes a distributed peer-to-peer (P2P) network, decentralized consensus algorithms, immutability, and encryption. These characteristics have made blockchain a distinctive technology, attracting significant interest across various fields (Shahnaz *et al.* 2019). In the Financial field, Blockchain technology, by its design, offers inherent benefits that the banking industry has been seeking to address the challenges and pressures arising from the digital age. The distributed nature of this technology brings a high level of transparency in processing, thereby reducing the need for manual verification and authorization (Khamis, 2023). In addition,

Blockchain technology is the key factor behind the existence of financial technologies, as it has been relied upon since the creation of digital currency (Bitcoin), which is the first financial technology. Its use offers several benefits, including (Mahna, 2023):

- The elimination of the need for intermediaries or central authorities to manage payments and transfers.
- High security due to the difficulty of hacking it.
- Prevention of double-spending, ensuring that the same balance cannot be spent more than once.

In general, blockchain technology is essential to financial technology as it offers a decentralized and secure framework for handling digital transactions. It eliminates the need for intermediaries, ensuring faster and cost-effective transfers. Its inherent security features, such as encryption and immutability, make it resistant to fraud and double-spending, fostering trust in digital financial systems. The regulatory environment encompasses all institutions and forces surrounding an organization that directly influence its performance, operations, and resources. The impact can be observed by tracking changes in the organization's performance and their consequences, which are influenced by the surrounding forces and institutions. Every organization has its own environment (Al-Tamimi, 2024). The active and dynamic environment Some organizations are located in a stable environment where they do not change much external forces, while others are active and dynamic environment (Bryce, 2024) The business environment may also influence the presence of new competitors. The regulatory environment in general comprises all external elements beyond the organizational boundaries that can affect the organization holistically or some aspect of it. The regulatory environment includes all of the institutions and forces that are external to an organization and may affect its performance, operations or resources. Changes to the surrounding forces and institutions are those the organization's performance and consequences are influenced by - follow their development to understand the impact. The environment that the organization operates in varies (Al-Tamimi, 2024). Bryce (2024) states about some organizations functioning in a stable environment with no change in external forces and others operating in a trendy and active environment. New competitors might also be influenced by the business environment. Regulatory environment refers to the totality of factors outside the organization that influence its functioning, either entirely or collectively.

The regulatory environment has many features, the foremost of which is defining the environment in a specific framework. This means that whatever resides inside indies of the organization is within the antigenic or strategics and exogenies of studying the organization's environment (Clarity Guides & Documentation, 2024).

Besides, the regulatory environment is also one of the features that are prone to environmental impacts. An organization cannot function separately from its environment, which it affects and is affected by. This engagement degrees, as well as adverse effects on the organization levels (Al-Tamimi, 2024) and decides the performance.

The regulatory environment can influence environmental variables; however, changes within an organization are difficult to control. Unlike physical changes such as temperature, gravity, or chemical reactions, which can be managed and directed, the organization's work environment is governed by social and economic factors. These factors are hard to fully control, although some can be predicted and partially managed (Zou & Wang, 2024).

Hence, the regulatory environment in financial technology consists of external institutions and forces that shape the performance, operations, and resources of fintech companies. These forces, such as legal, economic, and technological factors, significantly influence the industry's growth and competitiveness. While some regulatory changes can be anticipated or partially controlled, others are challenging to manage due to their dynamic nature. The primary motivation for investment is to build wealth and generate profits from available capital. Instead of letting this money remain idle, it can be effectively utilized in a way that increases its value and multiplies it. Jin *et al.* (2024) define an institutional investor as an organization or company that collects funds from various sources, such as individual investors or other entities, and invests them in various market securities on their behalf. In essence, these investors pool capital from others to engage in the buying and selling of financial instruments such as stocks, bonds, currencies, and contracts. Chen and Ganti (2024) highlighted that institutional investors are entities that acquire, trade, and oversee various financial instruments, such as stocks and bonds, for the benefit of their clients, customers, or stakeholders. These investors operate on behalf of others and include six key categories: endowment funds, commercial banks, mutual funds, hedge funds, pension funds, and insurance companies. Institutional investors face fewer protective regulations compared to individual investors, as they are presumed to possess greater expertise and are better equipped to protect their interests.

Furthermore, Friel *et al.* (2024) noted that institutional investors are organizations that aggregate funds from multiple sources to invest in and trade securities. There are five main types:

- Mutual Funds: Investment vehicles that gather funds from multiple investors to create a diversified portfolio of securities
- Hedge Funds: Investment partnerships where pooled funds from members are managed by a general partner and invested in a range of securities, with limited partners providing capital.
- Insurance Companies: Large institutional investors that collect premiums from policyholders and invest these funds in various securities, with the returns used to settle claims.
- Endowment Funds: Funds established by organizations like universities or hospitals to support their specific missions and activities.
- Pension Funds: Investment funds contributed to by both employers and employees, designed to invest in securities for the purpose of funding retirement benefits.

However, institutional investors hold considerable influence in financial markets, as they execute large transactions that significantly affect supply and demand dynamics of securities. Their actions impact security prices, and many individuals attempt to mimic their strategies in hopes of achieving similar success, though investment experts generally advise against this (Wei *et al.* 2024). Institutional investors play a crucial role in managing and investing funds from diverse sources to generate returns. These investors, including mutual funds, hedge funds, insurance companies, endowment funds, and pension funds, pool capital to buy and sell a wide range of securities. Unlike individual investors, institutional investors face fewer regulatory constraints due to their expertise, allowing them to make larger investments and better manage risks Wijayanti, *et al.* (2025). Fintech, a term derived from the combination of "financial" and "technology," refers to innovative technologies that aim to enhance and streamline financial services. At its core, fintech seeks to help businesses, entrepreneurs, and individuals manage their financial activities, processes, and overall financial health more effectively. It leverages advanced software and algorithms implemented on computers and mobile devices to achieve these goals (Kagan, 2024). Samuvel & Pradeep (2022) explain that traditional financial institutions are increasingly facing competition from non-bank financial players and shadow banking systems. The advent of fintech has further intensified this competition by allowing startups, major tech companies, and digital-first banks (also known as neo banks or challenger banks) to join the financial services industry. Fintech startups are making significant strides across various sectors, including payments and money transfers, lending, corporate financial management, crowdfunding, institutional financial technology, trading, insurance, wealth management, personal finance management, and digital banking. Navaretti *et al.* (2018) argued that fintech companies are not likely to replace traditional banks but rather exist alongside them, either collaborating or evolving into similar entities. One key factor is that fintech lenders face limitations in providing liquidity, as they lack access to central bank funding, unlike traditional banks. Additionally, their inability to perform maturity transformation further restricts their liquidity services. Several instances have occurred where online lending platforms have allowed mismatched maturities, with lenders able to withdraw their funds faster than borrowers can repay their loans Shah, (2025). Generally, FinTech refers to innovations that automate and enhance the delivery of financial services. Initially focused on improving the backend systems of traditional banks, FinTech has evolved to offer consumer-facing services, covering sectors like payments, lending, insurance, and cryptocurrency development. Although FinTech companies face challenges such as limited liquidity and inability to access central bank funds, they continue to coexist with traditional financial institutions, often collaborating or evolving into similar entities while reshaping the financial services landscape.

2. Materials and Methods

The study employs a descriptive approach to outline and analyze the key variables: Blockchain, Regulatory Environment, Institutional Investor Participation, and FinTech Innovation. In addition, the study adopts an analytical approach to study the impact of impact of Blockchain Adoption, Regulatory Environment, and Institutional Investor Participation on FinTech Innovation. The study is considered as an applied study targeting Fintech companies in Jordan

2.1 Research Methodology

The study population consists of Administrative staff at Fintech companies in Jordan. After extensive search, the researcher found that the only bank in Jordan that relies on financial technology is the Bank Al Etihad, and several financial companies. The study tool was distributed to these institutions electronically, and (125) questionnaires were retrieved that could be processed statistically.

Table 1. Gender

Gender	Frequency	Percent
Male	73	58.4
Female	52	41.6
Total	125	100.0

Source: Statistical analysis outputs Shah, (2025)

Table 1 illustrates that the majority of the study sample were male, comprising 58.4% of the participants, while females represented 41.6% of the sample.

Table 2. Age

Age	Frequency	Percent
18-25 years old	7	5.6
26-40 years old	21	16.8
41-60 years old	83	66.4
61 years old and above	14	11.2
Total	**125**	**100.0**

Source: Statistical analysis outputs Wijayanti *et al.* (2025)

Table 2 shows that 66.4% of the sample are aged between 41 and 60 years, while 16.8% fall within the 26 to 40 years age group. Additionally, 11.2% of the sample are 61 years or older, and the smallest proportion, 5.6%, belongs to the 18 to 25 years age group.

Table 3. Experience

Age	Frequency	Percent
1 - 5 years	8	6.4
6 - 10 years	39	31.2
11 - 15 years	50	40.0
16 - 20 years	21	16.8
More than 20 years	7	5.6
Total	**125**	**100.0**

Source: Statistical analysis outputs Shah, (2025)

Table 3 shows that 40% of the sample have 11 to 15 years of experience, while 31.2% have 6 to 10 years of experience. Additionally, 16.8% of the sample have 16 to 20 years of experience, and 6.4% have 1 to 5 years of experience. The smallest proportion, 5.6%, have more than 20 years of experience.

2.1 Data Collection Sources

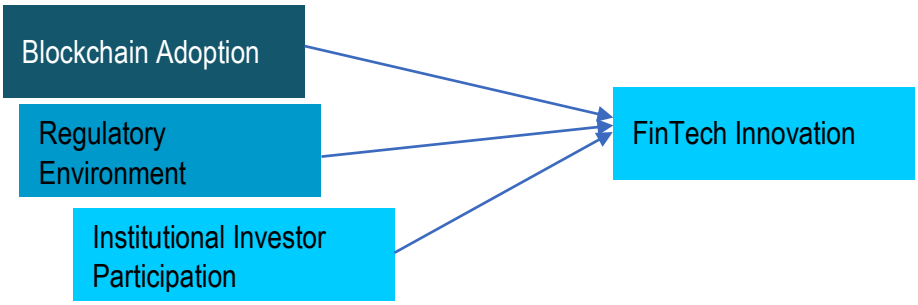
Two sources will be utilized to gather data for this study:

- Secondary Sources: This will involve desk research, using references, books, and relevant literature.
- Primary Sources: Data will be collected directly from the study sample through the application of the study tool.

Hypothesis:

H1: Blockchain Adoption has a statistically significant impact on FinTech Innovation at fintech companies in Jordan, at the 0.05 significance level.

Figure 1. Study Model



Source: compiled by the author based on the data Wijayanti *et al.* (2025)

3. Application Functionality

The study will utilize existing literature to develop a questionnaire for gathering primary data. The questionnaire will be structured into the following sections:

Section I: This section will collect demographic information about the study sample, including variables such as gender, age, and educational qualification.

Section II: This section will contain items related to the study variables: Blockchain, Regulatory Environment, Institutional Investor Participation, and FinTech Innovation in fintech companies in Jordan.

The responses will be categorized using a five-point Likert scale with the following options: (Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree).

The study will employ two types of validity tests:

Face Validity: The face validity of the questionnaire will be verified by presenting it to a group of experts and specialists from universities. Their feedback will focus on the tool's suitability for collecting data relevant to the study, its clarity, coherence, consistency, and alignment with the study's variables. Any suggestions or feedback will be incorporated into the tool.

Reliability: To verify the reliability and consistency of the study tool, Cronbach's alpha will be applied to evaluate the internal consistency and reliability of the measurement instrument. The results of this analysis are presented in Table 4.

Table 4. Internal coherence consistency coefficients (Cronbach's Alpha)

Variables	Number of	Variables
Blockchain Adoption	6	76.1%
Regulatory Environment	6	79.7%
Institutional Investor Participation	6	81.6%
FinTech Innovation	6	76%
All Variables	**24**	**79.6%**

Source: Statistical analysis outputs Shah, (2025)

The table shows that the coefficients for all study variables exceeded 60%, indicating strong internal consistency among the items within each variable. This supports the reliability and validity of the questionnaire in accurately measuring the intended constructs. For data analysis, drawing conclusions, and testing the study hypothesis, descriptive statistical methods were utilized using SPSS. These methods include:

- Frequencies and Percentages
- Arithmetic Means and Standard Deviations
- Regression Analysis

4. Research Results

The study sample results were analysed based on the study dimensions. Means and standard deviations were calculated, and the study hypotheses were tested using regression analysis through the SPSS software to derive the following findings: First, Blockchain Adoption:

To assess Blockchain Adoption at fintech companies in Jordan, means and standard deviations were calculated. The results are presented in Table 5.

Table 5. Means and Std. Deviation of Blockchain Adoption

Statement	Mean	Std. Deviation	Rate
Blockchain technology adoption has significantly enhanced the efficiency of financial transactions in my organization.	4.184	0.745	High
The integration of blockchain has reduced operational costs in FinTech services.	3.976	0.884	High
Blockchain adoption has improved data security and transparency in financial operations.	4.080	0.819	High
The complexity of blockchain technology poses challenges to its widespread adoption in FinTech.	4.104	0.801	High
Blockchain adoption has facilitated the development of innovative financial products and services.	4.016	0.861	High
My organization is actively investing in blockchain related technologies to stay competitive in the FinTech sector.	3.872	0.933	High
Average	**4.039**		**High**

Source: Statistical analysis outputs Wijayanti *et al.* (2025)

Table 5 presents the attitudes of the sample towards the questionnaire statements regarding Blockchain Adoption at fintech companies in Jordan. The average mean was 4.039, indicating a high level of appreciation. The means for the Blockchain Adoption items ranged from 3.872 to 4.184, reflecting a high degree of appreciation for all statements. The statement with the highest level of appreciation was paragraph (1), which stated, “Blockchain technology adoption has significantly enhanced the efficiency of financial transactions in my organization,” with a mean of 4.184 and a standard deviation of 0.745, reflecting a high level of appreciation. On the other hand, paragraph (6), which stated, “My organization is actively investing in blockchain-related technologies to stay competitive in the FinTech sector,” received the lowest level of appreciation, with a mean of 3.872 and a standard deviation of 0.933. However, it still indicates a high level of appreciation.

Second, Regulatory Environment:

To evaluate the Regulatory Environment in fintech companies in Jordan, means and standard deviations were calculated. The results are presented in Table 6.

Table 6. Means and Std. Deviation of Regulatory Environment

Statement	Mean	Std. Deviation	Rate
The current regulatory framework in my region supports innovation in the FinTech industry.	3.688	0.787	High
Regulatory uncertainty poses a significant challenge to the adoption of blockchain technology.	3.640	0.865	Moderate
The introduction of clear and flexible regulations could accelerate FinTech innovation.	3.568	0.874	Moderate
Compliance with regulations increases operational costs for FinTech companies.	3.520	0.955	Moderate
Collaboration between regulators and FinTech companies fosters innovation in financial services.	3.528	0.921	Moderate
My organization has faced challenges in aligning with regulatory requirements for new technologies like blockchain.	3.584	0.900	Moderate
Average	**3.588**		Moderate

Source: Statistical analysis outputs Shah, (2025)

Table 6 It presents the attitudes of the sample towards the questionnaire statements concerning the Regulatory Environment at fintech companies in Jordan, with an average mean of 3.588, indicating a moderate level of appreciation. The means for the Regulatory Environment items ranged from 3.520 to 3.688, reflecting a range from moderate to high degrees of appreciation. The statement with the highest level of appreciation was paragraph (7), which stated, "The current regulatory framework in my region supports innovation in the FinTech industry," with a mean of 3.688 and a standard deviation of 0.787, reflecting a high level of appreciation. In

contrast, paragraph (10), which stated, "Compliance with regulations increases operational costs for FinTech companies," had the lowest level of appreciation, with a mean of 3.520 and a standard deviation of 0.955, indicating a moderate level of appreciation. Third, Institutional Investor Participation:

To assess Institutional Investor Participation at fintech companies in Jordan, means and standard deviations were calculated. The results are presented in Table 7.

Table 7. The means and standard deviations for Institutional Investor Participation at fintech companies in Jordan. The results provide insights into the level of participation and engagement of institutional investors in the fintech sector.

Statement	Mean	Std. Deviation	Rate
Institutional investors play a key role in driving innovation in the FinTech industry.	3.648	0.775	Moderate
The involvement of institutional investors has increased funding for blockchain-based projects.	3.672	0.791	High
Institutional investors prioritize regulatory compliance when funding FinTech innovations.	3.760	0.723	High
Institutional investors' risk-averse nature can hinder the adoption of disruptive technologies like blockchain.	3.760	0.902	High
The participation of institutional investors enhances trust and credibility in FinTech innovations.	3.800	0.718	High
My organization has experienced growth due to institutional investor participation in blockchain initiatives.	3.752	0.779	High
Average	**3.732**		High

Source: Statistical analysis outputs Shah, (2025)

Table 7 displays the sample's attitudes toward the questionnaire statements regarding Institutional Investor Participation in fintech companies in Jordan, with an average mean of 3.732, reflecting a high level of appreciation. The means for the items on Institutional Investor Participation ranged from 3.648 to 3.800, indicating a mix of moderate to high levels of appreciation. The statement with the highest appreciation was paragraph (17), which stated, "The participation of institutional investors enhances trust and credibility in FinTech innovations," with a mean of 3.800 and a standard deviation of 0.718, suggesting a strong level of approval. On the other hand, paragraph (13), which stated, "Institutional investors play a key role in driving innovation in the FinTech industry," received the lowest appreciation, with a mean of 3.648 and a standard deviation of 0.775, indicating a moderate level of approval. Fourth, FinTech Innovation:

To assess FinTech Innovation at fintech companies in Jordan, means and standard deviations were calculated. The results are shown in Table 8.

Table 8. The means and standard deviations for FinTech Innovation at fintech companies in Jordan. The results offer insights into the extent of innovation within the sector, highlighting the degree of advancement and development in fintech-related technologies and practices.

Statement	Mean	Std. Deviation	Rate
Blockchain adoption has accelerated the pace of innovation in my organization's FinTech services.	4.184	0.745	Moderate
A supportive regulatory environment is essential for fostering innovation in FinTech.	3.984	0.871	High
Institutional investor participation has enabled my organization to implement cutting-edge FinTech solutions	4.080	0.819	High
My organization has developed new financial products due to advancements in blockchain technology.	4.112	0.785	High
Collaboration among technology providers, regulators, and institutional investors is crucial for FinTech innovation.	4.024	0.847	High
The overall adoption of blockchain, regulatory clarity, and institutional investment has positively impacted FinTech innovation in my sector.	3.864	0.936	High
Average	**4.041**		High

Source: Statistical analysis outputs Shah, (2025)

Table 8 presents the attitudes of the sample towards the questionnaire statements regarding FinTech Innovation at fintech companies in Jordan, with an average mean of 4.041, indicating a high level of appreciation. The means for the FinTech Innovation items ranged from 3.864 to 4.184, reflecting a consistently high degree of appreciation for all statements. The statement with the highest level of appreciation was paragraph (19), which stated, "Blockchain adoption has accelerated the pace of innovation in my organization's FinTech services," with a mean of 4.184 and a standard deviation of 0.745, indicating a high level of appreciation. On the other hand, paragraph (24), which stated, "The overall adoption of blockchain, regulatory clarity, and institutional investment has positively impacted FinTech innovation in my sector," had the lowest level of appreciation, with a mean of 3.864 and a standard deviation of 0.936, still reflecting a high level of appreciation.

Hypotheses Test:

The following section tests the study hypothesis:

H1: Blockchain Adoption has a statistically significant impact on FinTech Innovation at fintech companies in Jordan at the 0.05 significance level.To test this hypothesis, regression analysis was conducted to determine whether Blockchain Adoption has a statistically significant effect on FinTech Innovation at fintech companies in Jordan, using a significance level of 0.05. (Details of the model summary will follow here, typically including R-values, R-squared, F-statistics, and significance levels to assess the relationship and significance.)

Table 9. Model Summary main hypothesis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.534	0.286	0.280	0.53247

Source: compiled by the author

a. Predictors: (Constant), Blockchain_Adoption

Table 9 shows The regression coefficient between the independent variable (Blockchain Adoption) and the dependent variable (FinTech Innovation) is 0.534. This coefficient reflects the strength and direction of the relationship between the two variables. The coefficient of determination (R^2) is 0.286, indicating that approximately 28.6% of the variation in the dependent variable (FinTech Innovation) can be explained by the independent variable (Blockchain Adoption).

Table 10. ANOVAa independent variable on FinTech Innovation

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	13.943	1	13.943	49.176	0.000
Residual	34.874	123	0.284		
Total	48.816	124			

Source: compiled by the author

a. Dependent Variable: FinTech

b. Predictors: (Constant), Blockchain_Adoption

Table 10 shows the Analysis of Variance (ANOVA), which is used to evaluate the explanatory power of the independent variable, Blockchain Adoption, on the dependent variable, FinTech Innovation. The F-statistic value was 49.176, with a p-value of 0.00. Since the p-value is smaller than the significance threshold of 0.05, it indicates that the model is statistically significant.

Interpretation:

F-statistic (49.176): This value reflects the overall fit of the regression model. A higher F-value suggests that the model accounts for a significant amount of the variation in the dependent variable.

p-value (0.00): As the p-value is below 0.05, we can conclude that there is a statistically significant relationship between Blockchain Adoption and FinTech Innovation. This implies that Blockchain Adoption has a notable effect on FinTech Innovation.

Therefore, we reject the null hypothesis (H0), which posits no relationship, and accept the alternative hypothesis (H1):

H1: Blockchain Adoption has a statistically significant impact on FinTech Innovation at fintech companies in Jordan at the 0.05 significance level.

Testing the Next Hypothesis:

The subsequent hypothesis to be tested is:

H1: The Regulatory Environment has a statistically significant impact on FinTech Innovation at fintech companies in Jordan at the 0.05 significance level.

Similar to the prior analysis, regression analysis will be conducted to examine if the Regulatory Environment has a statistically significant effect on FinTech Innovation. The significance level for this hypothesis will also be set at 0.05.

After performing the regression analysis, we will follow the same steps:

Check the F-statistic and its p-value to assess whether the model is statistically significant.

Review the coefficient values for the Regulatory Environment to evaluate its impact on FinTech Innovation.

Table 11. Model Summary main hypothesis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.356	0.127	0.119	0.58876

a. Predictors: (Constant), Regulatory_Environment

Source: Statistical analysis outputs Wijayanti *et al.* (2025)

Table 11 The regression analysis shows the coefficient for the independent variable, Regulatory Environment, and its effect on the dependent variable, FinTech Innovation. The regression coefficient is 0.356, indicating a positive relationship between the Regulatory Environment and FinTech Innovation. The coefficient of determination (R^2) is 0.127, suggesting that 12.7% of the variance in FinTech Innovation can be explained by the Regulatory Environment. This implies that while the Regulatory Environment does influence FinTech Innovation, there are other factors not captured in the model that also contribute to the variation in FinTech Innovation.

Table 12. ANOVAa independent variable on FinTech Innovation

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	6.180	1	6.180	17.829	0.000
Residual	Residual	42.636	123	0.347	
Total	Total	48.816	124		

a. Dependent Variable: FinTech

b. Predictors: (Constant), Regulatory_Environment

Source: Statistical analysis outputs Wijayanti *et al.* (2025)

Table 12 The Analysis of Variance (ANOVA) results for the Regulatory Environment and its effect on FinTech Innovation show an F-statistic value of 17.829, with a p-value of 0.00. Since the p-value is less than the significance level of 0.05, we can conclude that there is a statistically significant impact of the Regulatory Environment on FinTech Innovation at the 0.05 significance level.

Interpretation:

F-value = 17.829: The F-statistic tests whether the regression model as a whole is a good fit for the data. In this case, the high F-value suggests that the model significantly explains the relationship between Regulatory Environment and FinTech Innovation.

p-value = 0.00: Since the p-value is less than 0.05, we reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1), which states that there is a statistically significant impact of Regulatory Environment on FinTech Innovation at the 0.05 significance level.

Thus, Regulatory Environment has a statistically significant impact on FinTech Innovation in FinTech companies in Jordan.

Table 13. Model Summary main hypothesis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.291	0.085	0.077	0.60264

a. Predictors: (Constant), Investor

Source: Statistical analysis outputs Wijayanti *et al.* (2025)

Table 13 displays the regression coefficients for the relationship between Institutional Investor Participation (independent variable) and FinTech Innovation (dependent variable). The coefficient value is 0.291, indicating a positive relationship between the two variables. The coefficient of determination (R^2) is 0.085, meaning that 8.5% of the variation in FinTech Innovation can be attributed to Institutional Investor Participation.

Table 14. ANOVAa independent variable on FinTech Innovation

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4.145	1	4.145	11.414	0.001
Residual	44.671	123	0.363		
Total	48.816	124			

a. Dependent Variable: FinTech
b. Predictors: (Constant), Investor
Source: compiled by the author

The analysis of variance (ANOVA) in Table 14 tests the explanatory model of Institutional Investor Participation (independent variable) on FinTech Innovation (dependent variable). The results are as follows:

F-Statistic = 11.414: he R^2 value measures the overall fit of the regression model, indicating how well the independent variable explains the variance in the dependent variable.

p-value = 0.001: Since the p-value is lower than the significance level of 0.05, we can conclude that the regression model is statistically significant.

5. Discussions

Impact well on fintech innovation; however, its growth over time will be relevant to impact most blockchain technologies. As an innovative force in the financial sector, blockchain technology presents the potential to deliver exceptional levels of transparency, security, and efficiency for financial transactions. After that, Blockchain is capable of creating decentralized financial systems (DeFi), which can create a great change in the delivery of traditional financial services, increasing accessibility for users across the globe. But, it does come with its hurdles, including technical difficulties, scalability concerns, and legal and regulatory challenges. Blockchain technologies are new to the financial sector, thus appropriate regulation needs to be provided for guaranteeing security and transparency of operations. But across different countries, the legal environment is not the same, posing challenges for fintech companies with international reach. Are, why there is no such regulation in places so once upon it comes to such matter startup needs to understand the process and for which they are and provide all the details regarding the ongoing, so now we are going to discuss what happens in a/or b, so now we are going to talk about a/ or b. However, blockchain and cryptocurrencies still lack a clear regulation covering some parts of the world that limits the scope for their significant use. Contrarily, progressive laws related to these issues, like in Switzerland or Singapore, attract innovation and are the reason for a boom with fintech ventures in certain areas. It works on the basis of outputs of experimental studies regarding the relationships between innovation and regulation. Legislative efforts to develop a transparent legal environment for the use of blockchain and cryptocurrencies will greatly accelerate the development of fintech services. Less regulation of markets often means companies face less restrictions on product and service development – leading to faster innovation. But not having one international legal framework creates challenges for multinational firms looking to operate in multiple markets. In this regard, in the context of international organizations, harmonization of legislation can facilitate the joint work of the entities involved in the implementation of blockchain technologies. Another important factor in the development is the participation of institutional investors in fintech innovation. In contrast to individual investors, institutional investors can provide the sizeable financial resources needed for scaling and developing technologies. Investment firms, financial institutions and banks have the necessary resources and funds to support these fintech companies in creating solutions to the banking world like innovations and implement them as well. On the flip side, however, institutional backers may buck the trend and prefer more stable, traditional projects with lower risk, perhaps stifling the progressive development of more ambitious concepts. And they run the risk of being overly centralized, too much at risk of capital concentration in a few big players. Small and Medium-sized Startups cannot compete with the scale and scope of Big tech and that could reduce the competitiveness and innovative flexibility of fintech industry. Institutional investors can dictate terms as well; this may shape the course of product development in fintech and cause these companies to concentrate on projects that produce immediate profits as opposed to long-term innovation. Therefore, the blockchain adoption, the

regulatory environment, and the participation of institutional investors, can all be considered interdependent factors contributing to fintech innovation. While the advent of blockchain technologies creates huge potential for development of new financial products, the successful implementation of this potential is impossible without proper regulation and financial backing from large-scale investors. The aim ability of fintech market to stimulate sustainable growth and continuous competition are also achieved through a balanced market regulation which can be sustainable to ensure a streamline good players in the market.

Conclusions and Further Research

The study results showed that the level of appreciation of Blockchain Adoption was high; meaning that the level of Blockchain Adoption at Fintech companies was high in Jordan. The study, therefore, recommended respectively the following based on the results:

- Explore blockchain opportunities: Identify ways blockchain can increase efficiency and innovation
- Supportive Regulation: Design agile regulatory structures to strike a balance between innovation and security.
- Engage Institutional Investors: Raise awareness to bolster investment in blockchain-powered FinTech.
- Engage Stakeholders: Build coalitions among regulators, firms, and investors.
- Pushing sustainable FinTech innovation through research on blockchain

Blockchain Technology Adopting to Improve Financial Transactions Efficiency in Fintech Journal: Blockchain Technology Adopting to Improve Read More. The results indicate that Blockchain technology adoption has a significant impact on improving the effectiveness of financial transactions through the use of Fintech Jordan companies. Moreover, the result indicates that Fintech Firms in Jordan are investing in blockchain technologies to remain competitive in the financial technology industry. By conversely, the research found a moderate level of appreciation of Regulatory Environment which meant that the level of Regulatory Environment at Fintech companies in Jordan was moderate. The findings showed the current regulatory landscape in the area fosters innovations in the FinTech sector. Furthermore, the study indicates that ensuring compliance with regulations does not raise costs of operation for FinTech companies. The study also found that the level of Institutional Investor Participation in the fintech companies in Jordan was high, indicating a high degree of appreciation for the subject. The findings indicated that the involvement of institutional investors strengthens trust and credibility in FinTech and Innovare. In contrast, this study did not find a significant implication that Institutional investors plays a crucial role in the growth of Fintech innovation. Nonetheless, the study found a high level of appreciation for FinTech Innovation; (Hanan, 2020) proposed that Jordanian Fintech companies were high in terms of level of FinTech Innovation. It has been found in the results that the conceptualization of Blockchain has increased the work pace of the organization toward the innovation of its FinTech services. Furthermore, the research discovered the various aspects of blockchain adoption, regulatory evolution, and institutional investment have a positive influence on FinTech innovation among Fintech firms in Jordan. However, there is a statistically significant impact at 0.05 significance level of Blockchain Adoption on FinTech Innovation at Fintech retails in Jordan, according to the study hypotheses testing results. The findings also revealed that the effect of Regulatory Environment on FinTech Innovation at Fintech companies in Jordan is statistically significant at the 0.05 significance level. Also there is a statistically significant effect of Institutional Investor Participation on Finance Technology Innovation at level of 0.05 on Finance Technology Innovation at Fintech companies in Jordan.

Credit Authorship Contribution Statement

The authors equally contributed to the present research, at all stages from the formulation of the problem to the final findings and solutions.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have used/not used generative AI and AI-assisted technologies during the preparation of this work.

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Dynamics and Trading Behaviour of Four Domestic Institutional Investors in Indian Stock Markets

Purwa SRIVASTAVA
Humanities and Social Science Department
Jaypee Institute of Information Technology, India
ORCID: 0000-0002-0554-2285
Corresponding email: purwa.sr@gmail.com

Sakshi VARSHNEY
Humanities and Social Science Department
Jaypee Institute of Information Technology, India
sakshi.varshney@mail.jiit.ac.in

Taru MAHESHWARI
KIET School of Management
KIET Group of Institutions, Delhi-NCR, Ghaziabad, India
ORCID: 0000-0003-1614-3121
tarumaheshwari1982@gmail.com

Neha SINGH
Humanities and Social Science Department
Jaypee Institute of Information Technology, India
neha.singh@mail.jiit.ac.in

Divya RANA
Management Department
KCC Institute of Legal and Higher Education, Greater Noida, India
ranadivya84@gmail.com

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Abstract: The stability of financial markets is the need of the hour. The runaway of foreign institutional investors has left Indian markets dry many times. Domestic institutional investors (DII) have rescued stock markets during many turbulence-making events. The study focuses on the Trading strategies of four types of DIIs in Indian stock markets: mutual funds, Insurance companies, Development financial institutions, and banks.

A vector autoregressive model is used to study the behavior of Four DII's (insurance companies, development financial institutions, banks, mutual funds) in Indian stock markets on daily data. The data is studied at three levels Buy Sell and Net.

Banks became positive feedback traders whereas mutual funds, insurance companies, and development financial institutions were found as negative feedback traders. These results broke the myth about DII's as only contrarian traders in the Indian context. The study results reveal the significant impact of purchase and sell done by all the DII's on stock returns. At the Net investment level, it is Mutual funds and development financial institutions impacting the stock market. Buying done by banks also creates price pressure in the markets.

It is the first paper in the Indian context to study the domestic institutional investor's data at the disaggregated level. The daily data is taken from the Securities Exchange Board of India (SEBI) on special requests under the regulatory authority's data-sharing policy. Such a bifurcation study on trading strategies is mostly done in the U.S. and Japan to the best of my knowledge. The research on DII at the bifurcated level may include pension funds, Hedge fund, Venture capital funds, and REITs in future research

Regulatory authorities should make policy changes so that Insurance companies, Development financial institutions, mutual funds, and banks can increase their investment corpus in stock markets as their investment is having a positive effect on stock markets.

Investor awareness programs against panic selling in mutual funds will benefit investors as they will be able to gain more earnings from their mutual funds' investments. Insurance awareness programs will not only increase their investment corpus but also make society self-reliant.

Keywords: domestic institutional investors; mutual funds; insurance companies; development financial institution; banks; positive feedback trading; negative feedback trading.

JEL Classification: G23; C22.

Introduction

The trading pattern of institutional investors and their impact on stock markets have been the focusing area of research for academicians, policymakers, and researchers. This paper examines the trading behavior of Domestic institutional investors (DII) in Indian capital markets at a disintegrated level. Some researchers found that domestic institutional investors do not show a distinct buying pattern at a combined level, which presents heterogenic behaviour concerning their investment objectives and their information review skill (Mishra & Debasish, 2017) so it is crucial to study them at disintegrated levels. While others have found that at the aggregate level, DII shows a contrarian trading strategy (Chauhan & Chaklader, 2020,Mishra & Debasish, 2017, Arora, 2016, Naik & Padhi, 2014, Thenmozhi & Kumar, 2009, B. H. Boyer & Zheng, 2002). However, trading strategies at the disintegrated level are yet to be explored.

After the economic reform of 1991, the Indian equity market becomes more competitive because of the participation of institutional investors (foreign and domestic). South Asian markets are more integrated with international markets (Kumar & Dhankar, 2017) which is opening doors for FII's. DII (Banks, Mutual funds, development financial institutions, insurance companies, pension funds) channel the savings of a local nature in equity markets. Domestic institutional investors (DII) and Foreign institutional investors (FII) both investors constitute a significant portion of investment in Indian financial markets (Andrieş *et al.* 2023). Money invested by FII is known as hot money as it can be easily pulled out to leave the market dry, but DII are more stable investors (Mishra & Debasish, 2017, Vo, 2016)

In emerging economies like India majority of people are uneasy about investing money directly into the stock market, and here, the role of domestic institutional investors becomes essential because they become the critical factor in channeling the domestic savings into stock markets.

The results of much empirical literature (Ng & Wu, 2007,) Grinblatt & Keloharju, 2000) divide the investors' responses to the stock market trend and techniques of managing their portfolio into two categories first is negative feedback trading, and the second is Positive feedback trading. Contrarian behavior of investment (negative feedback trading) is when the investor sells those stocks that have ascending movement and buys those that show descending movement. On the other hand, in the Price momentum strategy (positive feedback strategy), the investors buy the ascending stock and sell the descending stock. Another phenomenon that influences the trading behavior of the investors' groups is the information asymmetry among these groups, which makes them make differing investment decisions (*e.g.* Ahmed, 2014; Phansatan *et al.* 2012 ; de Haan & Kakes, 2011; Bose, 2012). One more flow relationship approach is the price pressure hypothesis (Harris & Gurel, 1986) which postulates that contemporaneous stock returns are positively related to flows when flows increase stock returns also increase. If one set of investors have some private information about the market and they increase their inflow, then the less informed investors also follow the wave as they assume that the current market prices are below the rates at the fundamental level, this aggregate purchase will increase the overall cost, which is information revelation hypothesis (Lee, Charles ; Shleifer, Andrei ; Thaler, 1991).

It is assumed that asset prices reflect information owned by noise traders and informed investors in inefficient markets (Black, 1986). The informed investors look for mispriced stocks, whereas noise traders pump volatility and liquidity in the markets. Investments of aware investors provide stability and decrease volatility but are not able to stop the effect created by noise traders (Thaler, 1999). Positive feedback traders believe that the current market scenario will prevail, so they behave like noise traders and keep buying (selling) the stock. (Bohl & Siklos, 2008) compared the positive and negative feedback trading behaviour in emerging and mature markets and found a high presence of feedback trading in emerging markets in comparison to mature markets. (Dai & Yang, 2018) studied the relationship between positive feedback trading and sentiments; the findings show that when prices of the most stock move ahead together, then positive feedback traders trade. Institutional investors don't need to always take on a positive feedback trading strategy (Lakonishok, Shleifer, & Vishny, 1992), a study

on pension funds and monetary funds by (Irvine, Lipson, & Puckett, 2007) show the presence of negative feedback strategy by institutional investors.

At the disintegrated level, we found no studies in the Indian context regarding the trading strategies DII. This paper is an attempt to analyze the trading strategies of domestic institutional investors in the Indian stock market at a disaggregated level which includes insurance companies (INSU), development financial institutions (DFI), banks, mutual funds (MF) in the national stock exchange (NSE) of India. Investment behaviour of DII's at the disaggregated level.

Hypothesis

H01: No significant evidence of momentum trading/contrarian trading by DII at a disintegrated level in Indian stock market exist.

H02: No significant causality among the Nifty returns and DII investment behaviour at disintegrated level exists in Indian stock markets.

The rest of the paper is organized as follows. The literature review covers the second section with the third section containing the data and methodology part. The fourth section discusses the empirical findings, leading to a summary and conclusion in the fifth section.

1. Literature Review

Lakonishok, Shleifer, & Vishny, (1992) studied the behaviour of pension funds as institutional investors in the United States. They found that these investors usually trade in large market capitalization stocks and more herding behaviour and positive feedback trading is shown for small market capitalization stocks as less information is available for small stocks. Nofsinger & Sias (1999) confirm the positive feedback trading pattern of domestic institutional investors in the United States. The data under study was from 20 years till 1996, and foreign institutional investors were excluded. The outcome reveals that the positive feedback trading behaviour of DII is instrumental in contributing towards a positive relationship of stock returns with changes in institutional ownership. Cai & Zheng (2004) covered a data set of bank insurance companies, mutual funds, and investment advisors as institutional investors. The paper confirms the positive feedback trading behaviour of institutional investors mainly during purchases than in redemption whereas there is a negative relation of stock returns with lagged institutional trading. Berko (1997) found positive contemporaneous relationship between stock returns and equity flowed when he analyzed Mexican data.

Griffin, Harris, & Topaloglu (2003) studied the relation between trading activities of institutional and individual investors with past stock returns in Nasdaq 100, which exhibit that both follow trades of past stock returns. There was a positive contemporaneous relationship with the institutional and negative contemporaneous relationship with individual investors. B. H. Boyer & Zheng (2002) examined the connection between institutional trading, and stock returns data from the United States for 44 years until 1996. The data consists of quarterly purchases done by mutual funds, insurance companies, pension funds, foreign investor's households, and other institutional investors. The results indicate a positive correlation of stock returns with foreign investors, mutual fund, and pension funds, which depicts that these investors can create some price pressure in the market, but the presence of Granger causality was not there in any direction. The paper also analyses the movement of cash flow by institutional investors in the bull and bear market. The regression values show that pension funds and foreign investors move with the market return in the bull market showing the presence of positive feedback trading and mutual funds move with market return in the bear market showing their contrarian trading behaviour. Sias, Starks, & Titman (2005) observed in the New York stock exchange that there exists a correlation between stock returns and institutional trading, and they are informed, traders. Rakowski & Wang (2009) analyses daily mutual funds and monthly mutual funds in a VAR environment. Daily funds do not chase hot funds and have contrarian trading strategies, but the monthly mutual fund is showing no relation with returns. This predicts that the driving force of mutual funds in the short run and the long run is different. Baik, Kang, & Kim (2010) found that the return forecasting power of local institutional investors in the United States was statistically more significant than non-local investors. The local investors include investment advisors, mutual funds, banks, and insurance companies over 12 years till 2007.

Some studies from European countries show local investors as informed traders. Alexakis, Niarchos, Patra, & Poshakwale (2005) studied daily mutual funds from a period 1994 to 2003 in the Athens stock exchange of Greece, where the results revealed bidirectional causality between stock returns and mutual funds. Bohl, Brzeszczyński, & Wilfling (2009) used daily data of the Polish stock market from 1994 to 2003 to study the impact of trading done by institutional investors on the dynamics of the stock market return. Markov-switching-GARCH Model is used in this study, the results of which show that stock market volatility is reduced by the informed

trading of pension funds who adjust the stock prices to new information, in turn acting as stabilizers for the stock market. de Haan & Kakes (2011) observed the behaviour of life insurers, non-life insurance, and pension funds in Dutch markets from 1999 to 2005. The results show that pension funds follow a constant contrarian trading strategy, whereas the other two institutional investors, life insurers become contrarian when they have more pool of money from unit-linked policy and non-life insurers become contrarian when they have a business model which is relatively risky.

Yang (2002) in his study, shows a negative correlation of stock returns and domestic mutual funds in Taiwan stock exchange with daily data of 787 days. The paper utilizes a VAR-ECM model to find out the short-run and long-run behaviour. The analysis of this paper shows that market returns granger cause domestic institutional investors, and they follow the trend of foreign investors. Kamesaka, Nofsinger, & Kawakita (2003) bifurcated the institutional investors into foreign investors, security firms, Banks, Insurance firms, Investment trust, Companies, and individual investors, a weekly data set covering 17 years till 1997 in Tokyo stock exchange. Insurance firms, Investment trust, and banks showed negative feedback trading behaviour in the short-run but the coefficient was positive in the long run, which indicates positive feedback trading in the long term. Oh & Parwada, (2007) inspect mutual funds in Korean stock exchange from the period of 1996 to 2003 with the help of the VAR model. A significant negative correlation is between the net mutual fund and returns which is the indication of negative feedback trading. Purchasing mutual funds bears a strong relationship with market returns and purchase is also having information about the returns as bidirectional Granger causality is running between purchase and return in the Korean stock market. In Sri Lanka, the research on institutional data of Colombo stock exchange finds (Samarakoon, 2009) positive feedback trading behavior during purchase and negative feedback trading behavior for sells but the pattern is reversed in times of crises. The results also show the purchase of institutional investors leads to higher returns but on the other hand, the returns impact the purchase and sale of domestic institutional investors more than the purchase and sell of foreign institutional investors. H. Cha (2018) while studying the relationship between Korean stock market return and equity mutual funds with the help of monthly data from 1995 to 2016, the author found a contemporaneous positive correlation between the two.

Talking about Indian markets, (Thenmozhi & Kumar, 2009) while studying the dynamic relationship between stock market returns and mutual fund flows on the daily data from 2001 to 2008 observed that there is a positive relationship between them, but the causality was running from stock market returns to mutual funds and not vice-versa, which reflects negative feedback behaviour of mutual funds. A positive relationship with the stock market volatility and mutual fund flow is seen under the VAR environment that shock in mutual fund flow affects market volatility positively. R. Acharya & Thiripalraju (2011) examined the relationship of Mutual fund and FII with Bombay stock exchange in Indian Markets covering nine years till 2009 with daily data. The author found that mutual funds are followers of their trading strategies as they have a positive relationship with their lags. The study was divided into three study periods; they are 2000-2003, 2004-2007 and 2008-2009. There is bidirectional causality shown in the first two periods between returns and flows, but in the last period, causality is running from returns to flows only. Bose (2012) examined daily data of institutional investors in the Indian stock market from the period of 2008 to 2012 in a multivariate VAR framework. The findings of the study reveal that mutual funds follow the investment pattern of their lags, a contrarian trading strategy, and granger causality is running from by BSE returns to mutual funds.

Naik & Padhi (2014) examined the dynamics between stock market movement and institutional investors with daily data of 10 years till 2012. The results reveal that institutional investors follow their past strategies and mutual fund flows are associated with stock returns. Arora (2016) observed the trading behaviour of FII and DII in Indian stock markets. The results obtained reflected contrarian trading strategy for DII and momentum trading strategy for FII and future stock returns were having a significant positive relationship with DII. The paper documents DII's as sentiments traders as they follow an inverse trading strategy than FII's. (Mishra & Debasish, 2017) the paper relates to the trading behaviour of institutional investors in Indian stock markets covering a period of 2007 to 2016. In a VAR environment, the author finds that DII's are having an indistinct buying behaviour at the aggregate level. The DII consists of banks, mutual funds, financial institutions, insurance companies, and each of them has a different objective of investment and information analysis skills. On the other hand, the sells done by the DII's show the contrarian behaviour of selling meaning that they sell high performing shares. The variance decomposition analysis reveals that DII purchase defines the market return more than vice versa, whereas the DII sell is more defined by the market return. The results show that market returns and DII both have an impact on each other.

Chakraborty & Kakani (2016) studies the impact of the second moment of volume traded by institutional investors (DII+FII) on market volatility in a Markov switching framework by applying the Generalized orthogonal

multivariate GARCH model. Data of four countries, namely India, Taiwan, Korea, and Vietnam, are used from a period of 2000-2012, showing asymmetric information flow in both types of institutional investors across the four countries. The results of the paper show that the volume dispersion of institutional investors is affected by the market volatility and FII's are more affected by market volatility in comparison to DII, proving that DII's are more stable investors. The study also reveals that FIIs destabilizes the market in case of bad news by creating more volume dispersion in comparison to domestic institutional investors. Ferreira, Matos, Pereira, & Pires (2017) investigated the data for institutional investors of 32 countries and found that in countries with less efficient stock markets, non-English speaking and high information asymmetry local institutional investor is making informed investments. Chauhan & Chaklader (2020) also found mutual funds as values investors and Tom Jacob (2019) found their positive influence on stock returns. Major stock Indexes as well as sectoral indices in Indian stock markets also represent behavioural dependence on the Investment pattern of DII's (Srivastava & Varshney, 2023; Suneetha & Aithal, 2024)

From the review of the above literature, it is evident that a majorly contrarian trading strategy is followed by DII in stock markets, but inconsistencies also exist in the results. This may be due to changes in the economic nature of countries, frequency of the observations, sample periods, the methodology adopted, and due to the cognitive capability of the investors. As far as the Indian scenario is concerned, the DII is always represented by mutual funds in almost all papers; only very few articles have considered the data of DII, which contain consolidated data of mutual funds, banks, insurance companies, and Development financial institutions which come under the ambit of DII. Still, none of the studies has taken into consideration the DII data in a disintegrated level, which means banks, insurance companies, mutual funds, and development financial institutions, are studied separately for the leading stock exchange of India, *i.e.* NSE. So, the objective of this paper is to study the trading strategies of DII at a disintegrated level.

2. Data Description and Methodology

The data source for the study is the Securities Exchange Board of India (SEBI), from where the data for Mutual funds, Insurance companies, Development financial institutions, and Banks are collected. The data covers ten years, from January 2012 till December 2022, with daily frequency. The daily data helps to achieve greater precision in explaining non-contemporaneous and contemporaneous relation (Froot, O'Connell, & Seasholes, 2001). Data contains purchase, sell, and net (difference of purchase and sell) Prices of four major domestic institutional investors of Indian equity markets:

1) Mutual funds (MF): Private sector and public sector
2) Insurance companies (INSU):
   i. Life insurance companies: Private and Public sector
   ii. General insurance companies: Private and public sector
3) Development financial institutions (DFI): organizations owned by the government or charitable institutions to provide funds for low-capital projects or where their borrowers are unable to get it from commercial lenders. For example, Industrial Corporation of India established in 1948, Industrial Credit and Investment Corporation of India Limited established in 1955, Industrial Development Bank of India was set up in 1964, Industrial Reconstruction Corporation of India was set up in 1971, Small Industries development bank of India was established in 1989, Export-Import Bank was established in January 1982, National Bank for agriculture and rural development was established in July 1982, and National Housing Bank was established in 1988.
4) commercial banks.

Data for the Index of National Stock Exchange (NSE) nifty 50 is collected from the official website of NSE. It is a well-diversified index and is calculated as a weighted average of 50 Indian companies covering over 17 sectors. The closing prices of the nifty 50 index are converted into returns as $NSER_t = \log(close_t / close_{t-1})$ where $NSER_t$ is the return compounded at time t, and $close_{t-1}$ and $close_t$ are the stock index on two continuous days t-1 and t, respectively.

All the flow variables are normalized by 90 90-day moving average of Nifty 50 market capitalization such that control for market and fund growth is applied as per (Warther, 1995, Oh & Parwada, 2007, Thenmozhi & Kumar, 2009, B. Boyer & Zheng, 2009, R. Acharya & Thiripalraju, 2011 and Naik & Padhi, 2015). As market fundamental behaviour affects stock market (Chang *et al.* 2020). Three market fundamental variables are used in the study which is the exchange rate (IND(INR) v/s USA ($)), call money rate used as a proxy to short-term interest rate, and the dividend yield (H. J. Cha & Lee, 2001, Oh & Parwada, 2007, Thenmozhi & Kumar, 2009, Naik & Padhi, 2014). The daily data of the first two variables are collected from the Reserve Bank of India (RBI), and the third variable is collected from the website of NSE.

The VAR method is employed for analysis. First, the relationship between flow variables and returns is developed, and then the causality analysis is done. The VAR model helps to find out whether past returns can predict future flows and vice versa. In this model, stock return and equity flows are endogenous variables. Market fundamentals are exogenous variables. Every endogenous variable is explained with the help of lagged values of other variables and its own lagged values. If any of the flow variables affect the stock returns indirectly in the presence of market fundamentals (*i.e.* information effect), then that means the flows contain additional information about return and if not then flows only respond to the stock market returns (H. J. Cha & Lee, 2001). The VAR system empowers to predict the stock returns with the help of past equity flows while controlling for information which is in their previous stock return and vice versa. It is one of the most flexible models for the analysis of multivariate time series and useful for describing dynamic behaviour. The VAR model, which includes the exogenous variable, can be defined as follows in the general form.

$$y_t = \alpha_0 + B_1 y_{t-1} + B_2 y_{t-2} + \cdots \ldots + B_p y_{t-p} + \gamma E_t + \varepsilon_t \; ; t = 1,2,3 \ldots, T \quad (1)$$

The measured variable in the above equation (1) y_t = (y_{1t} , y_{2t} , y_{3t}……y_{nt}) is a vector of an endogenous variable in the system. The α_0 represents a nx1 vector of constant. The (nxn) matrix of coefficients are B_1 B_2……B_p; E_t is (nx1) matrix of exogenous factors, and γ are a coefficient matrix of exogenous variable respectively and ε_t is (nx1) the white noise error. To select the VAR lag order minimum value of lag selection criterion Akaike information criterion (AIC) is taken into consideration. In the first VAR system (model) purchase and sell value of DII and Nifty returns are used and in other VAR system (model 2) the net value of the flow variables is used with nifty. In the next step, a granger causality block exogeneity test shows the direction of causality. If causality runs from flows to return, then this supplements the price pressure hypothesis as this means that flows directly affect the returns (Oh & Parwada, 2007). After applying the VAR model, the impulse response function presents the response of institutional investors to innovations in stock returns and vice-versa.

2.1 Relationship of Mutual Funds, Insurance Companies, Development Financial Institutions, and Banks with Stock Returns

This section covers the dynamic interaction of stock returns and all the four types of DII flows of the study in a VAR framework. Considering the four sets of investment flows (MF, INSU, Banks, and DFI) as interdependent and forming an endogenous part of VAR system with stock returns we will estimate two VAR model, first with the sell and purchase values of MF, INSU, Banks, and DFI with stock returns (model 1) and second with net values (purchase-sell) of all the four types of DII and stock returns (model 2). The equation for the VAR model is as follows.

$$NSER_t = \alpha_1 + \sum_{i-1}^{p} B_{1i}\ NSER_{t-1} + \sum_{i-1}^{p} \gamma_{1i}\ mf_{t-1} + \sum_{i-1}^{p} \delta_{1i}\ dfi_{t-1} + \sum_{i-1}^{p} \theta_{1i}\ insu_{t-1} + \sum_{i-1}^{p} \lambda_{1i}\ bank_{t-1} + \mu_1\, dExrate_t + \nu_1\, dint_t + \rho_1 div_t + \varepsilon_t^{NSER} \quad (2)$$

$$mf_t = \alpha_2 + \sum_{i-1}^{p} B_{2i}\ NSER_{t-1} + \sum_{i-1}^{p} \gamma_{2i}\ mf_{t-1} + \sum_{i-1}^{p} \delta_{2i}\ dfi_{t-1} + \sum_{i-1}^{p} \theta_{2i}\ insu_{t-1} + \sum_{i-1}^{p} \lambda_{2i}\ bank_{t-1} + \mu_2\, dExrate_t + \nu_2\, dint_t + \rho_2 div_t\ \varepsilon_t^{mf} \quad (3)$$

$$insu_t = \alpha_3 + \sum_{i-1}^{p} B_{3i}\ NSER_{t-1} + \sum_{i-1}^{p} \gamma_{3i}\ mf_{t-1} + \sum_{i-1}^{p} \delta_{3i}\ dfi_{t-1} + \sum_{i-1}^{p} \theta_{3i}\ insu_{t-1} + \sum_{i-1}^{p} \lambda_{3i}\ bank_{t-1} + \mu_3\, dExrate_t + \nu_3\, dint_t + \rho_3 div_t + \varepsilon_t^{insu} \quad (4)$$

$$dfi_t = \alpha_4 + \sum_{i-1}^{p} B_{4i}\ NSER_{t-1} + \sum_{i-1}^{p} \gamma_{4i}\ mf_{t-1} + \sum_{i-1}^{p} \delta_{4i}\ dfi_{t-1} + \sum_{i-1}^{p} \theta_{4i}\ insu_{t-1} + \sum_{i-1}^{p} \lambda_{4i}\ bank_{t-1} + \mu_4\, dExrate_t + \nu_4 dint_t + \rho_4 div_t + \varepsilon_t^{dfi} \quad (5)$$

$$Bank_t = \alpha_5 + \sum_{i-1}^{p} B_{5i}\ NSER_{t-1} + \sum_{i-1}^{p} \gamma_{5i}\ mf_{t-1} + \sum_{i-1}^{p} \delta_{5i}\ dfi_{t-1} + \sum_{i-1}^{p} \theta_{5i}\ insu_{t-1} + \sum_{i-1}^{p} \lambda_{5i}\ bank_{t-1} + \mu_5\, dExrate_t + \nu_5\, dint_t + \rho_5 div_t + \varepsilon_t^{bank} \quad (6)$$

$NSER_t$ represents the market return variable at time t. The flow variables are f, $insu_t$, dfi_t $Bank_t$ which represents the Purchase sell and net of the domestic institutional investors. $dExrate_t$, int_t are the first difference in the exchange rate and interest rate and div_t denotes the dividend yield variable. We consider all four sets of investment flows to be interdependent, so they form an endogenous part of the VAR system. $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ and α_5 are the intercepts; B,γ,δ,λ,μ,ν, and ρ are the parameters which need to be estimated; ε_t^{NSER}, ε_t^{mf}, ε_t^{insu}, ε_t^{dfi} and ε_t^{bank} are the error terms and p denotes the lag length in the equation. In equation (3) mutual funds purchase, sell or net granger cause returns if null hypothesis for joint significance of $\gamma_{11} = \gamma_{12} =$…… $\gamma_{1p} = 0$ holds. Granger causality of equation (4), (5) and (6) are tested in the same way.

3. Empirical Findings

This section first holds the descriptive statistics of the variables under study in Table 1. All the series are highly deviated from their mean values as the standard deviation values are very high. Mutual funds seem to be the most top investors in terms of value, followed by Insurance companies, banks, and development financial institution (DFI). The values of skewness are almost near to 0 but kurtosis is not near to the standard value of 3. Heavily tailed leptokurtic values of kurtosis confirm the presence of outliers which means the behaviour of these investors is uncertain and its magnitude can vary up to any level.

Table1. Descriptive Statistics

	NSECLOSE	Dividend yield	call money	exchange rate
Mean	7421.055	1.293	6.531	59.122
Median	7355.025	1.28	6.48	61.866
Maximum	12271.8	2.18	11.77	74.387
Minimum	2573.15	0.900	2	43.948
SD	2364.701	0.195	1.57	8.895
Skewness	0.299	0.315	-0.502	-0.337
Kurtosis	1.988	3.715	3.112	1.708
J B test	156.3576 (0.000)	99.403 (0.000)	111.99 (0.000)	232.154 (0.000)

	Bank_buy	Bank_Sell	Bank_net	MF_buy	MF_sell	MF_net
Mean	15.03025	15.3025	-0.272	25.458	25.069	0.389
Median	15.07776	14.055	-0.063	11.89	11.798	0.122
Maximum	132.999	125.404	84.835	305.257	337.946	34.248
Minimum	0.0095	0.0048	-86.502	0.000	0.000	-73.724
SD	13.696	15.267	9.968	37.944	39.141	6.228
Skewness	1.1376	1.767	-0.785	3.6725	4.03	-1.708
Kurtosis	6.3184	8.837	13.924	18.224	21.583	24.411
J B test	1832.110 (0.000)	5270.029 (0.000)	13785.89 (0.000)	32334.23 (0.000)	46434.18 (0.000)	53204.45 (0.000)

	DFI_buy	DFI_sell	DFI_net	INSU_BUY	INSU_sell	INSU_net
Mean	0.309	0.331	-0.022	5.654	6.03	-0.375
Median	0.204	0.226	-0.0178	5.11	5.711	-0.409
Maximum	4.974	12.558	3.467	36.99	27.293	16.582
Minimum	0.000	0.000	-11.225	0.000	0	-16.002
SD	0.372	0.421	0.44	2.861	3.356	2.929
Skewness	4.031	10.856	-5.63	1.896	1.056	0.3377
Kurtosis	28.429	10.856	167.819	12.527	12.438	4.929
J B test	80535.24 (0.000)	8105758 (0.000)	3088588 (0.000)	11900.59 (0.000)	1485.819 (0.000)	472.851 (0.000)

Source: Research Findings

Note: the value in the table represents the t statistic and the value in parentheses is the probability for Jarque Bera test (JB) at 1 per cent level of significance

Before we move forward to estimate the empirical model, we need to check the stationarity of the variables to eliminate all the likelihood of spurious regression problems. The results of the Augmented dicky fuller test (ADF) shown in Table 2. admit that all the variables are stationary at level except Mutual fund Buy, mutual fund sell, interest rate, exchange rate, and Nifty 50 index are which are stationary at first difference.

Table 2. Results of Unit root test

Series	ADF Unit Root Test (level)				Remark
	None	With Intercept	With trend and intercept	First difference	
Bank Buy	-1.042 (0.268)	-2.475 (0.121)	-4.422 (0.002)		I(0)
Bank Sell	-1.901 (0.054)	-3.566 (0.006)	-13.239 (0.000)		I(0)
Bank Net	-39.331 (0.000)	-39.347 (0.000)	-39.347 (0.000)		I(0)
Insurance companies Buy	-1.712 (0.082)	-10.041 (0.000)	-15.127 (0.000)		I(0)
Insurance companies Sell	-1.380 (0.155)	-7.196 (0.000)	-14.033 (0.000)		I(0)
Insurance companies Net	-10.724 (0.000)	-10.930 (0.000)	-11.175 (0.000)		I(0)
Mutual funds Buy	-0.070 (0.0753)	-0.895 (0.788)	-2.877 (0.170)	-25.333 (0.000)	I(1)
Mutual funds Sell	-0.070 (0.7051)	-0.991 (0.785)	-2.867 (0.1730)	-25.496 (0.000)	I(1)
Mutual funds Net	-18.42 1(0.000)	.-18.417 (0.000)	-18.416 (0.000)		I(0)
Development financial institution Buy	-3.872 (0.000)	-10.612 (0.000)	-11.257 (0.000)		I(0)
Development financial institution Sell	-5.090 (0.000)	-23.614 (0.000)	-24.066 (0.000)		I(0)
Development financial institution Net	-52.457 (0.000)	-52.588 (0.000)	-52.633 (0.000)		I(0)
NSE close price	1.943 (0.988)	-0.679 (0.850)	-2.874 (0.1711)	-48.763 (0.000)	I(1)
Exchange rate	1.400 (0.960)	0.559 (0.876)	-2.585 (0.286)	38.176 (0.000)	I(1)
Interest rate	0.151 (0.631)	-2.059 (0.261)	-1.912 (0.647)	-21.128 (0.000)	I(1)
Dividend yield	-1.394 (0.152)	-3.845 (0.002)	-3.812 (0.116)		I(0)

Source: Research findings

Note: the value in the table represents the t statistic and the value in parentheses is the probability. All values are significant at 1% significance I(1) means integrated of order1, I(0) means integrated of order 0.

Table 3. Selection of Lag Length

VAR lag order selection criteria (model 1)						
Endogeneous variables : DFI equity Purchase and sale investment , MFequity Purchase and sale investment, INSUequity Purchase and sale investment, Banks equity Purchase and sale investment and nifty return						
Lag	LogL	sequential modified LR test statistic	FPE: Final prediction error	AIC: Akaike information criterion	SC: Schwarz information criterion	HQ: Hannan-Quinn information criterion
0	158745.2	NA	1.55E-64	-121.3837	-121.3029	-121.3545
1	162097.2	6670.525	1.27E-65	-123.8854	-123.6228	-123.7903
2	162793.7	1381.311	7.95E-66	-124.3562	-123.9118	-124.1952
3	163124.1	652.944	6.57E-66	-124.5469	-123.9207*	-124.3201
4	163333.7	412.7684	5.96E-66	-124.6453	-123.8373	-124.3526*
5	163485.1	297.1351	5.64E-66	-124.6991	-123.7093	-124.3406
6	163619.8	263.4868	5.42E-66	-124.7402	-123.5686	-124.3158
7	163746.6	247.0943	5.23e-66*	**-124.7752***	-123.4219	-124.285
8	163816.6	135.9165*	5.28E-66	-124.7668	-123.2317	-124.2107

Source: Research findings
Note: *Indicates lag order selected by the criterion.
Bold: Indicates optimum lag selection which is adopted for further analysis

Table 4. Selection of Lag Length

VAR lag order selection criteria (model 2)						
Endogeneous variables : DFI equity net investment , MFequity net investment, INSUequity net investment, Banks equity net investment and nifty returns						
Lag	LogL	sequential modified LR test statistic	FPE: Final prediction error	AIC: Akaike information criterion	SC: Schwarz information criterion	HQ: Hannan-Quinn information criterion
0	82635.16	NA	2.49E-34	-63.18559	-63.1407	-63.16933
1	83303.91	1332.896	1.52E-34	-63.67794	-63.57695	-63.64136
2	83436.65	264.0531	1.40E-34	-63.76034	-63.60324*	-63.70344
3	83506.63	138.9443	1.35E-34	-63.79475	-63.58153	-63.71751*
4	83545.64	77.30691	1.34E-34	-63.80546	-63.53614	-63.70791
5	83571.69	51.51656	1.34E-34	-63.80626	-63.48083	-63.68838
6	83602.85	61.51025	1.33e-34*	**-63.81097***	-63.42943	-63.67277
7	83623.81	41.29691	1.34E-34	-63.80788	-63.37023	-63.64936
8	83647.57	46.72871*	1.34E-34	-63.80694	-63.31318	-63.62809

Source : Research findings
Note: *Indicates lag order selected by the criterion
Bold: Indicates optimum lag selection which is adopted for further analysis

Table 5. VAR Granger Causality/Block Exogeneity Wald test

Dependent variable: NSER					Dependent variable: NSER			
Excluded	Chi-sq	df	Prob.		Excluded	Chi-sq	df	Prob.
DFI_NET	3.353208	6	0.7634		DFI_SELL	5.072537	7	0.6511
MF_NET	2.971491	6	0.8124		DFI_BUY	2.966327	7	0.8881
BANKNET	2.579095	6	0.8595		D(MF_BUY)	2.116615	7	0.9531
INSUNET	3.109434	6	0.795		D(MF_SELL)	2.017592	7	0.9589

					INSU_SELL	8.543685	7	0.2871
All	11.56773	24	0.9844		INSU__BUY	7.394064	7	0.389
					BANK_SELL	0.806633	7	0.9974
					BANK_BUY	14.25842	7	0.0468
					All	49.84985	56	0.7055

Source: Research findings
Note: INSU, DFI, MF represents insurance companies, development financial institution and mutual funds respectively

Table 6. VAR Granger Causality/Block Exogeneity Wald test

Dependent variable: DFI_SELL					Dependent variable: DFI_BUY			
Excluded	Chi-sq	df	Prob.		Excluded	Chi-sq	df	Prob.
NSER	2.705996	7	0.9108		NSER	14.14503	7	0.0487
Dependent variable: D(MF_SELL)					Dependent variable: D(MF_BUY)			
Excluded	Chi-sq	df	Prob.		Excluded	Chi-sq	df	Prob.
NSER	30.19651	7	0.0001		NSER	16.56984	7	0.0204
Dependent variable: INSU_SELL					Dependent variable: INSU__BUY			
Excluded	Chi-sq	df	Prob.		Excluded	Chi-sq	df	Prob.
NSER	42.74749	7	0.0000		NSER	21.35777	7	0.0033
Dependent variable: BANK_SELL					Dependent variable: BANK_BUY			
Excluded	Chi-sq	df	Prob.		Excluded	Chi-sq	df	Prob.
NSER	17.7957	7	0.0129		NSER	8.143698	7	0.3201
Dependent variable: DFI_NET					Dependent variable: MF_NET			
Excluded	Chi-sq	df	Prob.		Excluded	Chi-sq	df	Prob.
NSER	10.53142	6	0.104		NSER	105.6826	6	0.0000
Dependent variable: BANKNET					Dependent variable: INSUNET			
Excluded	Chi-sq	df	Prob.		Excluded	Chi-sq	df	Prob.
NSER	10.13898	6	0.1189		NSER	47.92464	6	0.0000

Source: Research findings
Note: INSU, DFI, MF represents insurance companies, development financial institution and mutual funds respectively

To study the multivariate VAR model, we adopted optimum lag based on AIC criteria. Lag Length for the model 1 and model 2 under study is lag 7 and lag 6 respectively as can be seen in Table 3 and 4. The results of Block exogeneity granger causality test under VAR approach is represented in table 5 and 6. The results depict significant multivariate causal relationship of selected time series in the study. We have found significant causality running from nifty returns towards MF (buy, sell and net), INSU (buy, sell and net) DFI (buy) and Bank (sell). Bank (buy) is weakly causing Nifty returns (which shows price pressure effect) and no other flow variable is causing stock returns. In magnitude for causal relations nifty return has maximum effect on MF (net) followed by investments of INSU (net). However, none of the flow variables except bank (buy) is causing nifty returns.

The responsiveness of one time series to unexpected shock of other time series can be studied in a VAR environment with help of impulse response function. It helps in investigating the responsiveness of endogenous variables within a VAR system. To check this, a unit shock is injected in the error for every endogenous time series from every equation of the VAR system.

Impulse response function in figure 1 and figure 2 represents the model 1. Figure 1 shows the response of nifty returns to one standard deviation shock in the daily buy and sell values of MF, INSU, DFI and banks. The response of nifty returns to 1 SD shock in selling done by DFI, INSU, MF and Bank is negative. The response of

nifty returns to 1 SD shock in buying done by MF, DFI, INSU is positive for 10 days. The response of nifty returns to shock in buying done by banks is negative. Trading done by MF, INSU, DFI and Banks is impacting stock returns for a short run.

Figure 2 shows the response of buying and selling done by MF, INSU, DFI and banks to one standard deviation shock in nifty returns. Response of MF, DFI, and INSU buying is negative to 1 SD shock in returns. Response of 1 SD shock in nifty reurns on selling done by MF and INSU is positive, which means they move opposite to market and show contrarian trading strategy. Buy and sell values of Banks is negatively reacting to shock in returns which shows that they move with the market showing a positive feedback trading behaviour. Shocks in returns are having a long-lasting impact of 20 to 25 days on the trading of all the four domestic institutional investors. INSU buy showing a sharp increase as against to shock in returns and INSU sell showing a sharp decrease as against to shock in returns which depict them as most active traders.

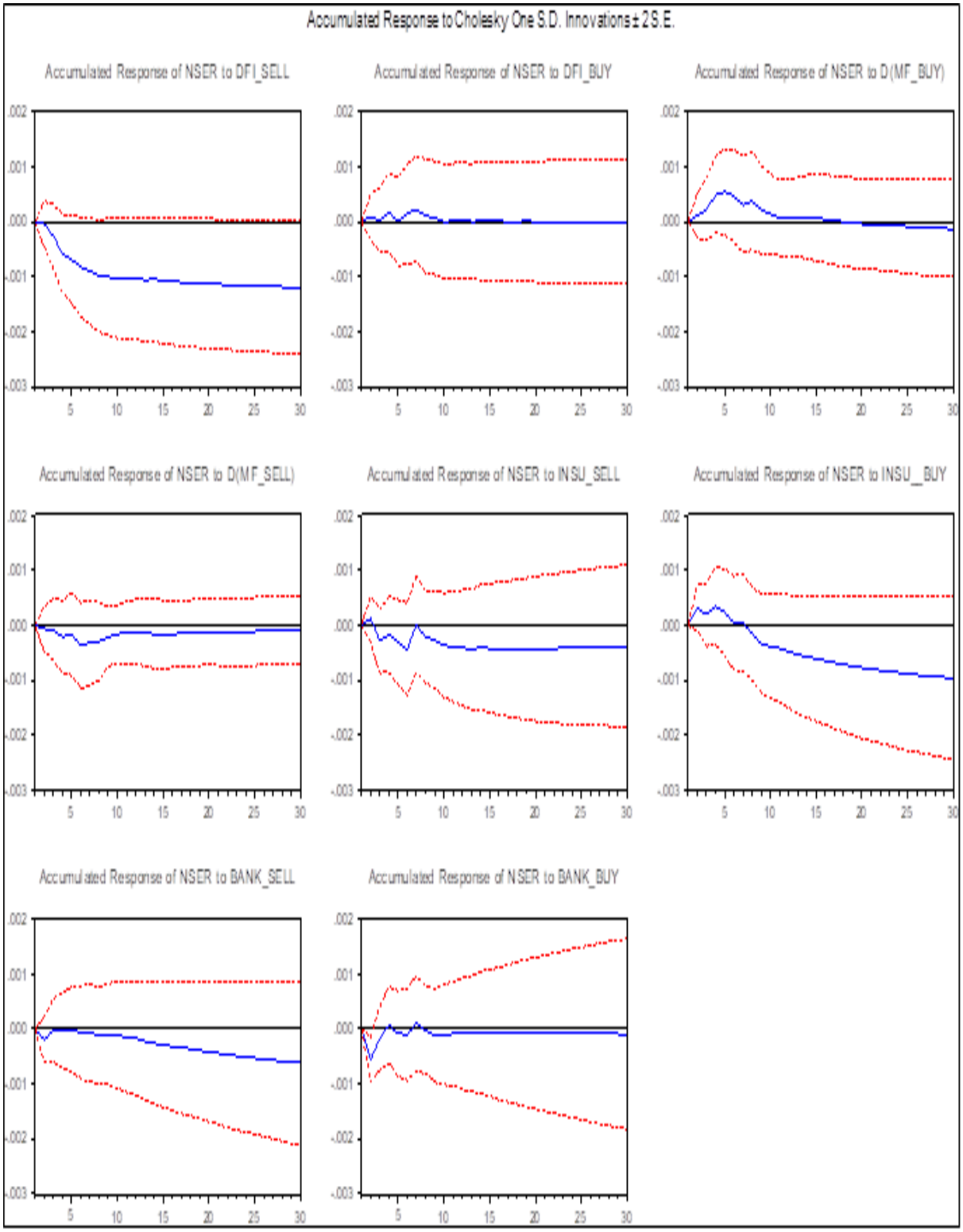
Impulse response function in figure 3 and 4 represents model 2. Figure 3 shows the response of nifty returns to one standard deviation shock in net values of MF, INSU, DFI, and Banks investments. The response of nifty returns is positive to 1SD shock in net investment of four Domestic institutional investors.

Figure 4 shows the response of MF, INSU, DFI and banks to the one standard deviation shock in nifty returns. MF, INSU, and DFI are showing a negative response which confirms their contrarian trading behaviour (value investing or negative feedback trading).

There is a positive response of Banks net investments to one standard deviation shock in nifty returns, so it concludes to momentum trading (positive feedback trading) behaviour. Banks chase the nifty return of Indian stock market which can increase the volatility in the returns of the nifty 50 index. MF, INSU, DFI invest in a falling market which shows that have better micro information about the firms listed in the stock market, so they involve in value investing. Likewise, MF, INSU, DFI know the timing when the share value of the firm is overvalued while the stock markets are moving up, so they sell and provide stability to the market in.

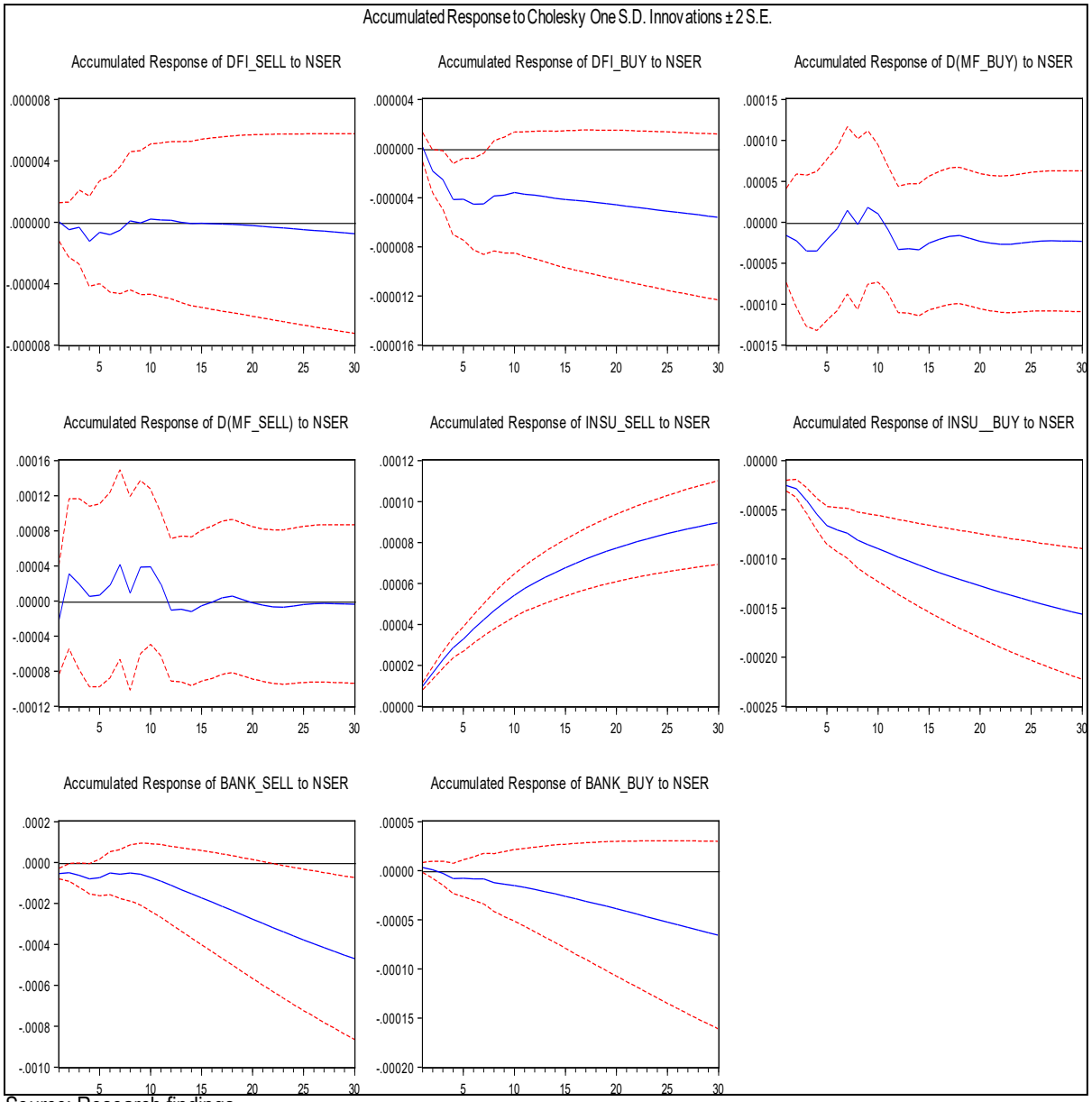
The variance decomposition in VAR provides a different method to examine the dynamics of this system. The table of variance decomposition represents the proportion of variation in the movement of endogenous variables which are due to shock in its ‘own’ lagged values and shocks in lagged values of other variables of the system. Results in Table 7 show that variance in nifty is defined by its ‘own’ lagged values. Buy and sell values of MF, DFI, INSU, and bank are defining return with a small percentage. Out of all of them, Bank Buy is defining the nifty returns of 0.54%, which is the highest. Stock returns are defining INSU buy and sell by 4.12% and 10.015% respectively. Stock returns define Bank buy and sell values by 0.26% and 0.58% respectively. Stock returns are defining DFI buy and sell values by 0.68% and 0.16% respectively. Stock returns define the buy and sell of MF by 0.06% and 0.16% respectively.

Figure 1. (model 1) Impulse Response Function between buy and sell values of mutual funds, Insurance companies, banks, development financial institution equity investments and Nifty Returns. Line in red is 5 percent confidence band



Source: Research findings

Figure 2. (mode1) Impulse Response Function between mutual funds, Insurance companies, banks, development financial institution (Buy and sell) equity investments and Nifty Returns. Line in red is 5 percent confidence band



Source: Research findings

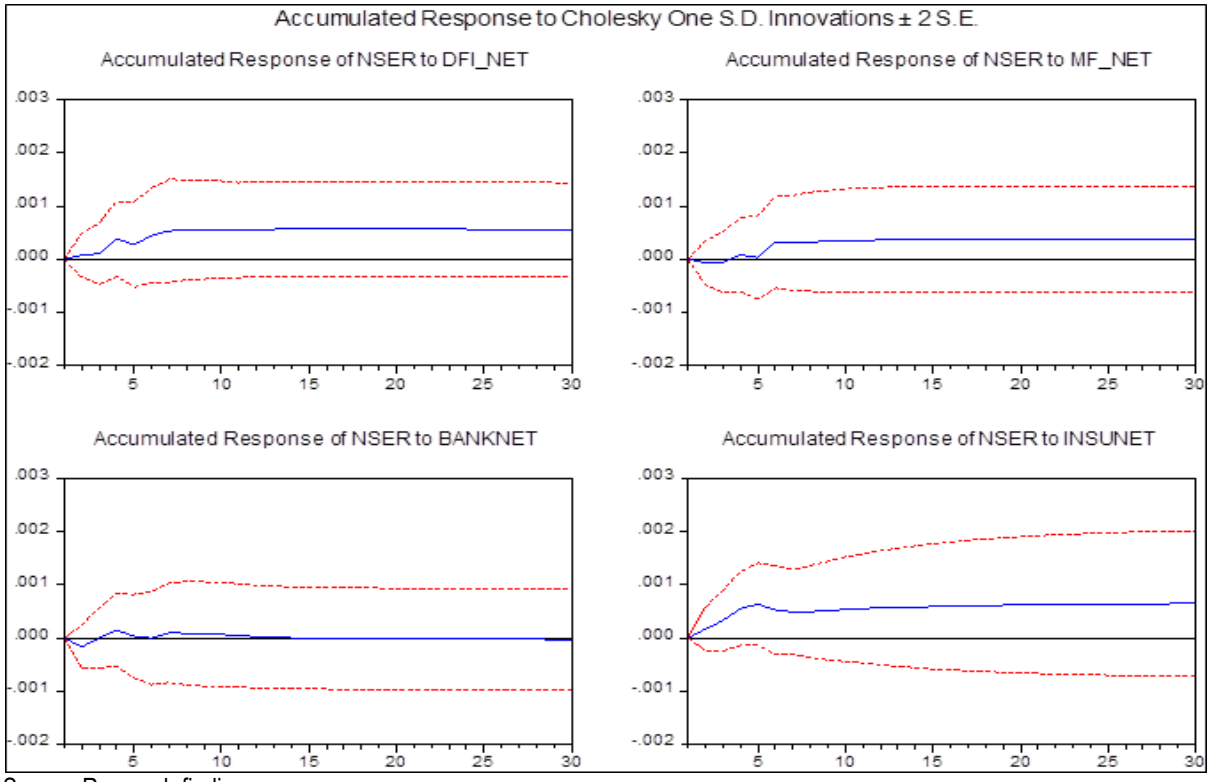
Table 7. Variance Decomposition analysis (model 1)

Variance Decomposition of NSER: By DII								
Period	DFI_SELL	DFI_BUY	D(MF_BUY)	D(MF_SELL)	INSU_SELL	INSU__BUY	BANK_SELL	BANK_BUY
10	0.175	0.1	0.15	0.0723	0.4509	0.2298	0.063	0.548
Variance Decomposition of DII Buying and selling : By NSER								
Period	DFI_SELL	DFI_BUY	D(MF_BUY)	D(MF_SELL)	INSU_SELL	INSU__BUY	BANK_SELL	BANK_BUY
10								
	0.174	0.69	0.07	0.1625	10.314	4.1219	0.612	0.258

Source : Research findings

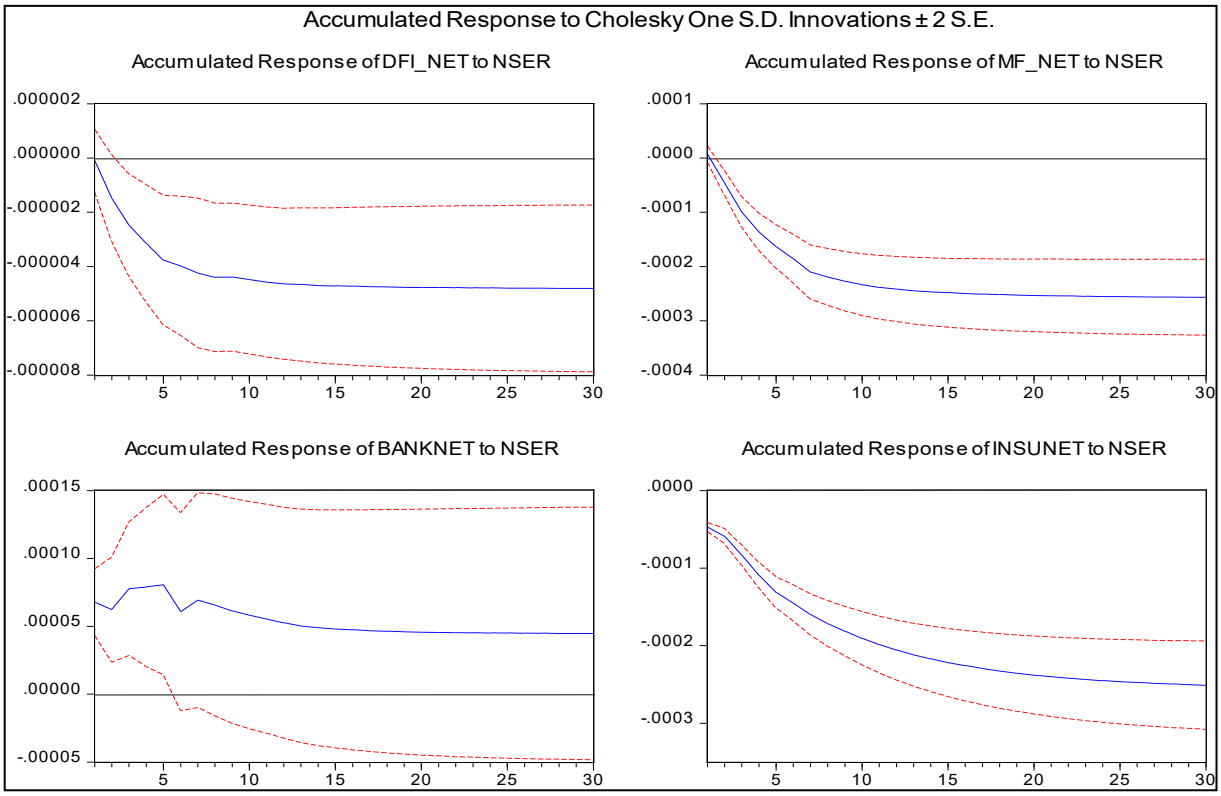
Cholesky Ordering: NSER DFI_SELL DFI_BUY D(MF_BUY) D(MF_SELL) INSU_SELL INSU__BUY BANK_SELL BANK_BUY

Figure 3. (model 2) Impulse Response Function between buy mutual funds, Insurance companies, banks, development financial institution (net) equity investments and Nifty Returns. Line in red is 5 percent confidence band.



Source: Research findings

Figure 4. (model 2) Impulse Response Function between mutual funds, Insurance companies, banks, development financial institution (net) equity investments and Nifty Returns. Line in red is 5 percent confidence band.



Source: Research findings

Table 8. Variance Decomposition analysis (model 2)

Variance Decomposition of NSER: By DII						
Period		NSER	DFI_NET	MF_NET	BANKNET	INSUNET
10		99.57998	0.116802	0.095712	0.091602	0.1159
Variance Decomposition of DII net investment: By NSER						
Period		DFI_NET	MF_NET	BANKNET	INSUNET	
10		0.434037	5.287941	1.238542	14.0704	

Source: Research findings
Cholesky Ordering: NSER DFI_NET MF_NET BANKNET INSUNET

The Table 8 results show variance decomposition between the net values of all four DIIs and the Nifty returns. The nifty returns define the INSU net as a maximum value of 14%, the MF net as 5.27%, the bank net as 1.23%, and the DFI net as 0.43%.

The dynamics of relationship between DII at disintegrate level with nifty returns reveal that there is strong impact of nifty returns on MF, INSU, Bank and DFI trading behaviour. Shock in investments of MF, INSU, Banks and DFI are all impacting nifty returns positively. The impact of stock returns on MF, INSU, DFI and Banks last for a longer time period as compared to their impact on stock returns, this analysis is similar to (Mishra & Debasish, 2017). Purchasing done by these investors is having much influence on nifty returns as compared to selling which can be seen in variance decomposition table, which is similar to Oh & Parwada (2007). Therefore, three DII (MF, INSU, DFI) have negative impact of lagged index returns which means they follow contrarian trading behaviour which makes the results at a disintegrated level similar to Chauhan & Chaklader (2020), Naik & Padhi (2014), Bose (2012), R. H. Acharya (2013) as they represented DII with Mutual funds. The results are also similar to Mishra & Debasish (2017) and Arora (2016) who have taken a consolidated data for DII.

Stock returns have a positive impact on Banks, so they follow a momentum trading behaviour, which is similar to the results of SriLankan markets (Samarakoon, 2009) where DII follow positive feedback trading and in Korean markets where equity trust follow positive feedback trading (Ndei, Muchina, & Waweru, 2019). We can conclude that not all DII's follow contrarian trading behaviour in Indian markets. Lagged values of stock index return highly impact insurance companies and appear to be the most active traders of the markets. Net maximum investments done by MF is highest among all the four DII under study, it can be seen in descriptive statistics. Ganger causality results confirm Unidirectional causality from returns to buy, sell, and net values of MF and INSU. Causality is running from stock returns to DFI buy, only which in sync with results of variance decomposition where returns are least defining DFI's. Stock returns are granger causing Bank Sell, while causality is running from bank buy to stock returns which gives support to the presence of price pressure hypothesis similar to the results of (Ben-Rephael, Kandel, & Wohl, 2010). Many studies confirm that granger causality is running from stock returns to DII (Mishra & Debasish, 2017, Arora, 2016). Stock returns define the trading of INSU the maximum followed by MF, Banks and DFI.

Conclusion

The study investigates about the trading strategies of four domestic institutional investors *i.e.* Mutual funds, insurance companies, development financial institution, and banks in Indian stock markets. The study uses data of DII at disintegrated level with separate buy sell and net values of MF, INSU, DFI and banks. The time duration of data under study is from 2012 to 2022, and CNX nifty 50 Index is used to represent the returns in the Indian stock market. Vector autoregressive model and granger causality block exogeneity test is used for the purpose of the study. The VAR model runs in the presence of three market fundamental variables exchange rate, interest rate and dividend. Rate. There are different categories of investors like aggressive investors, well-informed investors, risk-averse investors who trade in the stock market. Investment behaviour of rational and informed investors provides sentiments to stock returns whereas feedback traders follow them with an expectation of a persisting trend. The results of this study tell that it is the nifty returns that negatively impact the investment behaviour of MF, INSU, DFI, and positively impact the banks. MF, INSU and DFI are involved in contrarian trading strategy (negative feedback trading or value investing) and Banks are involved in positive feedback trading (momentum trading).

Bank is the biggest investor among four DII at net level and trade by chasing the pattern of stock markets, it tends to move the stock prices away from fundamentals which may increase the volatility in stock markets. MF,

INSU, DFI make investments in falling markets because they have better information regarding the firms and tend to buy stocks of good firms in falling markets. They also have better information regarding the timing of overvaluation of stock of the firm, so they sell the stock in rising markets. In both cases they provide stability in stock markets and bring the values of stock near to fundamentals. MF, INSU, DFI and Banks are not only following their past lagged investment pattern but are also following the investment pattern of other institutional investors which may lead to herding behaviour in the market and can be matter of concern during shock periods.

The regulatory authorities should make policies promoting investment through equity mutual funds as savings of small investors may pump in huge amounts of money in stock markets which will result in stabilizing effects to stock markets. Policies regarding investments in equity mutual funds for a larger duration of time will help the fund managers to invest consistently in stock markets.

Regulatory authorities of Insurance companies should increase the ceiling limit of their investment in stock markets so that their investment participation can be increased which will lead to stability in stock markets. An awareness drive to increase the investments into insurance instrument should be done to increase the investment corpus of insurance companies as many people in India still not think insurance as a mandatory part of their investments.

Development financial institutions investments is providing strength to Indian stock markets as they are contrarian traders so regulatory authorities should support DFI for increasing their horizons to invest into the stock markets. Strict Norms should be made by regulatory authorities for banks so that to curb the volatility creation in the market due to positive feedback trading.

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Credit Authorship Contribution Statement

Purwa Srivastava contributed to the study's conceptualization and assisted in designing the research methodology. **Sakshi Varshney** supervised the overall research work, validated the data, and provided critical input throughout the development of the paper. **Taru Maheshwari** worked on selecting appropriate software tools and helped in data analysis. **Neha Singh** and **Divya Rana** were responsible for reviewing, editing, and refining the final draft of the manuscript**.**

Declaration of Competing Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Decision-Making Theory in Analyzing Investor Behaviour in the Bond Market

Mykhailo ZHYLIN
Department of Practical Psychology
Educational and Scientific Maritime Institute of Humanities
Odessa National Maritime University, Ukraine
ORCID: 0000–0003–2898–4403
zhylinmyhailo@gmail.com

Viktoriia SHUTENKO
Department of Mathematical Support of Computer Systems
Odesa I.I. Mechnikov National University, Ukraine
ORCID: 0009-0005-3322-5489
vshutenko@gmail.com

Alla LYSENKO
Department of Audit, Accounting and Taxation Faculty of Economics
Central Ukrainian National Technical University, Ukraine
ORCID: 0000-0001-8193-4267
alysenko@gmail.com

Volodymyr SHEVCHUK
Interregional Academy of Personnel Management, Ukraine
ORCID: 0009-0002-4456-7618
volodymyrshevchuk@gmail.com

Artur OLEKSYN
Department of Finance and Credit, Faculty of Economics
Yuriy Fedkovych Chernivtsi National University, Ukraine
ORCID: 0000-0002-4194-5962
arturolex@gmail.com

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Abstract: Aim: study the integration of economic variables and behavioural data to make bond price forecasting more accurate and understand market dynamics across economies. Methodology: media-based sentiment analysis, Bayesian forecasting, and time series modelling were used to determine bond price movements. Conclusions: The results show how behavioural and sentimental data influence bond price forecasts, especially in the context of emerging markets where sensitivity to investor sentiment is high. The findings show that the extended relationships with structured economic variables were more prominent for developed economies. It was demonstrated how sentiment analysis can be integrated into traditional economic models to improve forecasting accuracy when capturing volatility periods of. So, it adds to its usefulness for capturing market dynamics during volatility periods. Originality: The study offers a conceptual methodological framework by combining bond market analysis using structured and unstructured data. This improves the overall understanding of the role of sentiment in financial forecasting and extends applicability in different economic contexts to a broad discussion. Limitations of the Study: The use of publicly available sentiment data has some biases, and further improvement of the analysis tool is needed. This methodology can be extended to other financial instruments in further studies, and variables can be included to increase robustness. Practical Implications: The obtained data allows financial analysts and institutional investors to understand how to use sentiment analysis in bond market decision-making.

Keywords: bond price forecasting; behavioral economics; psychology of decision-making; sentiment analysis; economic indicators; Bayesian framework; financial markets; emerging economies; psychological economics.

JEL Classification: A11; A12; C61; C63; C91; D70.

Introduction

Investment strategy, monetary policy, and the stability of the global financial system depend heavily on the bond market (Muhammadullah *et al.* 2022). Understanding the process of bond price movements is becoming increasingly important for investors and financial analysts. Historically, bond price forecasts have been based on a small set of structured economic variables, such as interest rates, inflation, and economic growth (Prokopenko *et al.* 2024). However, recent advances in data science and sentiment analysis allow unstructured market sentiment data from news or social media to be superimposed on forecasting models. This greatly expands the possibilities for more accurate forecasting (Nica *et al.* 2023).

The analysis of financial markets and their impact on macroeconomic indicators is still one of the main branches of modern economics. The increasing complexity of global financial systems requires a detailed understanding of the determinants of corporate bond markets and equity returns. The importance of these markets is not only in ensuring economic growth and stability, but also in determining investor confidence and macro trends. The combination of macroeconomic analysis with behavioural and predictive modelling provides a unique approach to understanding market dynamics. This allows for effective risk management and informed investment decisions.

The aim of this research is to study the impact of macroeconomic factors, market sentiment and forecasting tools on the financial market, in particular on the corporate bond market and the stock market. The main goal is to integrate macroeconomics and behavioural finance to better understand the effect of these indicators on market outcomes and investment strategies. This allows building a more accurate picture of market processes and the interaction of various economic factors. The aim involved the fulfilment of the following research objectives:

- Study the impact of macroeconomic factors on corporate bond yields and stock return forecasts, as well as identify key factors of market dynamics;
- Analyse the role of market sentiment and macroeconomic announcements in shaping investor behaviour and their impact on market risk premiums;
- Assess the effectiveness of modern forecasting tools, such as automatic time series modelling, in forecasting economic indicators and their implications for financial decision-making.

The contributions of this study lie in providing a novel and comprehensive approach for forecasting the evolution of the bond market dynamics by utilizing structured macroeconomics indicators together with unstructured sentiment data read from news and social media channels, via adaptive Bayesian modeling. Although there is previous research exists in unearthing patterns in these streams of data, this is usually treated in isolation, and the craters caused by these two schools of literature are filled by the work done here: we unify insights from behavioural finance with econometric forecasting in one model. This approach is important because it can model the complexities of investor behavior, which will also allow us to predict bond price variations with more volatility, which is more often found in volatile and emerging markets. Additionally, the methodology of the study enables comparisons across countries as well as the robustness of the financial decision-making process as it concerns uncertainty (Prokopenko *et al.* 2024). Within this framework, both investor analysts and policymakers alike can gain practical tools to manoeuvre in more data-based financial environments, and through the theoretical contributions to the academic discussion on the stock market.

This research is important in the settings where financial markets are becoming increasingly interconnected and dependent on a variety of economic and behavioural factors. The article is intended to deepen the understanding of market mechanisms and address the problems associated with economic uncertainty and changing investor expectations. As a result, this research helps to create a basis for making informed financial decisions and improving market strategies.

1. Literature Review

Financial forecasting combines structured and unstructured data to analyse investment decisions, investor behaviour, and market dynamics. A consistent review by Che Hassan *et al.* (2023) focuses on behavioural aspects and financial literacy, emphasizing their interrelationship. Their study, however, lacks an analysis of the impact of cultural and demographic factors, which requires further study.

Yang *et al.* (2021) used structural equation modelling to examine the relationship between financial information and risk perception. This methodology demonstrates causal relationships but ignores external shocks and fluctuations in global markets. Including these factors could provide a more comprehensive analysis. Shehata *et al.* (2021) examined the impact of risk on decision-making in the Saudi Arabian stock market. Their findings

emphasize the importance of risk analysis but focus on only one geographical area. Cross-regional studies could improve the generalizability of these findings.

Raut *et al.* (2020a, c) examined the theory of planned behaviour to understand socially responsible investing in India. While the study is reliable, it does not cover the long-term outcomes of such investment. Further analysis could assess their impact across economic cycles. Lai (2019) focused on personality traits that influence investment behaviour, emphasizing their importance for market participation. The study does not cover the interactions between personality traits and economic factors. The integration of these variables would provide a more detailed understanding.

Cao *et al.* (2021) examined behavioural factors influencing investor decisions in Vietnam, suggesting a psychological background. However, the limited regional focus limits the generalizability of the findings. Comparative analysis across markets would support the findings. Raut, Das & Mishra (2020b) studied the relationship between financial literacy and past investor behaviour in India. The findings are consistent with other studies, but ignore the impact of technologies such as robo-advisors. This gap creates opportunities for further research.

Moueed & Hunjra (2020) analysed the impact of emotional states, such as anger, on the stock markets of Pakistan. The research found significant psychological effects but did not suggest strategies to mitigate emotional biases. Studying such interventions could improve the quality of decisions. Alhorani (2019) focused on mutual fund selection, identifying key financial and non-financial determinants. The study does not consider the impact of new technologies, such as mobile applications. Analysing this interaction could provide new insights.

Dima *et al.* (2023) focused on the role of technology in financial and educational systems, emphasizing cloud-based e-learning platforms. Their research ignores the real-time integration of these systems for financial forecasting. Further studies in this area could be useful. Cai *et al.* (2019) dealt with clustering in the corporate bond market, focusing on pricing and stability. However, the impact of regulatory changes remained unexplored. Expanding of this issue would deepen our understanding.

Dewachter *et al.* (2019) conducted a macro-financial analysis of the corporate bond market, revealing the impact of macroeconomic conditions on the market. Geopolitical risks were not taken into account, which creates a room for further research. Fisher *et al.* (2022) analysed the relationship between macroeconomic attention and risk, showing changes in investor behaviour. The study does not consider the impact of digital platforms on these processes. Further analysis of the interaction with digital technologies could reveal new aspects.

Frydman *et al.* (2020) studied the psychological aspects of market sentiment, emphasizing its impact on stock forecasting. The findings ignore the role of sentiment in market crashes. This gap requires further study. Guerard *et al.* (2020) explored automated time series modelling for economic forecasting. Despite the effectiveness of the methodology, real-time data integration was neglected. Further research may focus on this aspect.

To gain understanding of the investors' behaviour in the bond market, it is necessary to integrate behavioural finance theories, risk perception, attention metrics, and institutional differentiation. Rad *et al.* (2025) proposes a structured approach using the behavioural framework in which decision tree regression models are utilized to map investment behaviours that stem from their irrational patterns under uncertainty. The authors' modelling is supportive of the theoretical premise that investors frequently follow heuristics as opposed to making rational assessments in congruence with the broader field of behavioural finance and lays a sturdy groundwork for the evaluation of bond related decisions.

Being based on this, Raza *et al.* (2025) study investor attention using Google search volume as a sentiment and informational demand proxy. That reveals the extent to which varying attention influences market volatility, particularly when it comes to fluctuations in interest rates on debt securities, which markedly fluctuate based on investors' perception of macro signal and policy announcement. Rad *et al.*'s model is complemented by this metric to provide insights regarding a real-time behavioural indicator that can be associated with changes in sentiment and included as part of the decision tree analysis.

Some further psychological dimension of the choice of investments is extended in Addo *et al.* (2025), on behavioural risk management. In the paper, they look at how cognitive biases like overconfidence and loss aversion influence portfolio choices. In the context of the bond market, this perspective is critical; risk and perceived safe havens lead preferences to favour government or even ESG-aligned bonds due to their higher yields even over riskier but higher yielding instruments. And their findings confirm that theoretical models along the lines of those proposed by Rad *et al.* need to take psychological risk profiles into consideration.

In parallel, Low *et al.* (202) examine how they present the findings that there is a tendency for Environmental, Social, and Governance (ESG) factors to have an effect on bond yield spreads, where they

compare sukuk to conventional bonds. The study finds that the behaviour of investors, and hence, stock prices are being influenced by non-financial performance measures, more so under dual economy environments. This extends the behavioural decision-making theory on the dimension of ethnic preferences and institutional framework that influence investment flows, which is very important when modelling bond investor behaviour.

Last, Cui *et al.* (2025) differentiate between retail investor sentiment and institutional investor sentiment as well as the differential effect of each of these sentiments on stock returns. Although the context is equity markets, their insights on how institutional investors behave more systematically in response to risk (whereas retailer investors are sentiment driven) can also be extrapolated to bond markets. The existence of these differences supports segments of investor profiles in decision making models and shows the heterogeneities in the behaviour of responding to fixed income investments.

This literature emphasizes the importance of integrating different data sources into financial forecasting. However, there are gaps in the consideration of technological changes, cross-regional aspects, and psychological factors. Further analysis of these areas is necessary to create comprehensive forecasting models.

2. Methodology

2.1. Research Procedure

The study consists of three stages. The data were first collected from publicly available sources: financial databases containing economic indicators and news sentiment analysis using natural language processing (NLP) tools. The second stage involved the application of an adaptive Bayesian model. This model was used to update the probability distribution of future bond prices by including new economic and sentiment information that became available. Finally, the model was evaluated for its performance using statistical such methods as mean square error (MSE), R-squared, and correlation coefficients to assess its accuracy.

2.2. Sample

This study intends to forecast bond price dynamics in 9 major economies (USA, Germany, Japan, UK, Canada, Australia, Brazil, China, and India) using an adaptive Bayesian model. These countries were selected for the sample because of their importance in the global economic arena, high level of financial market development, and stable macroeconomic indicators. The sample includes both developed and emerging economies. This allows for comparative analysis between different regions and economic conditions. The data were collected from multiple sources: historical bond prices, interest rates, inflation and GDP growth from financial databases and national agencies. Sentiment assessments were obtained from academic articles and financial reports using NLP (Financial Stability Board, 2020; Research and Markets, 2022; World Bank, 2023; WIPO, 2022; US Department of State, 2022; World Economic Forum, 2023; UNDP, 2022; International Monetary Fund, 2021; United Nations, 2022; UK Department for Business, Energy and Industrial Strategy, 2022; European Union, 2022).

The study uses publicly available data and guarantees anonymity of information, ensuring compliance with ethical standards. The adaptive Bayesian model is used to dynamically update bond price forecasts, taking into account new economic data and changing market sentiment. This enables a more accurate prediction of the dynamics of bond prices, which contributes to better investment decision-making.

2.3. Methods

The main method is Bayesian inference, which allows updating the probability distribution of bond prices taking into account new data. This is achieved by updating probabilities based on two types of data: structured data (economic variables); unstructured data (sentiment assessments). The mathematical model for predicting bond prices can be expressed as follows:

$$P_{t+1} = P_t * \frac{P(X_t \mid \theta) * P(S_t \mid \theta)}{P(X_t,\ S_t)} \quad (1)$$

where,

- P_t - represents the probability distribution of bond prices at a point in time t.
- X_t - a vector of structured variables at time t, which includes factors such as bond prices, interest rates, inflation, GDP, etc.
- S_t - represents sentiment indicators derived from unstructured data.
- θ - parameters or factors that relate structured and unstructured data to bond prices.

Explanation of model components:

- $P(X_t \mid \theta)$ - the probability of observing structured data (*e.g.*, interest rates, inflation) at time *t* taking into account the parameters *θ*.

- $P(S_t \mid \theta)$ - the probability of observing sentiment scores obtained from unstructured data at time *t.*

- $P(X_t, S_t)$ - the joint distribution of structured and unstructured data.

The model updates the probability distribution *Pt+1* based on new structured data and changes in market sentiment. This allows for dynamic adjustments to forecasts, including:

- updating bond prices based on new economic information and sentiment assessments.

- accounting for changes in economic indicators and market sentiment that affect investment decisions.

The structured variables *Xt* include: bond prices (BP), interest rates (IR), inflation (Infl), GDP growth (GDP). These variables directly affect bond prices through economic conditions. Interest rates and inflation affect bond yields, and GDP growth reflects investor confidence.

Unstructured data *St* – sentiment indicators extracted from news, social networks, and financial reports using NLP. This detects market sentiment and its impact on investment decisions. The initial probability distribution *Pt* is based on historical bond prices or previous market conditions. The initial assumption can be uniform or based on market knowledge.

The model performance is assessed using several metrics:

- Mean Squared Error (MSE);

- R-squared (R^2);

- Correlation coefficients.

These indicators help to compare the model with other methods using structured data only. This determines how much the influence of unstructured data (sentiment assessments) improves the accuracy of predictions.

The model is validated using:

- Split testing;

- K-Fold Cross Validation;

This provides an assessment of its robustness and ability to generalize to new data.

3. Research Results

The selected countries — the US, Germany, Japan, the UK, Canada, Australia, Brazil, China, India — cover a range of economic development, market maturity, and geopolitical risks. The analysis examines the impact of both structured and unstructured data on bond market outcomes. It also examines how sentiment derived from unstructured data can affect bond prices (Figure 1).

Figure 1. Panel regression results (Bond price model)

```
. xtreg BP IR GDP, re

Random-effects GLS regression


------------------------------------------------------------------------------
      BP | Coefficient  Std. Err.      z    P>|z|     [95% Conf. Interval]
---------+--------------------------------------------------------------------
      IR |    -0.0153     0.003    -5.10   0.000    -0.021       -0.010
     GDP |     0.1328     0.022     6.02   0.000     0.089        0.177
   _cons |    98.2014     1.443    68.07   0.000    95.357      101.046
------------------------------------------------------------------------------
```

Source: developed by the authors in Stata.

Analysis of the results in Figure 1 gives grounds to conclude that:

1. Interest rate (IR) is a negative coefficient (-0.0153), indicating that higher interest rates have a negative impact on bond prices.

2. GDP growth (GDP) is a positive coefficient (0.1328), indicating that higher GDP growth increases bond prices, likely because of increased investor confidence and economic stability.

The results of the panel regression analysis show that both interest rates and GDP growth play a significant role in determining bond prices. Higher interest rates usually lead to lower bond prices, which is consistent with the typical inverse relationship observed in bond markets. On the contrary, higher GDP growth is correlated with higher bond prices, as economic growth often increases investor confidence. The correlation analysis also highlights the importance of credit ratings in shaping bond market dynamics, with higher ratings leading to higher bond prices. These findings provide valuable information about how economic indicators and investor sentiment obtained through unstructured data can influence bond market decision-making. Table 1 includes the countries in question and provides values for bond prices, interest rates, inflation, GDP growth, and sentiment scores for 2019 - 2023.

Table 1. Bond price data, interest rates, inflation, GDP growth, and sentiment scores for the specified countries

Item No.	Country	Year	Bond Price (BP)	Interest Rates (IR)	Inflation (Infl)	GDP Growth (GDP)	Sentiment Score (S)
1.	USA	2019	100.5	2.5%	1.8%	2.3%	0.65
		2020	95.2	0.5%	2.2%	-3.5%	0.50
		2021	98.0	1.0%	3.4%	6.5%	0.70
		2022	96.8	1.5%	4.2%	2.1%	0.60
		2023	97.5	2.0%	3.1%	2.8%	0.55
2.	Germany	2019	102.3	0.0%	1.5%	1.6%	0.68
		2020	98.5	-0.5%	0.3%	-4.9%	0.45
		2021	101.2	0.0%	2.0%	3.5%	0.72
		2022	100.0	0.5%	3.3%	1.7%	0.65
		2023	99.8	1.0%	2.5%	2.0%	0.60
3.	Japan	2019	99.8	-0.1%	0.5%	0.8%	0.62
		2020	95.5	-0.1%	-0.1%	-4.8%	0.47
		2021	98.5	-0.1%	0.8%	1.7%	0.69
		2022	97.0	-0.1%	1.1%	2.4%	0.64
		2023	98.0	0.0%	0.5%	1.5%	0.60
4.	UK	2019	101.0	0.75%	1.8%	1.5%	0.64
		2020	97.0	0.25%	1.5%	-9.9%	0.50
		2021	99.5	0.50%	2.1%	7.5%	0.68
		2022	98.2	1.0%	3.5%	4.2%	0.60
		2023	97.8	1.5%	2.8%	2.4%	0.55
5.	Canada	2019	100.2	1.7%	1.9%	2.0%	0.66
		2020	96.5	0.25%	1.1%	-5.0%	0.48
		2021	98.2	0.5%	2.2%	6.0%	0.72
		2022	97.8	1.0%	3.0%	3.4%	0.61
		2023	98.3	1.5%	2.4%	2.7%	0.57
6.	Australia	2019	101.0	1.5%	1.3%	1.8%	0.66
		2020	97.3	0.25%	1.0%	-5.5%	0.50
		2021	99.5	0.75%	1.5%	4.0%	0.70
		2022	98.8	1.0%	2.8%	3.2%	0.62
		2023	99.0	1.5%	2.3%	2.3%	0.58
7.	Brazil	2019	100.0	6.5%	3.7%	1.1%	0.60
		2020	96.0	4.5%	2.4%	-4.5%	0.52

Item No.	Country	Year	Bond Price (BP)	Interest Rates (IR)	Inflation (Infl)	GDP Growth (GDP)	Sentiment Score (S)
		2021	98.0	6.5%	6.0%	4.5%	0.68
		2022	97.0	7.0%	5.5%	3.0%	0.65
		2023	97.5	8.0%	4.8%	2.8%	0.60
8.	China	2019	102.0	3.5%	2.5%	6.1%	0.75
		2020	99.0	3.0%	2.3%	2.3%	0.60
		2021	100.8	3.1%	1.8%	8.0%	0.76
		2022	99.5	3.2%	2.4%	4.5%	0.70
		2023	99.2	3.0%	2.0%	5.5%	0.65
9.	India	2019	99.5	6.0%	3.4%	4.2%	0.63
		2020	95.0	4.0%	6.2%	-7.3%	0.48
		2021	98.0	4.5%	5.0%	9.5%	0.70
		2022	97.5	5.0%	6.1%	7.0%	0.67
		2023	98.2	5.5%	5.2%	6.0%	0.64

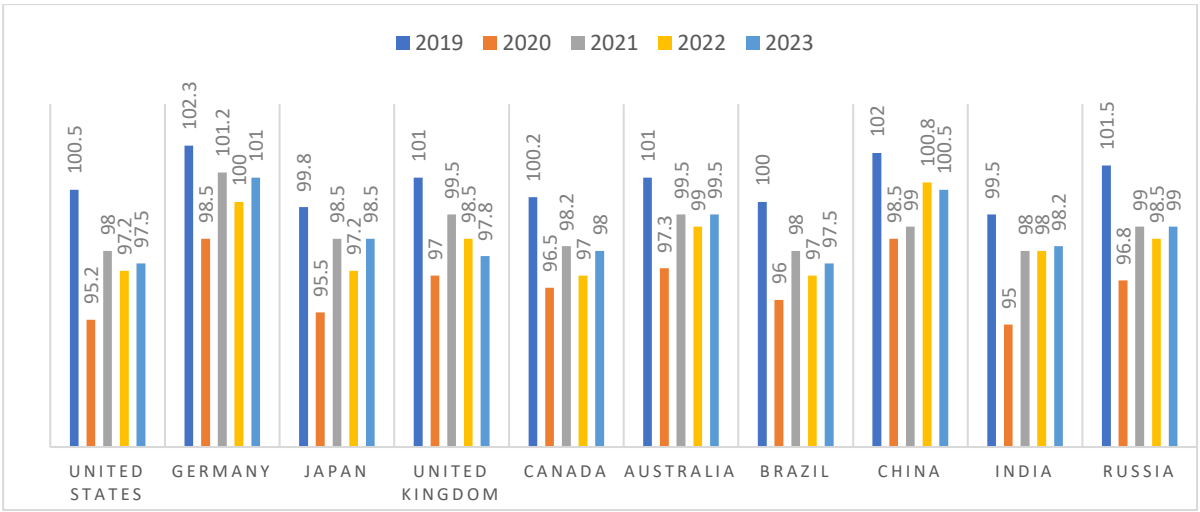
Source: calculated by the authors.

In the US, bond prices fell from 100.5 in 2019 to 95.2 in 2020 due to the economic impact of the pandemic. Prices recovered slightly to 98.0 in 2021, with a slight decline to 97.5 by 2023. The interest rate rose from 0.5% in 2020 to 2.0% in 2023, and sentiment indicators reflect moderate investor confidence (0.55-0.70). Germany followed a similar pattern: prices peaked at 102.3 in 2019, fell to 98.5 in 2020, and recovered to 101.2 in 2021. Interest rates remained close to zero, and inflation peaked at 3.3% in 2022. Japan's bond prices fluctuated between 95.5 in 2020 and 98.5 in 2021, with negative GDP growth in 2020 and negative interest rates throughout the period.

In the UK, bond prices fell from 101.0 in 2019 to 97.0 in 2020, recovering to 99.5 in 2021, but falling to 97.8 by 2023 under the impact of the pandemic and Brexit. Canada experienced similar trends, with bond prices falling from 100.2 in 2019 to 96.5 in 2020, before recovering to 98.2 by 2021. Inflation peaked at 3.0% in 2022. Bond prices in Australia have followed the same pattern, with a small recovery by 2021. Brazil's bond prices were more volatile, falling to 96.0 in 2020 and then recovering to 97.5 in 2023. China's bond prices remained relatively stable, while India's bond prices fluctuated because of high inflation and GDP growth.

Figure 2 presents the dynamics of bond prices from 2019 to 2023 for each country, based on a single indicator (Bond Price in USD). In 2020, bond prices fell in most countries reflecting the global economic downturn caused by the pandemic. After 2020, bond prices recovered in most countries, with small fluctuations depending on local economic conditions.

Figure 2. The dynamics of bond prices from 2019 to 2023 for each country based on a single indicator (Bond Price in USD)



Source: calculated by the authors.

Germany and China had a more stable growth trend, while Brazil and India showed more volatility driven by inflation and interest rate changes. The US and Canada showed a modest recovery, where bond prices remained relatively stable after an initial decline in 2020. As there are data on several variables for each country (bond price, interest rates, inflation, GDP, sentiment index), linear regression or exponential smoothing can be applied to build a forecast (Table 2).

Table 2. Economic performance forecast for selected countries for 2024-2026

Item No.	Country	Year	Bond Price (BP)	Interest Rates (IR)	Inflation (Infl)	GDP Growth (GDP)	Sentiment Score (S)
1	USA	2024	98.3	2.20%	2.80%	3.00%	0.57
		2025	99	2.40%	3.10%	3.50%	0.58
		2026	99.7	2.60%	3.40%	4.00%	0.6
2	Germany	2024	99.5	1.20%	2.40%	2.00%	0.58
		2025	100	1.40%	2.70%	2.20%	0.6
		2026	100.5	1.60%	3.00%	2.40%	0.62
3	Japan	2024	98.5	-0.10%	0.60%	1.00%	0.63
		2025	99	0.00%	0.80%	1.30%	0.64
		2026	99.5	0.20%	1.00%	1.50%	0.65
4	UK	2024	98	1.60%	2.90%	2.50%	0.55
		2025	98.3	1.80%	3.10%	2.80%	0.56
		2026	98.6	2.00%	3.30%	3.00%	0.58
5	Canada	2024	98	1.60%	2.50%	2.30%	0.58
		2025	98.5	1.80%	2.70%	2.60%	0.59
		2026	99	2.00%	3.00%	2.80%	0.61
6	Australia	2024	98.5	1.80%	2.40%	2.00%	0.59
		2025	99	2.00%	2.60%	2.20%	0.6
		2026	99.5	2.20%	2.80%	2.40%	0.62
7	Brazil	2024	98	8.50%	4.60%	3.00%	0.59
		2025	98.5	8.70%	4.90%	3.20%	0.6
		2026	99	9.00%	5.10%	3.40%	0.62
8	China	2024	98	3.00%	2.30%	5.00%	0.66
		2025	98.5	3.20%	2.50%	5.20%	0.67
		2026	99	3.40%	2.70%	5.40%	0.69
9	India	2024	98	5.70%	5.00%	6.00%	0.62
		2025	98.5	5.90%	5.20%	6.20%	0.63
		2026	99	6.10%	5.40%	6.40%	0.65

Source: calculated by the authors.

Analysis of the forecast economic indicators presented in Table 2 gives grounds to conclude that bond prices show a steady increase in all countries during 2024-2026. This indicates a general improvement in investor confidence. The most stable are Germany and Japan, where bond prices remain close to 100. Interest rates show an increase in most countries, including the United States, Canada, Australia, and India, reflecting an adjustment to inflationary pressures. At the same time, Japan shows the most stable low rates, which is consistent with its economic stimulus policy.

Inflation is increasing moderately in all countries, remaining relatively stable in advanced economies such as Germany, Canada, and Australia. Inflation rates are significantly higher in developing countries such as Brazil and India but also show stability within the forecast range. China and India are showing the highest levels of economic growth, reflecting the dynamic development of emerging economies. Developed countries such as the US, Canada, and Australia are showing moderate growth rates, indicating the resilience of their economies in the face of global challenges.

The positive dynamics of the sentiment index reflect investor optimism about the economic prospects. China and Japan had the highest levels of the index, which underlines their economic stability and potential. Among developed countries, Germany shows the highest stability across all indicators, while China and India have the greatest potential for economic growth among developing countries.

In summary, bond prices fluctuated in these countries, the pandemic caused an initial decline and a subsequent recovery. Inflation and interest rates played a key role, with higher volatility observed only in Brazil. Bond prices became more stable in countries with stable economies, such as the United States, Germany and China.

4. Discussions

The study by Guerard, Thomakos, and Kyriazi (2020) focuses on the automated modelling and forecasting of economic indicators, including GDP and unemployment. The authors apply time series analysis techniques to produce accurate forecasts, confirming the effectiveness of automated models in forecasting macroeconomic parameters. However, our study deals with other aspects of the economy, such as investment in innovation and sustainable development, which require the use of other methods of analysis, focusing on more detailed sectoral forecasts.

Pellini (2021) uses the Autometrics method to estimate the elasticity of electricity demand, which allows for a precise determination of consumer responses to price changes. This study is an important example of the use of econometric models to calculate elasticity, which can be adapted to other sectors, such as technology investment. However, our study takes a different approach, focusing on the social and economic consequences of investment, rather than just consumer behaviour in a specific sector.

Prokopenko *et al.* (2024) propose innovative models of green entrepreneurship that have a significant impact on the sustainable development of local economies. They emphasize the importance of social impact on the development of small and medium-sized enterprises in the context of environmental investment. Our study also focuses on investment in sustainable development, but with a greater emphasis on global economic changes and their impact on local markets, which adds an additional aspect to the analysis.

Yang *et al.* (2021) apply structural equation modelling to predict investment intentions among adult workers in Malaysia. This provides a better understanding of the psychological aspects of investment decisions. Their results demonstrate how social factors can influence investor behaviour, which has some similarities to our research in predicting investment trends. However, we consider a broader range of macroeconomic factors, such as political and economic changes, which may provide more accurate predictions for different countries.

Nikonenko *et al.* (2022) assess investment policies in the context of Industry 4.0, which is particularly important for understanding economic transformations. They focus on technological changes that drive economic growth in industrial sectors, and we add to this analysis the social and environmental impacts of green investments. Their research contributes to the development of an understanding of the impact of new technologies on the economy, while our study focuses on predicting long-term development trends.

Alazzam *et al.* (2023) develop an information model for e-commerce, focusing on globalization and legal compliance in digital systems. Their approach emphasizes the importance of digital transformations for businesses, which is relevant to our study, as we also analyse the impact of digitalization on economic systems. However, we focus not only on business platforms, but also on general economic processes in the context of global changes.

Alhorani (2019) examines the factors influencing investors' decision-making regarding mutual funds, in particular in the context of market conditions and psychological aspects. This study reveals how investors make decisions under uncertainty, which is useful for our work, as we also evaluate investment strategies in a changing economic condition. However, we add a more comprehensive analysis of economic and social factors to this aspect.

Cai *et al.* (2019) analyse institutional behaviour and its impact on price fluctuations in the corporate bond market. Their results suggest the importance of institutional factors in predicting financial markets, which is important for our study. We also consider the role of institutional change, but with a focus on investment in innovative and sustainable technologies, which allows us to broaden our understanding of market mechanisms.

Cao *et al.* (2021) examine behavioural factors influencing investment decisions of individual investors in the securities market of Vietnam. Their findings help to better understand how psychological and social factors determine investment decisions in unstable conditions. This study can be adapted for our analysis of the investment market, although we also focus on economic, social, and political factors, which enables comprising a wider range of issues.

Che Hassan *et al.* (2023) conduct a consistent literature review on investment intentions and decision-making, highlighting the importance of behavioural research. Their findings are important for our study, as we also analyse behavioural aspects of investment decisions, focusing on the specifics of green and innovative investments. So, our study complements their findings, considering new economic and social realities.

The aim of our study was to predict the impact of investment on the development of economies, taking into account the latest technologies and sustainable development. The results confirmed the importance of strategies for attracting investments in innovative and green technologies to stimulate economic growth. Therefore, our study meets the stated goal and has great practical significance for policymaking in the context of global economic changes. The results of our study can be used by government agencies to develop effective strategies for attracting investments in technologies that promote sustainable development. Furthermore, companies can use these data to assess risks and develop investment strategies, focusing on new socio-economic challenges and opportunities.

4.1. Limitations

The limitations in this study may affect the accuracy and validity of the results. *First*, the study focuses on corporate bond and stock markets only, which limits the overview of the financial sector. Other markets, such as the real estate market or the foreign exchange market, are not covered in this study, which may lead to an incomplete picture of the financial system. *Second*, the use of unstructured data, such as news and social media, for building predictive models has its limitations. This data may be subjective, incomplete, or outdated, which negatively affects the quality of forecasts. Text data from the media may not be sufficiently objective, which may cause inconsistencies in conclusions and reduce the accuracy of the models. Reliance on such information sources increases the likelihood of errors in building forecasts. *Third*, automatic time series modelling have limitations associated with high sensitivity to the choice of parameters. Insignificant or random variations can reduce the accuracy of forecasts, especially in cases of economic instability. High sensitivity to model parameters can lead to errors in forecasts in the event of large structural changes in the market. Therefore, it is important to consider these factors to improve the accuracy of forecasting models.

4.2. Recommendations

Given the limitations, several recommendations for further research and practical application of the results can be provided.

1. A more comprehensive analysis of financial markets can be achieved by including in not only corporate bond markets and stock markets the study. Adding derivatives, real estate and foreign exchange markets will allow creating a more complete model of the financial system. This approach will help to better assess the relationship between different segments of the financial market.

2. The methods for processing unstructured data should be improved in order to increase the accuracy of forecasts. The use of more sophisticated algorithms, such as machine learning and NLP, will allow identifying important information signals from news and social media. This will reduce the influence of subjective factors and increase the accuracy of forecasts. A wider use of data sources will ensure better reliability of forecast models.

3. It is necessary to improve methods for automatic time series modelling to reduce sensitivity to minor data fluctuations. Adaptive models that can adjust their parameters depending on market changes will increase the accuracy of forecasts. This will reduce insignificant or random variations in the data on the final results. The development of such models will improve the forecasting of financial markets under uncertain conditions.

Conclusions and Further Research

The relevance of the study is to determine the impact of macroeconomic variables and investor sentiment on bond price dynamics. Financial markets are subject to significant fluctuations under the influence of both economic and psychological factors. Understanding the interaction of these factors is important for predicting market behaviour, especially during economic shocks such as the COVID-19 pandemic. Integrating unstructured data from news and social networks together with traditional economic indicators allows for more accurate forecasts for financial markets. This is important for effective investment and risk management.

According to the results of the study, macroeconomic factors such as interest rates, inflation and GDP growth have a significant impact on bond price dynamics. However, unstructured data, such as sentiment from news and social media, are also important for accurate forecasts. During economic shocks, such as the COVID-19 pandemic, traditional models that only take structured data into account cannot fully explain changes in the bond market. Such countries as Germany and China demonstrated resilience through effective economic

strategies, which confirms the importance of unstructured data in improving forecasts. The results of the study are of great importance for investors, analysts, and policymakers, as they can be used to more accurately predict price fluctuations in the bond market. This is especially important for emerging markets, where political and economic instability can quickly change sentiment. Understanding these changes is essential for managing market dynamics. The findings can be useful in developing investment strategies and policy decisions to reduce risks in financial markets, thereby ensuring their stability in the face of global economic changes.

Further research should focus on deeper analysis of market sentiment using more sophisticated machine learning algorithms. This will enable a more accurate assessment of sentiment and its impact on the bond market. It is also appropriate to expand the model to include more economic variables to improve the accuracy of forecasts. In particular, the effectiveness of combining structured and unstructured data to forecast bond prices over different time horizons can be determined. This approach will increase the accuracy of forecasts and investment strategies, which will be useful for analysts and financial institutions in the face of global economic instability.

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Credit Authorship Contribution Statement

Mykhailo Zhylin: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Viktoriia Shutenko: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Alla Lysenko: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Volodymyr Shevchuk: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Artur Oleksyn: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Declaration of Competing Interest

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

Declaration of the Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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The Qualitative Determinants of Financial Failure in SMEs in Morocco. Case of SMEs in Casablanca-Settat Region

Adil BOUTFSSI
Laboratory in Applied Economics and Finance
Hassan II University, Morocco
Boutfssi.adil@gmail.com

Youssef ZIZI
LAREMEF, ENCG-FEZ
Sidi Mohamed Ben Abdellah University, Morocco
youssef.zizi@usmba.ac.ma

Tarik QUAMAR
Laboratory in Applied Economics and Finance
Hassan II University, Morocco
quamar.univ@gmail.com

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Abstract: In the context of this scientific study, our objective was to contribute to the understanding of the financial failure of SMEs in Morocco to their bank creditors, with a particular focus on the Casablanca-Settat region. Our research focuses on the primary objective of the empirical identification of qualitative factors that impact this phenomenon, greatly threatening a particularly significant number of SMEs. To achieve this objective, a target population consisting of 158 SMEs from the Casablanca-Settat region was selected. Contingency and binary logistic regression analyzes revealed that specific characteristics of SMEs, such as the nature of their activity, competition from the informal sector and their size, as well as the characteristics of the SME leader, such as their previous professional experiences and their skills in management or financial management, play an important role in explaining the financial failure situation of SMEs in this region. The conclusions of this study could be of paramount importance for banking institutions, taking into account the explanatory variables of default when evaluating credit applications, or ensuring careful monitoring of the situation of already affiliated SMEs. The conclusions of our study could also be beneficial for SME leaders in Morocco, as they would allow them to anticipate upcoming financial difficulties and implement corrective actions to avoid a financial distress.

Keywords: financial failure; characteristics of SMEs; Moroccan SMEs.

JEL Classification: D22; G32; C10; C12.

Introduction

The issue of business failure has attracted the interest of various disciplines, such as Finance Beaver (1966); Sociology Freeman *et al.* (1983); Management Moulton *et al.* (1996). This concept has been interpreted in various ways (Ucbasaran *et al.* 2013). The failure of a business is closely linked to two fundamental factors. On the one hand, its ability to adjust to changes in its environment and, on the other hand, the strategic choices made by its leaders (Keasey and Watson, 1991). Research on risk factors emphasizes the importance of including determinants from both the internal and external environments of a company (St-Pierre, 2004). Consequently, integration data from external sources into the organization enriches the qualitative and quantitative data collected, providing a more holistic and economic perspective that transcends the financial dimension. Over the past decade, business failure has become an increasingly prominent topic in Moroccan economic news. In 2023, the number of companies in a state of failure reached 14 245 (Ministry of Finance Morocco, 2023). The city of Casablanca stands out significantly, with 27% of companies in default (Ministry of Finance Morocco, 2023).

According to El Manzani *et al.* (2018), several factors are behind the difficulties faced by SMEs in Morocco. Firstly, various elements such as the national economic situation, the institutional context, industry

specifics, and access to external financial resources impact the external environment of SMEs. Subsequently, the specific characteristics of SMEs that impact the organizational configuration, internal climate, and management style of the company are analyzed. In conclusion, the elements that influence the SME's dependence on the owner-manager include their experiences, skills, management style, and particular characteristics.

The consequences of SME failures in Morocco are particularly concerning due to their impact on the country's economic growth and the unemployment rate, which reached 13.1% in 2023, (HCP, 2023). Moreover, the volume of non-performing loans reached 94 billion dirhams during the same year, representing a litigation rate of 8.6% compared to the total outstanding loans according to Bank Al-Maghrib (2023).

According to HCP statistics (2019), SMEs primarily favor banking institutions as their main source of external financing. Consequently, the banker is the main provider of funds affected by the difficulties faced by indebted companies, due to the specific nature of the relationship between the company and its banking institution. Consequently, banks' paramount importance comes with a significant risk, as payment defaults result in substantial costs for these financial institutions.

The majority of international research on entrepreneurial failure has focused primarily on businesses in general (Altman and Sabato, 2007; Crutzen and Van Caillie, 2009), although SMEs represent the majority of economic actors. This research orientation is partly attributable to the diversity of SMEs and the difficulty in accessing data about them. At the national level, the phenomenon of SME failure arouses significant interest from several economic researchers, as evidenced by the work of Kherrazi and Ahsina (2016).

However, several scientific studies, both at the national and international levels, focus mainly on the quantitative aspect of the analysis of SME failure factors. As mentioned by Van Caillie (2000) traditional studies on the determinants of entrepreneurial failure are mainly based on quantitative modeling based on financial data, which make it possible to identify predictive indicators of bankruptcy in SMEs.

Even though, to improve the understanding of the processes leading to bankruptcy, it becomes essential to broaden the analytical framework beyond financial indicators. An approach integrating qualitative factors, particularly those relating to the organizational structure and strategic context of companies, is crucial. To make a prediction model based on qualitative data that is specific to small and medium-sized businesses, you need to look at a lot of internal and external data. This includes things like the company's size and type of business, the skills of the managers, and the strategies they use. By including variables that haven't been taken into account in traditional predictive models before, this broader view could give us a more complete picture of the complicated processes that cause small businesses to fail.

This article therefore aims to develop an economic model that will predict the financial failures of SMEs in Morocco based on qualitative variables, with a focus on the Casablanca-Settat region. The Casablanca-Settat region was chosen because of its significant economic weight and its high concentration of companies, particularly SMEs and VSEs, which makes it a strategic choice for analyzing the challenges faced by SMEs in Morocco.Indeed, it is the main economic region of the country, bringing together about 40% of national companies, including SMEs operating in various sectors such as manufacturing, trade, and services, as mentioned in the report on companies in Morocco by HCP (2019).

This scientific study aims to answer the following question: What are the qualitative determinants of SMEs in the Casablanca-Settat region that explain their financial failure?

We begin with a literature review concerning the concept of SME failure. The variables and research hypotheses will be presented next, followed by an analysis of our study's results.

1. Literature Review

1.1. The Concept of Business Failure

Numerous researchers have examined the multidisciplinary subject of business bankruptcies, leading to the identification of several definitions associated with this concept. Various economic, financial, and legal perspectives have analyzed corporate bankruptcy in reality. Therefore, she acknowledges multiple interpretations that challenge a universally accepted definition. Gresse (2003); Bienayme (2011); Levratto (2012) break down the process of corporate bankruptcy into three levels of severity: economic, financial, and legal.

As mentioned by Blazy *et al.* (1993) bankruptcy is characterized by the initiation of judicial recovery proceedings against a company. On the economic front, economic failure manifests itself through negative added value (Gresse, 2003). As demonstrated by Zopounidis (1985) economic failure is due to the inefficiency and ineffectiveness of the production apparatus, the deterioration of the relationship between the company, its products, and the market, and the absence of the company's contribution to reducing structural economic

problems. Thus, it is possible to consider that a company is in economic distress when it can no longer achieve its economic objectives, according to Sidi Mamar and Sail (2022).

As explained by Ooghe and Van Wymeersch (1996) a distressed company is characterized by its inability to consistently maintain its economic objectives while taking into account social and environmental constraints. SMEs can see their financial performance negatively impacted by economic crises, fluctuations in exchange rates, changes in trade policies, and unpredictable market conditions.

From a financial perspective, default occurs when the company can no longer repay its due debts with its liquid assets. From a financial point of view, default takes on a regulatory dimension, since it is linked to the risk of default emanating from the debt, so controlling this risk is of high capital importance. Financial institutions carry it out constantly and regulators require it (Adams and Hagras, 2020). Malécot (1991); Casta and Zerbib (1979) classify this situation as a financial crisis when a financially troubled company, heavily indebted, becomes unable to meet its obligations.

According to Wruck (1990), financial distress is defined as the inability to have sufficient liquidity to meet short-term financial obligations. In the same vein, Ross *et al.* (2013) confirm this observation and describe failure as the situation where companies are unable to meet their commitments to their financial and non-financial partners. Benjabeur (2017) suggests that struggling companies are characterized by a significant lack of liquidity. According to Baldwin and Scott (1983), a company is considered to be in a state of failure when it reaches a level of deterioration such that it becomes unable to meet its financial obligations. The deterioration of the company's financial situation can be identified and highlighted through the company's financial statements, Veganzones and Severin (2021) the company's financial statements can identify and highlight the deterioration of its financial situation. Dioko and Guo (2024) emphasize that, in the long term, business failures are associated with financial problems. Financial default occurs when a company fails to meet its financial obligations, resulting in unpaid debts that have come due and thereby forcing the company to undertake a debt restructuring to liquidate its assets (Alvi *et al.* 2024).

It is important to note that, within the framework of our study, we adopt a definition of failure from a financial perspective, describing it as the inability of SMEs to meet their commitments to their financial partners, with a particular emphasis on bank creditors. Circular 19/G/2002 of Bank al Maghreb defines a small or medium-sized enterprise (SME) in financial default as one that faces the risk of either total or partial non-repayment of its debt, as per the current Moroccan banking regulations.

1.2. Factors of SME Failure

Only one of the well-defined variables can express business failure. Indeed, a thorough understanding of these variables allows us to determine the nature of the constraints weighing on the Mrani and Loulid (2023).

1.2.1 The Effect of SMEs Characteristics

Scientific studies have conclusively established the existence of a causal correlation between a company's field of activity and the risk of failure. Beaver (1966) pioneered this correlation by examining company characteristics, operational scope, and failure probability. Lennox (1999) asserts that the industry sector plays a crucial role in determining the risk of failure. Similarly, the studies conducted by Sharabany (2004) conclude that the industrial sector, particularly the field of traditional manufacturing, has a higher failure rate than the service and commerce sectors.Thornhill and Amit (2003) observed that the majority of companies in bankruptcy belong to the industrial sector. Mrani and Loulid (2023) highlighted that the specific characteristics inherent to each sector of activity make the modeling and control of de business failure process complex. According to Arowolo (2025) the performance of construction companies largely depends on the prevailing economic conditions of the sector.

The informal economy represents a major challenge to the competitiveness of businesses, both internationally and nationally, exerting a substantial burden on economies. Excluding the agricultural sector, the informal economy accounts for more than 20% of the gross domestic product (GDP), as indicated by (Derkaoui *et al.* 2021). This situation primarily affects sectors such as trade, maintenance and repair, the textile and leather industry, construction, agri-food industries, tobacco, and transportation (Derkaoui *et al.* 2021).

According to Jayasekara *et al.* (2020) several factors, including its size, age, and the unfavorable environment in which it operates, contribute to the failure of a small business. González and Lamanna (2007) highlighted the association between the size of formal firms, their field of activity, and the competition from informal enterprises. Legally established small businesses operating in sectors with low entry barieres are more likely to face direct competition from informal enterprises. Other research has also suggested that informal businesses can be formidable competitors due to their smaller size, which provide them with greater flexibility in

terms of internal organizational methods (Ali and Najman, 2016). An indirect impact of informal competition on the efficiency of formal businesses arises from the direct impact of taxation on informal competition (Kerrouch, 2023). The inability of SMEs to adapt to change as well as the nature of the business environment are determinants of SME failure in Cameroon (Boubakary, and Moskolaï, 2021). Indjendje and Peter (2025) demonstrate in their study that the transition of very small enterprises from the informal to the formal sector improves their capacity to anticipate, respond to, and adapt to environmental changes, thereby reducing their vulnerability to failure.

By significantly hampering the competitiveness of formal enterprises, especially small and medium-sized enterprises. Schmalensee (1985) confirmed the existence of a significant relationship between market structure and business performance. Indeed, this sector presents risks that go beyond its national tax evasion and non-payment of social security contributions. It is also characterized by its negative impact on the market for goods and services, promoting unfair competition that manifests itself in price dumping practices. This situation often leads to revenue losses, which limits growth and investment opportunities. According to Burns and Burns and Stalker (1961) less formalized structures would be more adapted in an unstable and turbulent market, while highly formalized structures would perform better in a stable environment.

Several researchers, such as Hall (1992); Mitchell (1994); Baldwin (1997) have highlighted that the probability of a company's failure is positively correlated with its smaller size. According to Venkataraman *et al.* (1990); Lussier (1995 small businesses primarily face the challenge of finding the necessary resources and skills to implement their strategy. It is crucial for any new business to reach a critical size to become profitable, as highlighted by Blazy *et al.* (1993).

Moreover, small businesses are likely to go bankrupt if they exhaust their financial resources before developing value-generating strategic assets, such as Thornhill and Amit (2003). Large companies generally face a lower risk of failure compared to medium-sized or small businesses (Duffie *et al.* 2007). As stated by Welsh and White (1981) SMEs may encounter obstacles in terms of growth and development if they fail to reach a critical size early in their operations.

The age of companies is an important factor in business failure. Barron *et al.* (1994) demonstrated a negative relationship between mortality and the age of organizations. However, maturity can become a liability, serving as a source of organizational inertia that handercompanies in their adaptation to external constraints.

According to St-Pierre (2018) the age of companies plays an essential role in failures; the younger a company is, the higher its probability of failure.

Age is a determining factor among the quantitative and qualitative variables that positively impact the fragility of SMEs in Morocco, according to a study by Nokairi (2016) involving 140 SMEs in the country. In the same vein, Indjendje and Peter (2025) emphasize that resilience is key to reducing the risk of failure among very small enterprises, highlighting the age of the business as a potential predictor of economic vulnerability.

As mentioned by Munawaroh *et al.* (2023) despite the fact that small and medium enterprises in Indonesia create employment opportunities for citizens, the majority of them go bankrupt within the first five years due to recurring entrepreneurial shortcomings. Studies widely recognize that young SMEs are most likely to face failure. Gumel and Bin Bardai (2023) identified several determinants related to the company and its manager that influence its success, including age, company size, sector of activity and economic environment. The results highlight that newly created companies or those that have just started their economic life cycle have a greater probability of experiencing financial difficulties than older companies that have existed for a considerable time. In the same vein, the lifespan of an SME is positively correlated with its success, due to the accumulation of experience and management skills during the exercise of its activity (Ma'aji *et al.* 2023).

1.2.1. The Effect of Leader Characteristics

Studies on business management observe frequently a relationship between the intellectual level, the management skills and experiences of the leader of the company, and the barriers to growth or even bankruptcy. Ooghe and Waeyaert (2004) three categories of variables: the personal traits, skills, and motivations of its business leader, are the keys of performance of the company management. Abriane and Aazzab (2016) highlighted a positive link between business failure and the competence of their leader. Boubakary, and Moskolaï (2021) confirms that the incompetence of SME leaders is an important factor of SME failure in Cameroon.

According to Altman (1984) the main cause of business failure lies in the incompetence of their leaders. The conclusions of his study reveal that 50% of failures are due to the lack of experience or excessive specialization, while 44% are the obvious incompetence of the leaders. Perry and Pendleton (1983) attributed nearly 90% of SME failures to the manager or management team's lack of general knowledge or skills. The lack

of skills in strategic areas such as business management, accounting, or finance inevitably leads Cameroonian companies to failure (Boubakary, and Moskolaï 2021).

Agyapong and Attram (2019) found a positive correlation between the financial literacy level of SME leaders in Ghana and the performance outcomes of SMEs. A crucial factor contributing to the cessation of activity among SMEs in the province of Kénitra is the absence of clear guidelines on financial and accounting management (Kherrazi and Ahsina, 2016). According to Ooghe and Waeyaert (2004) company management difficulties mainly stem from a lack of its leader skills, personal qualities, and motivation among the management. The lack of management skills in the financial field, particularly in accounting, inventory control, and cash management, can compromise the sustainability of (Khan and Rocha, 1982). Management difficulties are often persistent and generally reflect a deficit in skills, flexibility, and adaptability (St-Pierre, 2004).

Therefore, the success of small businesses closely depends on the knowledge, skills, and general abilities of their leader. Mayr *et al.* (2020) observed that management experience significantly reduces the risk of failure for small and medium-sized enterprises in Australia. More specifically, business leaders with management experience recognize the crucial importance of accurate accounting, strategic planning, and effective management. They also seek specialized external advice, particularly from consultants, in areas such as taxation, legal, or financial accounting (Mayr *et al.* 2020).

As stated by Syahputra *et al.* (2021) small business owners do not develop management skills due to their limited level of education rather than their lack of understanding. According to the conclusions of these researchers, individuals with a higher level of education develop management skills easier, which enables them to impact significantly the performance of their businesses. As mentioned by Bensalah and Tinaztepe (2021) the level of education of business leaders influences positively business performance. In addition, most successful Moroccan entrepreneurs use their knowledge learned during their educational training cycle to improve their businesses performance. According to Rulangaranga and Isoh (2021) a higher level of education among managers is a key factor in the profitability of their businesses. García-Pérez-de-Lema *et al.* (2021) also highlighted that the higher education of managers has a direct and indirect impact on mitigating the financial limitations of the company.

Previous research emphasized the impact of the education level of business leaders on their propensity to focus on the effective transition from the national market to the international market (Coudounaris, 2021). The education level of SME managers plays an important role in the success of their business (Mabrouk *et al.* 2021). Several managerial determinants influence SME success, such as education level, previous work experience, management skills, and managerial orientation (Gumel and Bin Bardai 2023).

Regarding the same subject, Wiedeler and Kammerlander (2021), Wang and Guedes (2024) emphasize that the companies sustainability depends on the managerial skills of their leaders. By implementing training programs dedicated to entrepreneurs will contribute positively to strengthening their ability to understand the role of different financial ratios and their distinctions, enabling them to adopt preventive measures keeping the financial health of their companies.

Cooper *et al.* (1994) noted that management skills could influence organizational performance by encouraging adoption of more effective strategies and improving management practices. According to Thompson (1963) failures in entrepreneurship are mainly due to the deficiencies of the leaders. In addition to objective variables such as age, religion, education level, professional experience, and family background, the author has included more subjective variables in their analysis, such as personal values, individual and sociological traits, as well as moral principles. The results obtained consistently highlight a link between the environmental and psychological attributes of the leader and entrepreneurial failure (Thompson, 1963).

The works of Thornhill and Amit (2003); Ucbasaran *et al.* (2013) provide valuable insights. Baldwin *et al.* (1997); Hall (1992) confirms that a manager cannot bear the failure of a company alone, as the evolution of the market in which the company operates also plays a crucial role in its survival. From this perspective, St-Pierre (2004) reinforces this finding by emphasizing that numerous small and medium-sized enterprises, including those founded by seasoned entrepreneurs, have nevertheless faced bankruptcy. It is evident that the failure of a company is often due to the leader's inability to adapt the organization to external changes in the SME, as well as a lack of expertise and training, particularly in the field of management.

Entrepreneurs with a higher education degree at the time of finding their business have a higher probability of success than entrepreneurs without a university education (Ma'aji *et al.* 2023). Executives who have pursued higher education have acquired a set of knowledge and skills, as well as abilities that promote personal development in certain professional fields. This could help them improve their business management, thereby increasing their chances of entrepreneurial success (Ma'aji *et al.* 2023). In addition, entrepreneurs with a higher

education degree are much more presumptuous, which facilitates their engagement in entrepreneurial exercises while mastering the risks inherent in entrepreneurial success (Jiménez *et al.* 2015; Ma'aji *et al.* 2023). Majune and Kalume (2025) argue that experienced business leaders are more likely to adopt structured accounting management practices and support the ongoing development of their team. On a practical level, business leaders who seek to increase their turnover and sustain their activities over time must adopt agility as a core management philosophy (Binwa *et al.* 2025). The manner in which SME leaders utilize knowledge acquired through learning opportunities significantly influences the overall success of their enterprises (Koporcic, *et al.* 2025). Furthermore, Arowolo (2025) points out that the personal characteristics of small business leaders - particularly their ability to manage personal and professional conflicts - greatly contribute to business survival and help prevent failure. In the same vein, Dansu *et al.* (2025), in their study of businesses, found that SMEs led by risk-tolerant managers were more likely to survive and avoid bankruptcy. Supporting this view, Nkwinika and Obokoh (2025) reveal a strong correlation between poor financial practices and business failure, emphasizing the need for greater financial literacy among SME leaders and the adoption of effective accounting systems.

2. Hypotheses and Conceptual Model

SMEs are paramount importance in economic development, innovation, and job creation. However, they encounter a variety of financial obstacles that can result in substantial financial hardship. The reasons for the failure in entrepreneurship of SMEs are linked closely to their internal and external environments. Guilhot (2000) asserts that we can examine the reasons for business failures from four analytical perspectives: economic, financial, strategic, and managerial. In the same subject, Keasey and Watson (1987) argue that the significant influence of internal company variables is a key element of their failures.

2.1. Research Hypotheses

We have identified several factors directly related to the environment of SMEs that influence their financial stability through our previously conducted literature review. It is necessary to consider elements such as the nature of the activity, the presence of informal competition, the size of the company, the age of the SME, the experience of the manager, his qualifications, and his level of education. Therefore, we have chosen to investigate the causal relationship between the characteristics of SMEs, their managers, and financial distress. Thus, on the basis of the elements previously cited, we propose to verify the following hypotheses:

Hypothesis No. 1: The characteristics of SMEs are determinants of the financial failure of SMEs in the Casablanca Settat region.

- Sub-hypothesis No. 1.1: A causal relationship exists between the nature of the activity of SMEs in the Casablanca Settat region and their financial failure.
- Sub-hypothesis No. 1.2: The existence of an informal market contributes to the explanation of the financial failure of SMEs in the Casablanca Settat region.
- Sub-hypothesis No.1.3: The smaller size of SMEs in terms of workforce in the Casablanca-Settat region makes them more vulnerable to financial failure than their larger counterparts.
- Sub-hypothesis No.1.4: Young SMEs in the Casablanca-Settat region are the most vulnerable to financial failure.

Hypothesis No.2: The characteristics of the SME manager are determinants of the failure of SMEs in the Casablanca Settat region.

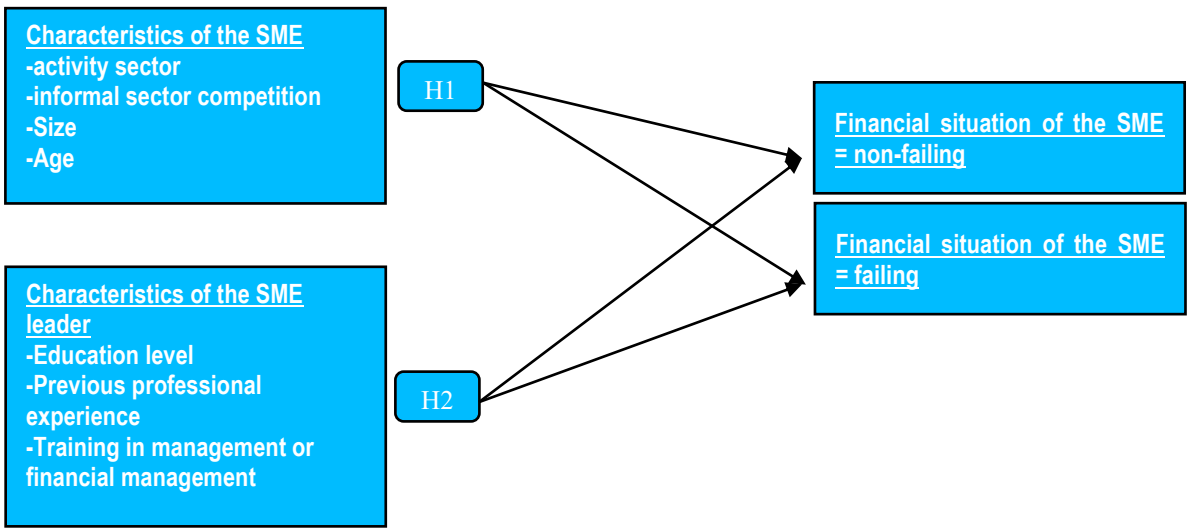
- Sub-hypothesis No.2.1: The number of years of previous professional experience of the SME manager helps explain the financial failure of the SME.
- Sub-hypothesis No.2.2: The level of education of the SME manager in the Casablanca Settat region helps explain his financial failure.
- Sub-hypothesis No.2.3: The management skills of the SME manager in the Casablanca Settat region help explain his financial failure.

2.2. Conceptual Model

We discussed business failure and its causes. We reexamine the theoretical factors we've identified as contributing to the failure of SMEs, focusing on the determinants of qualitative aspects. We have chosen to assign these factors to their respective dimensions in order to propose an easy-to-interpret and operational scheme at the level of various statistical tests. Thus, we have organized the structure of our conceptual model

into four blocks of variables: The first block of variables relates to the independent variables associated with SMEs, which include the sector of activity, informal competition, size, and age of the SME. The second block of variables relates to the independent variables associated with the SME leader, specifically: previous experience, level of education, and competence in management or finance. The third and final block corresponds to the dependent variables of our study and relates to the situation of the SME in relation to the bank (in a healthy situation or otherwise in default). We recall that in the context of our study, we adopt the definition of failure from a financial point of view, describing it as the inability of SMEs to honor their commitments to their financial partners as described by Baldwin and Scott (1983), with particular emphasis on bank creditors. Current Moroccan banking regulations define an SME in financial failure as one that faces the risk of total or partial non-repayment of its debt, as outlined in Bank al Maghreb's circular 19/G/2002.

Figure 1. Conceptual Model



Source: Statistical Results, Authors.

3. Methodology

The methodological framework will allow us to successively present the sample of our study, the measurement of the variables, and the statistical analysis tools used.

3.1. Sample

With the aim of forming our initial sample, we contacted the main investment banks and business centers located in the Casablanca Settat region. We have received several databases containing qualitative information concerning indebted SMEs headquartered in the Casablanca Settat region. In the end, we managed to create a global sample of 158 SMEs, with 74 in a state of failure and 84 in a healthy state at the conclusion of the 2023 fiscal year.

We primarily sourced our sample of SMEs from local banking institutions in the Casablanca-Settat region. However, banks must comply with strict regulations regarding the protection of customer data. Indeed, credit institutions in Morocco are required to adhere to the provisions of Law 08-09, related to the protection of personal data of their customers and falls under the jurisdiction of the National Commission for the Control of Personal Data Protection (CNDP). This limit our ability to assemble a more representative sample of all SMEs in the Casablanca-Settat region that have secured bank financing. We determine the selection criteria for our sample of SMEs in a state of failure by consulting Article 4 of Circular No. 19/G/2002 of Bank Al-Maghrib (BAM).

According to the article, non-performing loans are defined as follows: are considered as overdue debts, debts which present a risk of total or partial non-recovery, having regard to the deterioration of the immediate and/or future repayment capacity of the counterparty. We divide Non-Performing Loans into three categories: pre-doubtful, doubtful, and compromised, based on their degree of default risk.

3.2. Measurement of Variables

Before starting the processing of the data collected from the banks, the identification of the variable to be explained – in this case, the financial failure of indebted SMEs – is very important. Each SME in our sample determines the binary qualitative variable based on the presence or absence of financial failure. Then, we

identified the independent variables associated with the characteristics of the SME and its manager, aiming to assess their explanatory influence on the situation of financial failure. We assess the characteristics of the SME using six variables: sector of activity, age (date of creation), competition from the informal market and size (number of employees). The analysis of the characteristics of the manager is based on three main variables: level of education, training in management or finance and previous professional experience. In addition, the data collected from local banks were analyzed using the software "SPSS – Statistical Package for the Social Sciences", widely used by management science researchers due to its user-friendliness and efficiency.

3.3. Statistical Data Analysis Methods

Many researchers have used the LOGIT model to predict business failures, as it proves particularly well-suited for understanding the nature of bankruptcy prediction (Kherrazi and Ahsina 2016; Zizi, *et al.* (2020); Mrani and Loulid 2023). According to Hair *et al.* (2006) logistic regression is the appropriate statistical approach for modeling a categorical dependent variable based on categorical or continuous independent variables. Accordingly, the LOGIT model is considered the most appropriate choice among parametric models for interpreting the probabilities associated with a qualitative output variable.

Consequently, the statistical methods employed in this study include the chi-square contingency analysis, which will initially allow us to evaluate the existing relationship between our dependent and independent variables. We will then proceed with binary logistic regression tests to assess the form and direction of the relationship between dependent and independent variables that are significantly correlated at the chi-square test level.

Several methodological and empirical reasons motivate our use of the statistical method based on logistic regression in our study. First, social sciences widely recognize and use logistic regression because of its simplicity and interpretability. According to Hosmer *et al.* (2013) this method is a standard choice for modeling the probability of a binary event as a function of explanatory variables, and it provides reliable estimation of the relationships between independent variables and dependent variables. However, the prevalence of artificial intelligence (AI)-based failure prediction models persists. As stated by Kumar and Vadlamani (2007); Mrani and Loulid (2023) logistic regression does not require large amounts of data to produce meaningful results and is less prone to excessive complexity (Alvi *et al.* 2024). Artificial intelligence is beneficial for processing large datasets (Véry and Cailluet 2019).

Indeed, despite the implementation of artificial intelligence in various fields of management Tambe *et al.* (2019) and finance Veloso *et al.* (2021) AI models face numerous structural issues, such as the unintentional addition of unwanted features, excessive workload, and mistakes made by omitting certain elements (Zhang *et al.* 1999). Furthermore, Fletcher and Goss (1993) note that to achieve optimal performance, AI requires large sets of information. While AI methods, although powerful, can provide accuracy in specific contexts, such as banking risk prediction, they present challenges in terms of interpretability and understanding of the results (Leo *et al.* 2019). Adams and Hagras (2020) and Elliott *et al.* (2021) have criticized the opacity of artificial intelligence systems, which can mislead decision-making processes. In the same subject, Hsu *et al.* (2023) demonstrate that in the financial sector, the accuracy of the results can be more important than their transparency, and the use of artificial intelligence turns out to be a complex task that requires much more rigor.

Therefore, financial research continues to favor logistic regression because it is flexible and useful, especially when the goal is to report causal relationships in a clear and easy-to-understand way while also making sure the results are robust and valid (Alvi *et al.* 2024). Various studies on companies failure at national levels have demonstrated the effectiveness of logistic models in explaining this phenomenon (Benbachir and Habachi 2018; EL Haddad and Habachi 2020; Idrissi and Moutahaddib 2020; Zizi *et al.* 2020, 2021) are noteworthy.

3.3.1. Cross-Tabulation (chi-square)

Chi-square analysis allows the evaluation of the relationship between two categorical variables. We use this statistical test to verify the independence of two variables. By default, the null hypothesis (H0) indicates the absence of a relationship between the variables. The decision rule is based on the p-value, which represents statistical meaning. If the p-value is less than 0.05, we reject (H0), indicating that there is a significant correlation between the two variables.

The following formula computes the test statistic for the Chi-Square independence test:

$$\chi 2 = \sum_{i=1}^{R} \sum_{j=1}^{C} \frac{(oij - eij)2}{eij} \quad (1)$$

with:

−oij is the number of cells observed in the ith row and jth column of the table.

−**e**ij is the expected cell count in the ith row and jth column of the table, calculated as follows

$$\mathbf{eij} = \frac{\mathbf{row\ i\ total} * \mathbf{col\ j\ total}}{\mathbf{grand\ total}} \quad (2)$$

3.3.2. Multinomial Logistic Regression Test

Logistic regression allows modeling a variable with two binary response modalities or multiple polychromatic response modalities (K ≥ 2 classes) based on a matrix of explanatory variables (X1, X2, ..., XK), whether they are quantitative or qualitative. In general, the logistic regression test allows for the evaluation of the overall validity of the model and the assessment of the impact and relationship of each variable on the model. It also allows the verification of the validity of the model for each modality of the variable. The following equation expresses the logistic regression model.

$$\text{Logit}(p)=\ln(p/1-p)=\beta 0+\beta 1X1+\beta 2X2+\cdots+\beta kXk \quad (3)$$

where:

• p is the probability of the event of interest,
• p/1−p is the odds ratio of the event,
• ln p/1−p is the logit transformation of p • β0 is the intercept (constant),
• β1,β2,…,βk are the coefficients of the independent variables X1,X2,…,Xk.

3.3.3. Hosmer and Lemeshow Test

This test evaluates the presence of significant differences between the observed values and the predicted values for each subject. The objective is to obtain a non-significant result with a P value less than 0.05. Indeed, a low p-value associated with the test, such as less than 0.05, indicates a significant difference between the observed and predicted values, implying a poor fit of the model.

This test is based on the χ^2 calculation, which is based on the differences between the observed and expected frequencies in each variable group. However, when the model only includes a dichotomous predictor, it becomes impossible to calculate this test due to its sensitivity to sample size.

The formula for the Hosmer-Lemeshow test is:

$$x^2 = \sum_{g=1}^{G} \frac{(O_G - E_g).^2}{E_g(1-\frac{E_g}{n_g})} \quad (4)$$

• G is the number of groups;
• O_G is the number of observed events in group g;
• Eg is the number of expected events in group g;
• n_g is the predicted mean probability for group g.

3.4. Characteristics of the Sample

Before starting the analysis of our database, it is essential to conduct a statistical presentation of the key properties of our research subject. This preliminary step will allow a better understanding of this population, the structure of the observed subjects, and the characteristics studied. In summary, the preliminary statistical analysis proves essential to adequately define our research items.

We have chosen to evaluate the size of SMEs based on their workforce rather than their revenue for several reasons. We plan to conduct a study on the qualitative determinants of financial failures of SMEs in the Casablanca-Settat region. Thus, size is qualitative data, unlike revenue, which is quantitative data. In Morocco, access to quantitative data, such as the turnover of SMEs, remains limited and subject to inaccuracies in the information reported. In addition, small and medium-sized enterprises are reluctant to share quantitative data even with their financial partners. On the other hand, data on workforce numbers are generally more accessible, particularly for SMEs.

Table 1. Sample Characteristics

Independent variable	Measured variable	Response modality	Response number
Characteristics of the SME	Activity	(1) Trade	45
		(2) service	47
		(3) industry	28
		(4) construction	38
	Age of the SME (date of creation)	(1) between 1990 and 2000	23
		(2) between 2000 and 2008	12
		(3) between 2008 and 2018	28
		(4) between 2018 and 2024	95
	Size (number of employees)	(1) less than 5 employees	70
		(2) from 5 to 10 employees	40
		(3) from 10 to 20 employees	38
		(4) from 20 to 40 employees	4
		(5) more than 40 employees	6
	Informal sector	(1) strong competition in the informal sector	85
		(2) moderate competition in the informal sector	43
		(3) weak competition in the informal	30
Characteristics of the leader	Level of education of the manager	(1) high school diploma or equivalent	10
		(2) two years of higher education	25
		(3 three years of higher education	55
		(4) five years of higher education	62
		(5) higher level	6
	Previous experiences of the leader	(1) no experience	16
		(2) year to 5 years	25
		(3) years to 10 years	66
		(4) more than 10 years	51
	Management or financial management skills	(1) executive with training in management or financial management	61
		(2) leader without training in management or financial management	97

Source: Statistical Results, Authors.

According to Bank Al Maghrib (2021) the informal sector in Morocco refers to a set of economic activities that are not subject to administrative, legal, and tax regulations. Basic commercial activities that circumvent tax, social, or labor law provisions are called the informal sector. About 60% of jobs in Morocco are in the informal sector (HCP, 2023). The underground economy and the informal sector in Morocco are linked by the prevalence of undeclared transactions and unregulated activities. The collection of taxes, social contributions, and labor market regulation in Morocco are negatively impacted by this phenomenon. The informal sector is defined by Buehn and Schneider (2012) as economic activities that are based on the market for goods and services and are concealed from state control authorities to avoid tax and regulatory obligations. Schneider *et al.* (2010) define the informal sector on the market for goods and services as any economic activity that remains hidden from public authorities due to the existence of tax burdens, social security contributions, the complexity of administrative procedures, and institutional constraints.

4. Empirical Results and Discussion

At this stage, our focus is on using an empirical approach to comprehend the financial failure phenomenon that SMEs in the Casablanca Settat region are experiencing. This title aims to present the statistical results from our empirical study using advanced statistical techniques such as chi-square contingency tests and binary logistic

regression. Finally, this section will conclude with a discussion of the results obtained, thereby providing an informed understanding of the issue addressed.

4.1. Qualitative Determinants of Financial Failure by SME Characteristics

4.1.1. Pearson's Chi-Square Test

According to our results, the Pearson chi-square analysis indicates statistical significance with a threshold of (Sig =<0.05) for the examined variables, namely Activity, competition from the informal sector, Number of employees, and Age of the SME. This implies that there is a relationship between the performance or failure of an SME and its specific characteristics. On the other hand, the analysis highlights that the dependence is not statistically significant (Sig > 0.05) for the use of the variable new management or production technologies.

Table 2. Chi2 test results related to SME characteristics

Independent variable	analysis variable	Chi-squared	significance level
Characteristics of the SME	Activity	X2(3) =31,841	0,000
	Informal sector	X2(1)=12,805	0,000
	Size (number of employees)	X2(4) =18,858	0,001
	Age of the SME (date of creation)	X2(3)=19,863	0,001

Source: Statistical Results, Authors.

We observed a significant correlation (Sig at the 5% threshold) between the activity's nature and its situation, indicating whether it is in a healthy or failing state. Commercial SMEs recorded the highest number of failure cases among SMEs, with 35 cases, followed by industrial SMEs with 17 cases. SMEs operating in the service sector stand out for their low failure rate, with only 9 recorded cases, while SMEs in the construction sector account for 13 cases.

Regarding the number of employees in SMEs, there is a significant correlation between this parameter and their situation, whether it is stable or in difficulty (Sig = 0.001). 42 recorded cases reveal that SMEs with fewer than 10 employees exhibit a high failure rate. SMEs with more than 20 employees have lower failure rates, according to a set of 32 observations.

The dependent variable related to the informal sector is also significantly correlated with the situation of SMEs (sig =< 0.05). SMEs that claim to face a strong threat from the informal sector show a higher failure rate.

4.1.2. Binary Logistic Regression Tests

We began the analysis by performing binary logistic regression tests, which grouped the explanatory variables related to the SME and the dependent variable that indicates the status of the indebted SME (healthy or failing). The Chi-square tests previously carried out made it possible to determine that these variables, concerning different aspects of the SME, such as activity, size (number of employees), and competition from the informal sector, are statistically significant.

Table 3. Results of the binary logistic regression test related to the characteristics of SMEs

Variables of the equation		B	Wald	Ddl	Sig.	Exp(B)
Step 1	Activity (1)	1,975	5,561	1	0,018	1,203
	Activity (2)	2,061	5,697	1	0,017	0,127
	Activity (3)	1,981	4,343	1	0,575	,603
	Size (1)	3,838	8,688	1	0,007	0,022
	Size (2)	2,732	4,094	1	0,043	,0650
	Size (3)	2,564	3,751	1	0,430	0,065
	Size (4)	2,342	1,515	1	0,409	4,995
	Informal sector (1)	2,945	8,853	1	0,000	1,006
	Age (1)	1,558	1,260	1	0,262	0,211
	Age (2)	19,807	0,000	1	0,999	0,000
	Age (3)	19,158	0,000	1	0,999	0,000

	Age (4)	0,022	0,001	1	0,977	0,978
	Constante	0,909	0,527	1	0,468	2,482
Variables of the equation		B	Wald	ddl	Sig.	Exp(B)
Step 2	Activity (1)	2,346	1,672	1	0,001	1,446
	Activity (2)	2,631	1,629	1	0,000	0,072
	Activity (3)	0,866	1,195	1	0,274	0,421
	Informal sector (1)	3,298	2,256	1	0,000	2,053
	Size (1)	3,566	9,004	1	0,003	1,028
	Size (2)	1,356	1,635	1	0,008	0,035
	Size (3)	3,353	6,954	1	0,201	0,258
	Size (4)	2,864	2,794	1	0,195	7,532
	Constante	0,866	0,579	1	0,447	2,377

Source: Statistical Results, Authors.

Step 1: Introduction of variables in step 1: Activity, Size, informal sector, Age.
Step 2: Introduction of variables in step 2: Activity, Size, informal sector.

We find that the Hosmer-Lemeshow test remains non-significant, with a p-value greater than 0.05. This implies that we accept the null hypothesis (H0): The model fits well the data and reject the alternative hypothesis (H1): The model does not fit the data well. In other words, this suggests that the logistic model fits the observed data fine. The model is therefore adequate.

Table 4. Hosmer and Lemeshow test

Chi-square	ddl	Sig.
13,426	7	0,092

Source: Statistical Results, Authors.

After gradually eliminating non-significant variables in two steps (from Step 1 to Step 2), we exclusively retained three independent variables that proved significant at the 5% level and contributed to explaining the failure of SMEs. These variables include the number of employees, the type of activity, and the level of informal sector competition. We removed the variable representing the age of the SME, as measured by the date of creation, from our model due to its statistical insignificance. According to our binary logistic regression study, it is demonstrated that the SME's sector of activity plays an essential role in its failure (sig < 0.05).

According to our model, the indebted SMEs most at risk of experiencing financial difficulties are those operating mainly in the trade sector (activity category (1) = trade) and in the service sector (activity category (2) = services). Furthermore, our binary regression model demonstrates that intense competition from the informal sector contributes significantly to the financial failure of SMEs, with a significance level of less than 0.05. Our binary logistic regression model indicates that SMEs (Informal competition level (1) face strong competition from the informal sector.

According to our binary logistic regression model, it is demonstrated that the size of the SME, measured by the number of employees, plays a decisive role in its precarious financial situation, with a (sig =< 0.05). Our binary regression model shows that the SMEs most at risk of experiencing financial failure are those with fewer than 10 employees, with a distinction between those with fewer than 5 employees and those with 5 to 10 employees. We can therefore accept Sub-hypothesis No. 1.1: there is a positive causal relationship between the nature of the SME's activity and its financial failure. In addition, we can accept Sub-hypothesis No. 1.2 which suggests that the existence of an informal parallel market contributes to the explanation of the financial failure of SMEs in the Casablanca region and Sub-hypothesis No. 1.3 which asserts a positive causal relationship between the size of the SME and its failure. Conversely, we reject Sub-hypothesis No. 1.4: there is a positive causal relationship between the age of the SME in the Casablanca Settat region and its failure situation.

4.2. The Characteristics of the Manager Determine the Likelihood of Failure

4.2.1. Pearson's Chi-Square Test

According to our results, the Pearson Chi-square test reveals statistical significance at a threshold of (Sig =<0.05) concerning the analyzed variables, namely the leader's experience and qualifications in management or finance.

Table 5: Results of the Chi-square test related to the characteristics of the leader

Independent variable	Analysis variable	Chi-squared	Significance level
Characteristics of the leader	Previous experiences of the leader	X2(3) =12,521	0,006
	Level of education of the manager	X2(4)= 28,293	0,418
	Management or financial management skills	X2(1)=6,145	0,010

Source: Statistical Results, Authors.

Regarding the characteristics of the SME manager, our cross-analysis highlights a significant correlation between the current state of the SME (healthy or failing) and the professional experience of the manager, as well as his or her qualifications in management or finance, with respective significance levels of 0.006 and 0.010. Financial failures are much more frequent among SMEs whose managers have less than five years of experience in a field related to the company's main activity, with 59 cases observed. On the other hand, SMEs managed by individuals with more than five years of professional experience show a lower number of failures, with only 15 cases recorded. In our sample, we observed a higher failure rate of 53 cases in SMEs managed by managers without management or management training.

4.2.2. Binary Logistic Regression Tests

We initiated our analysis by conducting binary logistic regression tests, which combined our explanatory variables related to the SME leader and the dependent variable related to the SME's current situation (performing or failing). These variables, which are statistically significant in the previously established Chi-square tests, relate to the characteristics of the SME leader, such as their experience and qualifications in management or finance.

Table 6. Results of the binary logistic regression test related to the characteristics of the leader

Variables of the equation	B	Wald	ddl	Sig.	Exp(B)
Previous experiences of the leader (1)	1,167	3,951	1	0,047	0,311
Previous experiences of the leader (2)	0,797	1,742	1	0,187	2,218
Previous experiences of the leader (3)	0,661	2,902	1	0,088	1,936
Management or financial management skills (2)	0,930	6,872	1	0,009	0,395
Constante	0,023	0,005	1	0,942	1,024

Source: Statistical Results, Authors.

We find that the Hosmer-Lemeshow test remains non-significant, with a p-value greater than 0.05. This implies that we accept the null hypothesis (H0): The model fits well the data, and reject the alternative hypothesis (H1): The model does not fit the data well. In other words, this suggests that the logistic model fits the observed data well. The model is therefore adequate.

Table 7. Hosmer and Lemeshow test

Chi-square	ddl	Sig.
13,024	6	0,073

Source: Statistical Results, Authors.

The binary logistic regression analysis shows that the level of previous professional experience of the SME manager is a decisive factor of its failure (sig $p < 0.05$). According to our model, the SMEs most likely to encounter financial gaps are those whose leaders do not have prior professional experience. Indeed, according to our logistic regression model, it is also demonstrated that the qualifications in management or finance of the SME leader play a decisive role in its failing financial situation with a $p < 0.05$.

Therefore, we can accept Sub-hypothesis No. 2.1: the number of years of previous professional experience of the SME's manager contributes to explaining the SME's financial failure. Additionally, Sub-hypothesis No. 2.3 suggests that the management skills of the SME leader play a significant role in explaining the financial failure of the SME.

On the contrary, we reject Sub-hypothesis No. 2.2, which suggests that the level of education of the SME leader contributes to the explanation of the SME's financial failure.

5. Discussion of the Results

We can affirm that the qualitative characteristics of the SME and its manager contribute primarily to the financial failure or nonpayment of bank loans in the Casablanca-Settat region. Indeed, our logistic regression model highlighted that the direct impact of the nature of the SME's activity, the simultaneous presence of an informal sector, and the size of the SME (measured by the number of employees) are decisive factors of financial failure. Scientific studies have clearly established the existence of a causal correlation between the field of activity of a company and the risk of failure (Boubakary, and Moskolaï, 2021; Gumel and Bin Bardai, 2023). The decline in the performance of SMEs results from a lasting deterioration in their activity (Benjabeur, 2017).

Regarding the same subject, El Manzani *et al.* (2018) point out that some SMEs in Morocco are facing financial crises due to the insufficient level of their development and the crises encountered in their sector of activity. The responsiveness of SMEs to the constraints of their industrial environment does not offer them guaranteed growth prospects, is responsible for this situation.

Our results are not consistent with the findings of Thornhill and Amit (2003); Sharabany (2004), who argue that the rate of financial failure of firms is higher in the industrial sector than in the service and trade sectors. Moroccan SMEs, particularly in the trade and service sectors, face higher risks of failure due to various internal and external factors such as limited access to financial resources, economic sluggishness, and poor financial management (El Manzani *et al.* 2018).

According to data from Bank Al-Maghrib (2023) the recorded companies operating in the trade and services sectors, respectively, are 19% and 28% of all sectors of activity in Morocco, have bad debt rate. According to statistics from Moroccan Observatory of SMEs (2021) more than 60% of companies operating in the trade and services sectors reported a drop in their revenues, which calls into question their short-term viability. According to research by Derkaoui *et al.* (2021) the informal economy accounts for more than 20% of the gross domestic product excluding agriculture. Other studies have also suggested that informal firms could constitute strong competition due to their smaller size, thus granting them greater flexibility in their internal organization modes.

According to Ali and Najman (2016) an indirect consequence of informal competition on the performance of formal firms arises from the direct effect of taxation. An indirect impact of informal competition on the efficiency of formal firms arises from the direct impact of taxation on said informal competition (Kerrouch, 2023). According to Jayasekara *et al.* (2020) the unfavorable environment in which small firms operate contributes to their failure.

In reality, the risks associated with the existence of an informal sector go beyond national tax evasion and non-payment of social security contributions. They are also characterized by its harmful influence on the market for goods and services, promoting unfair competition that manifests itself in dumping price practices. According to the HCP (2021) the commercial sector remains the main driver of the informal economy in Morocco, representing 50.6% of all sectors of activity. Furthermore, small SMEs are more prone to financial failure in Morocco, particularly in the Casablanca Settat region.

Researchers such as Jayasekara *et al.* (2020); Munawaroh *et al.* (2023); Gumel and Bin Bardai (2023) have demonstrated a positive correlation between the smaller size of a company and its probability of bankruptcy. Venkataraman *et al.* (1990); Lussier (1995) pointed out that small firms mainly struggle to obtain the resources and skills needed to execute their strategy. It is crucial for any new venture to reach a critical size to become profitable, as (Blazy *et al.* 1993) point out.

Moreover, small firms are likely to fail if they exhaust their financial resources before developing value-generating assets (Thornhill and Amit 2003). In the same vein, Munawaroh *et al.* (2023) point out that Indonesian small and medium-sized enterprises fail within the first five years due to recurring entrepreneurial problems. Duffie *et al.* (2007) point out that large firms have greater financial flexibility than small firms. Studies by Carroll (1983); Hall (1992); Mitchell (1994); Baldwin *et al.* (1997); Sorensen and Stuart (2000); Glennon and Nigro (2005) have validated the idea that small firms are more likely to encounter obstacles and face a higher risk of failure.

Our research also highlighted that the qualities of the managers of SMEs in the Casablanca Settat region exert a particular influence on the probability of financial failure of these companies. Indeed, our logistic model indicates that SMEs, with a management team lacking prior experience in the same sector of activity and without university degrees in management or finance, are expected to end in failure.

Indeed, our various logistic regression tests reveal that managerial skills and the manager's previous professional experience are key factors in ensuring effective management of the company. A manager faced with such shortcomings will run a higher risk of seeing his company one day end up in a state of failure. In writing dealing with business management, it is common to observe a relationship between the leader's intelligence, their

management skills, their experience, and the challenges of growth or even the failure of the company (Boubakary, and Moskolaï, 2021; Bensalah and Tinaztepe, 2021; García-Pérez-de-Lema *et al.* 2021; Rulangaranga and Isoh, 2021; Ma'aji *et al.* 2023).

In this sense, Abriane and Aazzab (2016) highlighted the frequent link between business failure and the competence of their leader. The lack of management skills in the financial field, particularly in accounting, inventory control, and cash management, can compromise sustainability (Khan and Rocha, 1982). Cooper *et al.* (1994) found that management skills could influence organizational performance by encouraging the adoption of more effective strategies and improved management practices. According to Boubakary, and Moskolaï (2021); Bensalah and Tinaztepe (2021) the managerial incapacity of managers of small and medium-sized enterprises (SMEs) is a major determining factor in the failure of SMEs in Cameroon.

Conclusion

The objective of this article is to identify the qualitative factors that contribute to the financial failure of SMEs in the Casablanca-Settat region. Thus, we applied binary logistic regression statistical tests to a sample consisting of 158 SMEs, of which 74 were in financial failure.

The study results indicate that factors such as the size of the SME, the sector of activity, the presence of an informal sector, the manager's qualifications in management or finance, as well as their previous professional experiences, have a prominent influence on the likelihood of financial failure of SMEs in the Casablanca-Settat region.

The findings of this research could be important for creditors, particularly banks. Indeed, in order to minimize the costs associated with counterparty risk, it is essential for creditors to adequately assess the financial situation of borrowing SMEs by taking into account the explanatory factors detailed in the article.

On the other hand, potential investors could potentially benefit from our research, given the detailed explanatory factors. Indeed, the explanatory variables of a failure situation will enable potential investors to avoid investing in companies that are highly susceptible to failure.

Furthermore, the conclusions of our study can help SME managers to anticipate difficulties, particularly in their relationship with their bank, and implement corrective actions to prevent financial difficulties.

Our study provides qualitative data to the Moroccan public authorities, demonstrating that the informal sector has a significant impact on SMEs in the Casablanca Settat region, particularly commercial SMEs, leading to their financial difficulties. It is therefore important to adopt an economic approach that considers the negative impact of the informal economy on businesses in Morocco, particularly SMEs, and by promoting fair regulation to encourage the emergence of fairer and more sustainable entrepreneurial environment.

However, our study has limitations: On the one hand, the sample size is limited to a single Moroccan region. On the other hand, the study only considers qualitative variables related to the characteristics of the SME and its leader. Other qualitative factors, such as organizational structure, human resources, marketing capabilities, and personality traits, could also contribute to the explanation of the phenomenon of SME failure in this region. In this regard, our study could serve as a catalyst for future researchers to expand their geographical scope and incorporate the previously mentioned variables into their econometric models, thereby enabling them to obtain more precise insights into the financial failure of SMEs in Morocco.

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Tax Reform and Investment Decision Effects in an Emerging Economy: Insights from Ghana

Michael YEBOAH
Department of Accountancy and Accounting Information Systems
Kumasi Technical University, Business School, Ghana
ORCID: 0000-0003-2577-5358
michael.yeboah@kstu.edu.gh

Benjamin Adjei DANQUAH
Liberal Studies Department, Kumasi Technical University, Ghana
ORCID: 0009-0009-7826-6953
Benjamin.adanquah@kstu.edu.gh

Jonas BAWUAH
Department of Accountancy and Accounting Information Systems
Kumasi Technical University, Business School, Ghana
ORCID: 0000-0001-7700-741X
Jonas.bawuah@kstu.edu.gh

Agyeiwaa Owusu NKWANTABISA
Department of Accountancy and Accounting Information Systems
Kumasi Technical University, Business School, Ghana
ORCID: 0000-0002-8843-6428
agyeiwaaowusu1844@gmail.com

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Abstract: This study focuses on both domestic and foreign investment as indicators of economic growth in an emerging market context, examining the effects of tax reforms on investment decisions in Ghana from 1985 to 2020. The research employs a time-series analysis to integrate control variables like inflation, gross capital formation, and base rate, revealing their significant influence on investment activity in tandem with tax policy changes. Unlike previous research that mostly uses gross fixed capital formation as a proxy for investment, this study includes a wider range of investment types, giving a more complete picture of how the economy works. We did unit root and co-integration tests, which showed that the variables were first-order co-integrated. We performed the model estimate using a Vector Error Correction Model (VECM) and Granger causality tests. Results reveal that tax reforms have a measurable impact on investment patterns, underscoring the importance of adaptive tax policies in promoting sustainable economic development. The findings contribute to the broader literature on investment and fiscal policy in emerging economies, offering insights for policy-makers on optimizing tax strategies to encourage investment and drive economic growth.

Keywords: tax reform; investment decisions; VECM; Ghana.

JEL Classification: H20; D92; C32; O55; R11.

Introduction

Recently, developing economies have recognized tax reform as an essential mechanism for promoting investment. Historically, research evaluating investment reactions to alterations in tax policy has employed gross fixed capital formation as a surrogate for investment. This measure, however beneficial, encompasses only a fraction of investment activity, primarily concentrating on physical capital while frequently excluding other critical elements like finance or foreign direct investments. This method may be restrictive, as it might not adequately

capture the complexities of investment decisions influenced by tax policy, particularly in economies with varied investment sources. This study bridges this gap by incorporating both domestic and international investment metrics, thereby providing a comprehensive view of how tax reforms affect a broader range of investment activities in Ghana. This method facilitates a more refined comprehension of the correlation between tax policy and investment, which enhances the efficacy of fiscal plans for developing economies. Tax policy is a government's determination of which taxes to levy, in what amounts, and on whom to levy them (Nyamadi, 2014).

Tax policies have been used by governments for many reasons, such as funding spending that boosts growth (Melo-Becerra, Mahecha, & Ramos-Forero, 2021), redistribution of resources and income (Engel, Galetovic, & Raddatz, 1999; Bucheli, Lustig, Rossi, & Amábile, 2014), fair distribution of consumer wealth (Enami, Lustig, & Taqdiri, 2019), and encouraging private investment (Villela & Barreix, 2002; Tavares-Lehmann, Coelho, & Lehmann, 2012; Gaspar *et al.* 2016). However, this study focuses on how tax reforms impact investment decisions in Ghana. Investment decisions involve careful consideration of various factors to maximise returns from investments while managing risks (Gaspar *et al.* 2016; Kuma and Singh, 2017). A key challenge for policymakers is to use taxes to promote investment and raise required domestic revenue while maintaining fiscal policies that are beneficial to both the state and prospective investors (Nwokoye & Rolle, 2019). There is no doubt that this would demand a full revamp of the tax system, which might increase efficiency by broadening the revenue base without increasing the tax rate (Hassett & Hubbard, 2012). A recent analysis of the budgets of the Government of Ghana has revealed that the government has been regularly lowering the tax rate to broaden the revenue base (Cummins, Hassett & Hubbard, 2016).

Indirect taxation, particularly VAT, serves as Ghana's primary source of tax revenue, with citizens paying the government on specified products and services through registered individuals or businesses (Aghion *et al.* 2005; Azémar & Dharmapala, 2019). This is a result of the government's continuous efforts to lower the corporate tax rate, which is part of its broader initiative to enhance the business environment for private-sector investment (Ghana Revenue Authority [GRA], 2019). Thus, Ghana's tax reform goal, among other things, is to improve private sector investment for growth. The primary aim of investors in any functioning economy is to invest scarce resources to maximise their prospective return on investment (Mohamud & Isak, 2019).

Investors, therefore, invest in countries that have favorable incentives for realizing their primary goal, which is to maximize their return on investment (Abdallah, 2016). As a result, governments, such as the Government of Ghana (GRA), use fiscal policy, particularly tax reforms, to attract investors to their countries (Barro, 1990; Mohamud & Isak, 2019). Thus, the policy recognizes tax reform as a powerful tool to shape investment decisions (Zed, Stotsky, & Ley, 2002). Changes in tax policies can impact the after-tax returns on investments, affecting the attractiveness of different asset classes and investment strategies (Bora, 2013 & Tanzi, 2012). Researchers have conducted numerous studies on this subject, resulting in varying outcomes and/or methodologies. Vergara (2010), for example, examined the empirical relationship between Chile's tax change and its subsequent investment performance and found evidence suggesting the corporate income tax drop played a significant role in Chile's investment boom in the late 1980s and early 1990s. The figures explicitly indicate that the tax reforms account for a three-point increase in private investment as a proportion of GDP.

Again, the analysis showed that using microeconomic data, there was sufficient evidence to conclude that the tax reforms have a beneficial effect on investment. Although interesting, Vergara's analysis is out of date since the study used data between 1975 and 2003. Again, Chile's tax changes at the time aimed to reduce taxes, in contrast to Ghana's, which consolidated all three revenue agencies and resulted in tax hikes. As such, Vergara's (2010) conclusion may serve as a point of reference rather than a definite conclusion for Ghana. Also, López-Gutiérrez *et al.* (2015) investigated the effect of financial problems on the investment behavior of businesses in Europe and North America using the Generalized Method of Moments. According to the research, the influence of financial problems on investment differs based on the investment options available to organizations. Thus, businesses in distress with fewer possibilities have a greater tendency to underinvest, whereas those with more chances exhibit no different investment behavior than healthy businesses. Lopez-Gutierrez *et al.* (2015) did not mention the tax component, which is relevant to this investigation. However, Muhammed *et al.'s* (2012) study in Pakistan revealed that tax reforms have no direct effect on investment decisions, but they do have an indirect effect on investment. The lack of empirical studies on the impact of tax reforms on investment decisions in Ghana, along with the inconsistent findings in the empirical literature, supports the need for an independent study on the relationship between tax reforms and investment decisions in Ghana. It is also important to emphasize that the majority of previous studies used gross fixed capital creation as a proxy for investment choices. Therefore, the previous studies primarily focused on local investment opportunities. However, both domestic and foreign companies invest in Ghana.

This study considerably enhances the conversation on tax reform and investment decisions by providing empirical insights from the viewpoint of a rising economy such as Ghana. This paper examines the distinct problems and opportunities arising from Ghana's tax reforms, in contrast to prior research that primarily concentrates on wealthy economies or broad regional assessments. This study's originality lies in its analysis of the interaction among tax incentives, compliance costs, and investment behaviour in a dynamic economic context. The findings underscore the essential importance of policy continuity and digitalization in influencing investor confidence. This research offers practical advice for policymakers seeking to integrate tax reforms with sustainable development goals in Ghana and other settings by connecting theoretical models with real-world applications.

As such, this study draws on theoretical views and attempts to close methodological and contextual gaps in empirical research by examining the impact of tax reforms on investment choices in Ghana, considering both domestic and international investment inflows. We have organized the paper as follows: Section 1 examines the literature review. Section 2 explains the study methods. These include data sources, model needs, and estimation methods used to conduct empirical research. Section 3 delineates the empirical results, whereas the remainder of 4 elucidates these findings and provides policy implications.

1. Literature Review

Incorporating certain economic models, such as Keynesian and neoclassical investment theories, into theoretical study is crucial to ensure its foundation in well-established frameworks that directly influence the relationship between taxes and investments. Neoclassical investment theory elucidates the effects of tax policy on investment by altering capital costs, hence affecting firms' resource allocation decisions for growth. Keynesian models underscore the significance of government involvement and fiscal policy, especially taxation, as mechanisms to enhance aggregate demand and investment in the economy. By delineating these models, the study can provide a more lucid, theoretically supported justification for the impact of tax reforms on both domestic and foreign investment. This specificity bolsters the study's analytical framework and increases its significance for policymakers by situating the findings within established economic theories that have traditionally informed fiscal decisions in emerging economies. Every nation establishes its tax system as one of the factors influencing its business environment. The correlation between tax reform and investment decisions has been a significant subject of investigation for politicians and academics in Ghana. Tax policies profoundly affect the economic landscape by determining incentives for both domestic and international investment. In recent years, Ghana has implemented numerous tax reforms to improve revenue mobilization, streamline tax administration, and promote private sector development. The efficacy of these reforms in influencing investment decisions continues to be a topic of contention. Ghana has executed significant tax reforms, encompassing the implementation of Value Added Tax (VAT), modifications to corporate tax rates, and the establishment of electronic tax systems to enhance compliance.

Tax-efficient investing theory, for example, is a collection of theories that help understand how tax reforms affect investment decisions. The tax-efficient investing theory revolves around minimizing the impact of taxes on investment returns. According to the tax-efficient investing theory, investors aim to structure their portfolios in a way that reduces taxable events, such as capital gains, and takes advantage of tax-efficient investment vehicles, like tax-advantaged retirement accounts. When tax reforms alter the costs associated with different investment choices, investors are likely to adjust their portfolios to optimize their post-tax returns. Changes in corporate taxes, for example, may influence whether investors invest within an economy or not, or invest in an industry or not. Also, economic theory suggests that firms respond to incentives.

Tax incentives, such as tax credits for certain types of investments or industries, can influence investment decisions. Investors may be more inclined to allocate capital to regions that benefit from favorable tax treatments. Thus, based on these three theories - tax-efficient investing theory, rational choice theory, and economic theory - tax reforms influence investors regarding which country to invest in and which industry to invest in. The term "tax reform" refers to a departure from the status quo. If the marginal cost of tax I exceeds the marginal cost of tax J, the basic concept of tax reform is violated, and it is advantageous to move from I to J at the margin. In general, tax reform is desirable if it improves revenue while also boosting social welfare. We should impose a tax if the direct impact of the shift on families outweighs the cost of the increased demand due to shadow pricing. The shadow price of a good represents the welfare consequences of changes in general equilibrium caused by increased demand for an item. Therefore, the economy's response determines the shadow price (Stein, 1988b, and Reinhart and Rogoff, 2004). Newbery and Stein (1988) examined tax reform using the concept of optimal taxation as a normative framework. The study seeks to account for both tax losses in resource allocation

efficiency and vertical equity standards as a result of tax reform. The first component of the reform examines taxpayer sensitivity to tax-induced relative price increases, while the second examines the precise specification of a social welfare function. According to this perspective, optimal tax policies are those that minimise the efficiency costs (additional burden) of taxing while also taking income inequality into account. One of the most remarkable aspects of these schemes is their virtually complete lack of consistent tax rates.

For instance, Table 1 lists some of the tax reforms and policies that Ghana has implemented.

Table 1. Laws being administered by GRA

1991- 1999	2000- 2019	2020-
TIN Act, 2002 - Act 632 Stamp Duty Act 689 Free Zones Act 1995- Act-504	Ghana Education Trust Fund Act, 2000 - Act 581 Value Added Tax Act, 2013 - Act 870 Internal Revenue ACT (2006 Amended Version) Internal Revenue ACT (2012 Amended Version) Communications Service Tax Act, 2008 -Act 754 Communications Service Tax (Amendment) Act, 2013 -Act 864 Excise Tax Stamp Act, 2014 - Act 873; Excise Duty Act, 2014 - Act 878; Customs Act, 2015 - Act 891; Income Tax Act, 2015 (Act 896); Value Added Tax Act, 2013 - ACT 870 Acts Income Tax Act, 2015 - Act 896 Ghana Revenue Authority Act, 2009 - Act 791 VAT (Amendment) Act 954	Penalty and Interest Waiver Act 2021 Financial Sector Recovery Levy Act 2021 Revenue Administration (Amendment) Act, 2020 Act 1029 Penalty and Interest Waiver (Amendment) Act, 2021 Act 1073 Covid 19 Health Levy Act Ghana Infrastructure Investment Fundamental Act 2021 Electronic Transfer Levy Act, 2022 Act 1075 - E-Levy Income Tax (Amendment) (No.2) Act, 2021 Act 1071 Income Tax (Amendment) Act, 2021 Act 1066 VAT (Amendment) Act, 2021 Act 1072

1.1 Factors Affecting Investment Decisions

Investment does not have a common definition. Investment has evolved, giving rise to a plethora of definitions and opinions on the concept. While various disciplines define investment differently, they all refer to the notion of allocating resources - whether time or money - to an activity to accomplish the desired goal. For this study, investment will be defined as the present placement of money in an activity with the anticipation of a return that takes time, uncertainty, and inflation into account (Barton, 2016). Investment entails incurring risks due to the unpredictability of events since current expenditures are paid to receive typically uncertain future rewards. Generating income to cover future costs is the primary objective of investing. Due to the critical nature of both the present and future elements of investment, components that aid in defining assurance in investments are in high demand. Though several factors influence investment decisions, this study focused on critical macroeconomic factors relevant to investment decisions in Ghana. The following discussion highlights some of these factors:

Interest rates denote the expense of borrowing funds and serve as remuneration for lenders, profoundly impacting the economy by altering the cost of capital and the accessibility of credit. The International Monetary Fund (IMF) delineates three principal functions of interest rates: they promote saving, influence the demand for loanable money, and assist in managing inflationary risks (Mohamud & Isak, 2019). Interest rates, shaped by the monetary policy rate (MPR), fluctuate, impacting enterprises' borrowing expenses and, subsequently, their profitability and market valuation (Patil & Bagodi, 2021). As interest rates rise, corporate bonds become less attractive due to diminished yields. The central bank is crucial in determining interest rates, specifically by overseeing interbank lending rates, which directly influence the loan and savings rates offered by commercial banks. Moreover, elevated interest rates may stimulate demand for government-issued bonds and influence currency valuation. Understanding interest rates is crucial for overseeing loans, credit cards, and various financial commitments. Borrowers with elevated risks typically encounter increased interest rates, underscoring the necessity of maintaining favorable credit scores for improved borrowing conditions. Ultimately, interest rates function as essential regulators in financial models, influencing economic conditions and personal financial choices.

Economic growth denotes the rise in the market value of all products and services generated by an economy over time, adjusted for inflation (IMF, 2012). Typically, we quantify it as the percentage rate of growth in real GDP. Economic growth is a fundamental macroeconomic objective since it signifies an increase in a nation's real per capita income (Davids, 2015). This expansion enhances an economy's productive capacity, facilitating the production of additional goods and services while simultaneously elevating living standards and diminishing

income inequality. Monetary policies are essential instruments for fostering economic growth, as they govern the value, supply, and cost of currency within an economy (Folawewo & Osinubi, 2006). Robust and continuous economic growth is crucial for alleviating poverty and attaining the Millennium Development Goals. It can foster a cycle of wealthy generation, encourage education, and force governments to implement changes, thereby propelling future development (Davids, 2015).

Inflation, the country's overall price level of products and services, is consistently increasing. As a proxy for inflation, the yearly growth rate of the GDP implicit deflator represents the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current currency to GDP in constant currency in the prior year (World Development Indicators, 2018).

2.2 Empirical

This section examines empirical literature on tax reforms and investment decisions worldwide, concentrating on Ghana while noting gaps and proposing new study avenues. Alves (2019) examined OECD nations from 1980 to 2015, demonstrating that income taxation fosters investment development when tax collections attain 10.7%, whereas social security disbursements impede long-term growth. This study, however, ignored non-OECD nations, in contrast to Muhammad *et al.* (2012), who identified that taxes indirectly affect investment through disinvestment via income taxes, underscoring the necessity for further analysis in Ghana. Braunerhjelm and Eklund (2014) discovered that tax administration constraints hindered firm entry in 118 countries between 2004 and 2010, but their data may now be obsolete. Vergara (2010) associated Chile's corporate tax reductions from 1975 to 2003 with a spike in investment; nevertheless, Ghana's recent tax increases render Vergara's conclusions less applicable in the local context. Da Rin *et al.* (2010) discovered that corporate tax reductions diminish capital sizes for new enterprises across 17 European nations; however, labor-related consequences exhibit variability. Their results on tax reductions are at odds with the prior conclusions of Braunerhjelm and Eklund (2014).

López-Gutiérrez *et al.* (2015) investigated the impact of financial distress on investment decisions. Their findings revealed that distressed enterprises typically underinvest; they did not directly analyze taxes. Mungaya *et al.* (2012) conducted a survey of SME managers in Tanzania, revealing that tax policies adversely affect SME development; nevertheless, the descriptive character of their study constrains its statistical validity. Muhammed *et al.* (2012) discovered that Pakistan's tax structure influences investment via disinvestment; nevertheless, the simplicity of their technique undermines their conclusions. Mensah (2022) contended that corporate tax reforms in developing nations such as Ghana promote foreign direct investment (FDI) and local investment, consistent with the overarching notion that tax reforms influence investment patterns. Recent research by Okoth, (2023) indicates that tax incentives have short-term effects on capital formation in Ghana, but Osei and Addo (2021) emphasize that inflation diminishes short-term investment, despite the advantages of long-term tax reform. Boateng and Owusu (2024) discovered that decreases in company tax enhance investor confidence in capital-intensive industries within sub-Saharan Africa. Kwabena *et al.* (2022) underscored the significance of tax stability for fostering investor confidence, cautioning that frequent tax alterations may engender uncertainty and dissuade investment in Ghana.

Most research reveals that political stability, infrastructure, and access to finance influence the impact of tax reforms on fostering an investment-friendly climate. Tax policy significantly influences investment decisions and economic results, as evidenced by numerous recent studies. Rumasukun, Mohammad Ridwan, and Muhammad Yamin Noch (2023) examined the influence of tax policy on investment choices in the manufacturing sector, emphasizing that tax incentives can encourage investment in capital-intensive industries. Muslim (2024) evaluated the impact of tax accounting regulations on financial reporting, highlighting its dual function in guaranteeing compliance and promoting openness. Qi *et al.* (2023) conducted extensive research on the impact of tax policy alterations on business investment and economic growth, illustrating that effectively structured tax policies can enhance economic activity by mitigating uncertainty and promoting private sector engagement.

Nembe and Idemudia (2024) examined the difficulties of formulating efficient digital tax policies within the framework of global tax reforms, focusing on the intricacies of taxing digital economies and proposing adaptive techniques for the international harmonization of tax systems. Awuonda and Ombok (2024) examined inflation-driven VAT reforms in the sugar industry, demonstrating their effects on price stability and emphasizing the necessity of reconciling revenue generation with economic stability. Collectively, these studies highlight the complex nature of tax laws and their extensive effects on investment choices, financial reporting, and macroeconomic stability. These findings highlight the necessity of synchronizing tax policies with national development objectives to maximize their effectiveness. Although the existing literature emphasizes the

macroeconomic consequences of tax reforms, there is no focus on their micro-level impacts on investor conduct in Ghana. The interaction between tax incentives and non-tax issues, including governance and market access, requires additional examination.

Cobbinah, Wen, and Sarpong (2024) emphasize that policy tools, including interest rates, inflation management, and government expenditures, profoundly affect investor confidence and market performance. Their research reveals that fiscal growth and lenient monetary policies frequently stimulate favourable stock market trends, but macroeconomic instability, such as currency depreciation and budget deficits, may counterbalance these impacts. This observation highlights the essential function of coordinated policy frameworks in promoting a robust and growth-focused stock market in Ghana. Frimpong, Asare, and Aggrey-Darkoh (2023) examine the complexities of tax policymaking in Ghana, highlighting its development within the wider framework of public administration and governance. Their contribution elucidates the difficulties of formulating equitable tax policy in the face of conflicting needs for revenue generation and economic expansion. Seidu, Queku, and Carsamer (2023) expand on this discourse by examining the impact of financial limitations on tax planning practices within Ghana's banking sector. Their findings indicate that banks facing greater financial limitations employ more aggressive tax planning tactics. Naama (2023) advocates a reform-oriented strategy to revitalize Ghana's economy, highlighting the necessity of structural modifications in taxation and economic policy to rectify fiscal inefficiencies and stimulate economic growth. These studies collectively offer a detailed understanding of Ghana's fiscal dynamics and their effects on economic performance.

Mobilizing tax revenue is essential for economic stability and prosperity, especially in sub-Saharan Africa, where fiscal issues frequently impede sustainable development. Kassa and Obeng (2024) examine the factors influencing tax revenue mobilization in the region, highlighting the substantial impact of economic development and digital infrastructure. Their analysis highlights that economic growth expands the tax base, while strong digital infrastructure improves the efficiency and transparency of revenue-collecting operations. These innovations mitigate tax evasion and administrative inefficiencies, resulting in enhanced revenue returns. Furthermore, the analysis underscores the capacity of these enhancements to establish conducive conditions for investment. By rectifying inefficiencies in tax systems, nations may create a stable and investor-friendly fiscal climate, crucial for attracting both domestic and foreign capital. Kassa and Obeng contend that harmonising tax policies with economic development methods might provide a synergistic impact, in which heightened investments further enhance economic growth and tax revenue production. This thorough examination highlights the significance of structural reforms and technology innovations in developing tax systems that efficiently generate revenue while promoting economic engagement and investment.

2. Research Methods

2.1 Data Sources

The research utilised a quantitative, explanatory approach to examine the effects of tax reforms on investment decision-making in Ghana. The study used time-series data from 1985 to 2020, concentrating on Ghana because of its significant tax reforms and its position as a pivotal investment center in sub-Saharan Africa. We obtained data from the 2021 World Development Indicators, the Bank of Ghana, and the Ghana Revenue Authority, which encompassed factors such as tax revisions, interest rates, inflation, and foreign direct investment. We chose the timeframe from 1985 to 2020 due to the availability of pertinent data. The researchers used summary statistics to detect and rectify mistakes or outliers in the data, ensuring precision through verification with official sources. This comprehensive evaluation furnished a dependable dataset for examining the correlation between tax reforms and investment decisions in Ghana. To enhance the study's methodology and clarify the role of control variables, a detailed explanation of each control variable - its relevance, expected effect on investment, and interaction with the independent variable (tax reform) - is essential. This section will discuss the selection of control variables such as inflation, gross capital formation, and the base rate, providing insights into their importance in isolating the impact of tax reform on investment decisions in Ghana.

Inflation affects purchasing power and economic stability, which can influence both investor confidence and real returns on investment. High inflation often creates uncertainty and deters investment, whereas low, stable inflation can create a favorable investment environment. In order to accurately attribute observed changes in investment to tax policy rather than inflationary pressures, this study incorporates inflation as a control variable. As a measure of total investment in the economy, gross capital formation includes physical assets such as buildings, machinery, and equipment. It reflects the overall capacity for production expansion and economic growth. By controlling gross capital formation, the study isolates the direct influence of tax reforms on investment from other general trends in asset accumulation, offering a more targeted view of the policy's impact on new

investments. The base rate, or central bank interest rate, directly impacts borrowing costs for firms and individuals, which in turn affects their ability to finance investments. A higher base rate typically increases borrowing costs, reducing investment; a lower base rate can stimulate investment by lowering financing costs. Including the base rate as a control variable helps to distinguish the effects of monetary policy from those of tax reform, ensuring the study's results focus specifically on the relationship between tax changes and investment behavior.

Methodological Enhancements: To further enhance methodological rigor, the study acknowledges limitations associated with data availability (*e.g.*, pre-1985 data gaps) and the potential influence of external factors, such as global economic conditions. For instance, the study addresses how shifts in global conditions may have indirect effects on local investment, potentially interacting with domestic tax policies, given that international market trends shape Ghana's investment environment. These enhancements provide greater transparency and robustness, ensuring that conclusions drawn are reliable and consider contextual limitations. This comprehensive approach to control variables and methodological clarity strengthens the study's findings, offering a clearer understanding of how tax reforms specifically impact investment in Ghana.

Incorporating control variables like inflation, gross capital formation, and the base rate is essential to isolating the unique effects of tax reform on investment, thereby increasing the accuracy of the study's results. Each control variable plays a distinct role in shaping economic conditions and investor behavior. For example, inflation directly impacts the real returns investors can expect; as price inflation rises, real returns on investment decline, often leading traders to adopt more conservative strategies. Gross capital formation, on the other hand, is a direct indicator of economic growth and resource accumulation. By adjusting for these variables, the study can more effectively distinguish between investment behaviors driven by tax policy changes and those influenced by broader economic factors. Without these controls, we might mistakenly attribute any observed changes in investment to tax reform, even if they stem from other economic dynamics. The inclusion of the base rate as a control variable also highlights the interplay between fiscal and monetary policy, which together influences the cost of financing for both domestic and foreign investors. Since the central bank's base rate affects loan and credit costs, it can either facilitate or hinder investment independent of tax reform policies.

In Ghana, businesses, particularly small- and medium-sized enterprises, prioritize borrowing costs, and the inclusion of the base rate prevents confusion between changes in investment and interest rate shifts. By addressing these key economic factors, the study achieves a more nuanced analysis, revealing the distinct impact of tax reform on investment while controlling for confounding variables that might otherwise skew the findings. Enhancing the methodology with a clear explanation of the chosen variables and addressing data limitations strengthens the study's transparency and reliability. We explicitly acknowledge data availability limitations, particularly the absence of pre-1985 data, to ensure readers understand that our conclusions are based on available historical records. It is crucial to acknowledge this limitation, as it sets the context for the study's temporal scope and underscores the possibility of factors beyond the current data set influencing the observed trends. Additionally, the study accounts for external influences, such as global economic conditions, which can indirectly impact Ghana's investment environment and interact with domestic tax policies. The study, by acknowledging these contextual factors, offers a more realistic interpretation of the findings, assisting policymakers in understanding that external conditions may also shape tax reform outcomes.

Moreover, the inclusion of alternative methodologies in the discussion enhances methodological rigor and demonstrates an openness to further validation. By briefly outlining methods that could also be applicable, such as panel data analysis or time-series cross-sectional studies, the research not only justifies the chosen approach but also opens avenues for future research to build upon or verify the study's results. This transparency in methodology not only bolsters the credibility of the findings but also supports the development of a more robust understanding of tax policy impacts in emerging economies. These methodological enhancements ensure the study's conclusions are not only well-substantiated but also broadly relevant and replicable, thus contributing a valuable framework for future research on taxation and investment in similar economic contexts. In exploring the effects of tax reform on investment decisions, alternative research methods such as qualitative case studies or panel data analysis could provide valuable supplementary insights. Qualitative case studies, for example, allow an in-depth examination of specific companies, industries, or time periods, focusing on how individual firms or sectors perceive and respond to tax policies in Ghana. This approach captures unique insights into decision-making processes that aggregate quantitative data might overlook, especially in capturing qualitative variables like investor sentiment, regulatory compliance costs, or the adaptability of firms.

By studying a targeted selection of firms, qualitative case studies could reveal more nuanced patterns in how various economic agents interpret and react to tax reforms, enriching our understanding of the relationship

between tax policy and investment behavior. Another promising alternative is panel data analysis, which could leverage both cross-sectional and time-series data to capture more complex dynamics over time. This approach could account for individual heterogeneity among different sectors or firms, providing a broader and more flexible analytical framework than a purely time-series or cross-sectional design. For instance, panel data analysis could control firm-specific characteristics or industry-specific shocks, which might affect how tax policies impact investment decisions across various contexts. Additionally, it could help in distinguishing short-term reactions from long-term adjustments to tax reforms, a valuable perspective in understanding the temporal impact of policy changes. While the current study did not use these methods, their consideration highlights a comprehensive approach to research design, providing potential avenues for future research that could enhance the findings.

2.2 Study Variables

The variables used in this study were grouped into three dependent variables, independent variables, and control variables, as follows:

Table 2. Variables used in this study

Components	Specific Variables	Description/ measurement	Source
Dependent variable	Investment decision	Gross domestic investment comprising investment made by both local and foreign firms in Ghana	World Development Indicators, 2021
Independent variable	Tax reform	The effective tax rate represents the percentage of income that a corporation pays in taxes after taking into account various deductions, credits, and exemptions	Callihan, 1994
Control variables	Inflation	Customer price index	Marques, *et al.* (2003)
	Interest rate	Base rate from Bank of Ghana	Churchill, Kwaning & Ababio, 2014
	Business confidence	Business Confidence Index (BCI). The Business Confidence Index is a quantitative measure that reflects the sentiment and outlook of businesses regarding current and future economic conditions.	Khan and Upadhayaya (2020).

2.3 Model Specification

This analysis used VAR and Granger causality models to investigate the effects of the tax reform on investment decisions in Ghana. Time-series analysis uses vector auto-regressive (VAR) to capture the dynamic relationships among multiple variables over time. The VAR model is an extension of the univariate autoregressive model (AR model) to multiple time series. The study used VAR because it captures multiple time series variables as vectors and can analyse the response of variables to a shock. Additionally, we can test Granger causality between variables using VAR models. Granger causality tests help assess whether past values of one variable provide information about future values of another variable. Given the important features of VAR, it has been used in many previous time series studies (Büyükakin *et al.* 2009). This study relied on a model by Hann and Cook (1988) to specify the impact of tax reform on investment decisions, as shown in Equation 1. Where INVDEC is investment decision-making, TaxREF is tax reform, INFL is the inflation rate, INTR is the interest rate, and BUSENVI is the business environment index. When $\alpha 2 = 0$, it means that tax reform has no impact on investment decisions; $\alpha 2 = 1$, it means that tax reform has a complete impact on investment decisions; $\alpha 2, <1$, it means that tax reform has an incomplete impact on investment decision-making; and $\alpha 2, > 1$, it means that tax reform has an overly complete impact on investment decisions. Also, following Granger (1969), the study tested the causal relationships between tax reform and investment decisions using Equations 2 and 3. The study used time series procedures to estimate Equations 1, 2, and 3. These included the unit root test, lag selection, the Lagrange-multiplier test, and the Jarque Bera normality test. We entered the collected data into an e-view (9 x 64) to conduct preliminary tests and estimate Equations 1, 2, and 3.

3. Results

3.1. Summary Statistics

Table 3 displays the summary statistics of all the study variables, including domestic investment, effective tax rate, inflation, interest rate, and business environment index.

Table 3. Summary Statistics of the Study Variable

	Effective tax rate	Domestic investment	Inflation	Base Rate	Business Environment Index
Mean	34.375	19.096	23.562	34.964	45.342
Maximum	50.000	31.785	80.751	47.750	61.238
Minimum	25.000	-7.219	7.112	22.346	27.759
Std. Dev.	10.042	8.370	13.896	9.182	10.647
Skewness	0.585	-1.087	2.072	0.189	1.425
Kurtosis	1.787	4.106	8.964	1.472	6.836
Jarque-Bera	4.260	8.932	79.112	3.715	11.563
Probability	0.119	0.011	0.000	0.1560	0.000

Source: World Development Index 2021

Table 3 shows that the effective tax rate has a mean value of 34.375, with minimum and maximum figures of 50 and 25, respectively. This shows little resemblance to the effective global tax rate, which had a maximum of 43% and a minimum of 24% between 1980 and 2015 (ActionAid, 2019). The mean, minimum, and maximum values of domestic investment were about 134000000000, 43000000, and 349000000000, respectively. The mean values of inflation, interest rates, and the business environment index over the period were 23.6%, 35%, and 45.342%, respectively.

3.2. Unit Root Test

The study used the augmented Dickey-Fully and Phillip-Perron tests for the unit root of all the study variables, as shown in Table 4.

Table 4. Augmented Dickey-Fully and Phillip-Perron tests for the unit root of all the study variables

Study Variables	Augmented Dickey-Fuller Test				Phillip-Perron Test			
	At level	p-value	At first difference	p-value	At level	p-value	At first difference	p-value
Effective Tax rate	-1.2737	0.663	-5.8927*	0.000**	-1032	0.625	-6.325	0.000**
Domestic investment	-2.170	0.217	-7.6854	0.000**	-2.129	0.219	-6.6726	0.000**
Business Environment Index	-4.946	0.001*	-	-	-4.930	0.001*	-	-
Inflation	-5.500	-0.000**	-	-	-5.641	0.000*	-	-
Base Rate	-1.3475	0.370	-4.1958	0.004*	-1.306	0.348	-4.439	0.001*

Source: World Development Index, 2020; World Bank, 2021; **=statistical significance at 1%;
s*= statistical significance at 5%.

According to the augmented Dickey-Fuller and Philip-Perron tests for unit-root in Table 4, the effective tax rate, domestic investment, and base rate were stationary at the first difference. At this level, however, the business environment index and inflation were stationary. This implies that the vector autoregressive (VAR) model is most suitable for the estimation; hence, the study used VAR for the estimations.

3.3. Lag Selection

The results of this section's consideration of appropriate lags for the model of the impact of tax reform on investment decisions in Ghana are presented in Table 5. The criteria used include Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hanna-Quinn Information Criterion (HQ). This study relied on AIC as one of the criteria.

Table 5. Maximum Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-62.98066	NA	3.75e-05	3.998862	4.223327	4.075411
1	61.59111	205.1770*	1.09e-07*	-1.858301*	-0.511512*	-1.399007*
2	83.67829	29.88265	1.44e-07	-1.686958	0.782154	-0.844920
* Indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5%level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

From Table 5, all the criteria (LR, FPE, AIC, HQ, and SC) gave a maximum lag length of 1. Therefore, in this study, the appropriate lag for the impact of tax reforms on investment decisions in Ghana is 1.

3.4 Cointegration Test

Tables 6a and 6b display the co-integration test result for the impact of bank deposits on GDP growth.

Table 6. Unrestricted Cointegration Rank Test

Table 6a:Trace Test				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.493856	105.0624	95.75366	0.0098
At most 1	0.421328	68.29194	69.81889	0.0658
At most 2	0.257250	38.75286	47.85613	0.2702
At most 3	0.229767	22.69347	29.79707	0.2614
At most 4	0.146766	8.596134	15.49471	0.4040
At most 5	0.000466	0.025154	3.841466	0.8739
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* Denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Table 6b: Maximum Eigenvalue				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.493856	36.77049	40.07757	0.1126
At most 1	0.421328	29.53909	33.87687	0.1511
At most 2	0.257250	16.05938	27.58434	0.6607
At most 3	0.229767	14.09734	21.13162	0.3571
At most 4	0.146766	8.570981	14.26460	0.3236
At most 5	0.000466	0.025154	3.841466	0.8739
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* Denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Field Data (2021)

Table 6a rejects the null hypothesis. The null hypothesis states that there is no co-integration. This study rejects the null hypothesis because the trace test statistics are higher than the critical values at a 5% significance level. This suggests that Order 1 co-integrates tax reforms and investment decisions. Therefore, we use the Vector Error Correction (VEC) model to estimate both the short-run and long-run relationship between tax reforms and investment decisions in Ghana.

3.5 Long-Run Impact of Tax Reforms on Investment Decisions

Table 7 presents the results of this section of the study, which focused on estimating the impact of tax reforms on investment decisions in Ghana using VECM.

Table 7. VECM MODEL

VARIABLES	Coefficient	Std. Error	t-Statistic	Prob.
ECT	-0.140903	0.01464	-9.624521	0.0000
D(INVDEC)(-1)	0.124253	0.207487	0.598848	0.5543
D(TAXREF)(-1)	-0.120775	0.019044	-6.341892	0.0000
D(INFLATION)(-1)	-0.037268	0.267018	-0.139569	0.8900
D(GROSS CAP.) (-1)	0.175717	0.365243	0.481097	0.6343
D(BASERATE)(-1)	-0.050395	0.012892	-3.909013	0.0080
CONSTANT	0.167160	0.112059	1.491717	0.1474
R-squared	0.595687			
Adjusted R-squared	0.405271			
S.E. of regression	0.565858			
Sum squared resid	8.645271			
Log likelihood	-24.96499			
F-statistic	17.476155			
Prob(F-statistic)	0.000993			

Source: World Development Indicators (1985-2020)

The result in Table 7 shows that there is a long-run relationship between investment decisions and the study variables. This is because the error correction terms (ECT) are negative and significant at a 1% significance level; hence, tax reforms and investment decisions have a long-run relationship.

3.6 Short-Run Impact

The study further tested the short-run impact of tax reforms on investment decisions in Ghana using the Wald Chi-Square test, as shown in Table 8.

Table 8. Wald Test on the Short-Run Impact of Tax Reforms on Investment Decision

Test Statistic	Value	Df	Probability
F-statistic	9.396739	(2, 33)	0.0000
Chi-square	10.793478	2	0.0000

The study further tested the short-run impact of tax reforms on investment decisions in Ghana using the Wald Chi-Square test, as shown in Table 8. Based on data from 1985 to 2020, Table 8 shows that Wald Chi-square has a test score of 9.39539 and a p-value of 0.0000, which means that tax reforms have a significant short-term effect on investment decisions in Ghana. The findings from this study are consistent with some previous studies. For example, Alves (2019) analyzed the percentage of tax revenues in GDP and investment results in a study exploring the effects of tax structures on investment dynamics, using gross fixed capital formation as a proxy for investment. We conducted empirical research for all OECD nations between 1980 and 2015 to analyze the short- and long-term implications of tax system composition. The findings indicate that income taxation has a maximum impact on investment growth when receipts from this tax source are about 10.7%. Similarly, Muhammad *et al.* (2012) found a significant negative relationship between tax reforms, particularly corporate taxes, and investment decisions. Also, Braunerhjelm and Eklund (2014) investigated the administrative costs associated with taxes and their influence on new company creation and discovered that the tax administrative burden significantly reduces the entry rate, thus reducing investment. Vergara (2010) examined the empirical relationship between Chile's tax overhaul and its subsequent investment performance. The author analyzed data from 87 publicly traded firms in the nation from 1975 to 2003 and found that the tax change accounted for a three-point increase in private investment as a proportion of GDP.

3.7. Granger Causality Test

This study conducted the Granger causality test for all study variables. However, the analysis concentrated primarily on tax reforms and investment decision-making, as these were the primary variables of interest. Table 9 presents the results of the study.

Table 9. Granger Causality Test

Null Hypothesis:	Obs.	F-Statistic	Prob.
TAXREF does not Granger Cause INVDEC	35	6.71339	0.000
INVDEC does not Granger Cause TAXREF		2.45110	0.1273
INFLATION does not Granger Cause INVDEC	35	0.13858	0.7122
INVDEC does not Granger Cause INFLATION		7.03615	0.0123
GCFORM does not Granger Cause INVDEC	35	0.26247	0.6119
INVDEC does not Granger Cause GCFORM		3.65450	0.0649
BASERATE does not Granger Cause INVDEC	35	7.51843	0.0099
INVDEC does not Granger Cause BASERATE		0.00813	0.9287
INFLATION does not Granger Cause TAXREF	35	0.62829	0.4338
TAXREF does not Granger Cause INFLATION		8.06339	0.0078
GCFORM does not Granger Cause TAXREF	35	3.39158	0.0748
TAXREF does not Granger Cause GCFORM		4.15540	0.0498
BASERATE does not Granger Cause TAXREF	35	2.14843	0.1525
TAXREF does not Granger Cause BASERATE		0.87248	0.3573
GCFORM does not Granger Cause INFLATION	35	0.06302	0.8034
INFLATION does not Granger Cause GCFORM		1.66359	0.2064
BASERATE does not Granger Cause INFLATION	35	5.46106	0.0259
INFLATION does not Granger Cause BASERATE		0.00377	0.9514
BASERATE does not Granger Cause GCFORM	35	3.85572	0.0583
GCFORM does not Granger Cause BASERATE		0.11207	0.7400

Source: Field Data (2024)

Table 9 indicates that tax reform influences investment decisions, not the other way around. This implies that any change in tax reform, especially those in corporations, has a direct and significant effect on investment decisions. However, changes in investment decisions do have a direct effect on tax reform. Therefore, the relationship between tax reforms and investment decisions is not bidirectional. This section discusses alternate courses of action for dealing with the above-mentioned managerial problems, as well as suggestions for implementation. We identified the issues related to tax reforms, investment choices, and other primary management concerns.

4. Discussion

According to the World Bank's 2020 Doing Business Report, Ghana is ranked 118th out of 190 countries in terms of ease of doing business, with a score of 60.0. Ghana's best rankings are in "protecting minority investors," "getting electricity," and "getting credit"; in these areas, Ghana's position is 72, 79, and 80, respectively (World Bank, 2020). The worst rankings, on the other hand, are in "paying taxes," "trading across borders," and "resolving insolvency," where Ghana's position is 152, 158, and 161, respectively (World Bank, 2020). Globally, the study is essential for positioning the findings within a broader framework of tax reform and investment decision-making in emerging economies. We can better understand the universality or uniqueness of Ghana's experience by comparing the results of this study with similar research in other developing nations, particularly those with comparable economic structures or investment climates. For instance, examining how other African countries or emerging economies in Asia and Latin America have responded to tax reforms could reveal whether Ghana's investment behavior aligns with broader regional or global trends. This comparison can highlight common challenges faced by emerging markets, such as capital flight, investor confidence, or the complexity of implementing tax policies. It provides valuable insights into how global economic forces influence national investment decisions.

Moreover, sitting in the findings in the global context allows for a more robust discussion of the external factors that may have influenced investment decisions, such as global economic conditions, trade relationships, and international capital flows.

The impact of global economic crises shifts in international investment trends, or foreign direct investment patterns could provide critical background for interpreting the study results. By considering these global dynamics, the study can reflect on how international market forces, global tax competition, or cross-border capital mobility might shape domestic investment decisions in Ghana. This global perspective not only strengthens the relevance of the findings but also opens avenues for future research into how international economic interactions affect tax policy outcomes in emerging markets. Furthermore, studies like those by Barro (1990) and Tanzi (2012), which suggest mixed or limited effects of tax reform on investment, can contrast with the findings of this study. Barro (1990) argued that tax reforms may not always lead to an immediate increase in investment, especially in countries with weak institutional frameworks or high political instability. Tanzi (2012) observed that factors such as poor enforcement of tax laws or a lack of investor trust in the economy can muzzle the impact of tax policy on investment in developing countries. Our study indicates a significant positive impact of tax reforms in Ghana, but it's crucial to acknowledge the potential influence of Ghana's enhanced institutional framework and recent macroeconomic stability advancements, factors that Barro (1990) and Tanzi (2012) may have overlooked. Thus, the study extends the existing body of research by providing empirical evidence from Ghana, where tax reforms have been relatively successful in stimulating investment, particularly when paired with improvements in governance and economic stability.

Conclusion

The final chapter summarizes the study's goal and objectives, as well as the primary findings and conclusions. It also discusses the implications of tax reforms' impact on investment decisions and presents research recommendations. This study focused on the effects of tax reforms on investment decisions in Ghana. The study employed time-series data from 1985 to 2020. Tax reform was a proxy for corporate income tax, while investment decisions were a proxy for aggregate investment. The study employed control variables such as inflation, gross capital formation, and the base rate. We gathered the data from reputable sources such as the World Development Indicator and the Bank of Ghana website, and we thoroughly cleaned them before estimating the model. The study had objectives, namely, to perform trend analysis on tax reforms and investment decisions and to estimate both the long-run and short-run impacts of tax reforms on investment decisions. The study employed a line graph for the trend analysis. To estimate the model, the study conducted unit root tests and cointegration tests, which revealed a con integration of order in the variables. Therefore, VECM was used. The study also performed the Granger Causality Test. The study found that tax reforms and investment decisions exhibited opposite behavior, particularly between 2005 and 2010, but maintained some form of relationship throughout consideration. The VECM showed that tax reforms and investment decisions had a significant long-run relationship. According to the Wald Test, tax reforms had a significant short-run impact on investment decisions. The Granger causality test showed that tax reforms caused investment decisions, but investment decisions did not cause tax reforms.

Implications of the Findings

This thesis has three types of implications: theoretical, managerial, and implications for further research. In emerging countries, concerns about domestic taxation have made tax administration reform a prominent problem. Addressing tax issues, on the other hand, is a complex process that entails overhauling the tax administration system to broaden the revenue base, as well as establishing administrative institutions with adequate autonomy and a professional attitude to manage the tax system. Ghana's tax administrative system aims to help them broaden the tax net, create better tax policies, improve the effectiveness and efficiency of tax collection, and root out corruption among tax officers. The study investigated the long-run and short-run impact of tax reforms on investment decisions in Ghana using VECM and Granger causality models. Based on the models, this study concludes that tax reforms, measured as corporate income tax, have a significant long-run and short-run impact on investment decisions in Ghana. Moreover, tax reforms stimulate investment, but investment decisions do not trigger tax reforms. These findings are consistent with prior criteria and theories, as lower corporate tax serves as an incentive for both local and foreign direct investment.

Policy Recommendations

This study recommends intensifying and sustaining tax reforms based on its estimated results and findings. We must investigate two significant areas: the variety of taxes and the high cost of living. We should carefully target

the corporate income tax and tax reform toward stimulating Ghanaian investment. To begin, the research indicates that the volume of credit sought by the private sector is independent of the present interest rate. This could result from nonmarket pricing strategies, such as credit rationing, which discriminates against specific groups of people based on allowed traits, allowing banks to sidestep the issue of adverse selection. Therefore, policymakers should enact laws that promote competitive pricing mechanisms, allowing market forces to determine loan demand and supply. This can reduce credit rationing while also increasing competition for loanable funds. Second, the availability of financing affects long-term decisions in the private sector. As a result, central banks should lower interest rates to boost private-sector investment through increased borrowing. This would provide commercial banks with sufficient loanable funds. The central government should routinely implement legislation requiring banking institutions to meet certain basic standards, improving banks' ability to make loanable funds available. The stringent minimum requirement, on the other hand, has the potential to disturb market efficiency. We limited this assessment of financial sector reforms to one country (Ghana) and concentrated on loan demand.

Recommendations for Additional Research

The study recommends conducting more research in different countries to examine the impact of financial liberalisation on private investment, credit mobilisation, and interest rates in deregulated financial markets where some degree of government control and credit restriction remains. Furthermore, we should conduct extensive research to analyze the relationship between the riskiness of investment projects and the degree of inflation. We greatly appreciate more studies that aim to quantify the impact of the accounting information system on investment responses to tax policy.

Limitations

During the study, the researcher experienced several constraints, including time constraints. This prevented the researcher from broadening his population base and conducting specific inquiries into regions that could have been relevant to the study. Due to a lack of sufficient records, it was initially impossible to gain access to certain crucial information on primary data. Finally, because target respondents may be unwilling to provide meaningful and timely feedback on surveys, the study must rely on secondary data sources.

Institutional Review Board Statement

Ethical review and approval were waived for this study due to its less sensitivity.

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Credit Authorship Contribution Statement

Michael Yeboah: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Benjamin Adjei Danquah: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Jonas Bawuah: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Funding acquisition.
Agyeiwaa Owusu Nkwatabisa: Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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The Role of Financial Technologies in Ensuring the Sustainable Development of Agricultural Businesses

Nataliia MASLAK
Department of Finance, Banking and Insurance
Sumy National Agrarian University, Ukraine
ORCID: 0000-0003-1482-4118
N_maslak5@gmail.com

Rasim Cavan ABBASOV
School of Economics and Business, Tourism and Economic Sectors
Western Caspian University, Azerbaijan
Rasimabbasov19@mail.ru

Hanna BRATUS
Department of Finance, Banking and Insurance
Interregional Academy of Personnel Management, Ukraine
mari.anna.nerozna@gmail.com

Mykhailo PYRTKO
Lviv Polytechnic National University, Ukraine
ORCID: 0009-0001-8827-5601
PyrtkoMykhailo11@gmail.com

Olena SYMONENKO
Department of Statistics and Economic Analysis, Faculty of Economics
National University of Life and Environments Sciences of Ukraine, Ukraine
ORCID: 0000-0002-2459-4187
Osymon13@gmail.com

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Abstract: The role of financial technologies (FinTech) in ensuring the sustainable development of agricultural businesses is gradually becoming relevant for the agricultural sector, especially in view of the problems and obstacles facing small and medium-sized agricultural companies. The aim of the study is to assess the impact of the use of FinTech on the sustainable development of the agricultural sector.

A structured online questionnaire with ten questions was developed to collect data covering the level of implementation, usage frequency, and the impact of FinTech on the sustainable development of agricultural businesses. Quantitative correlation analysis was used to assess the statistical relationship between the FinTech usage rate and sustainable development indicators. The analysis of variance (ANOVA) determined the strength and direction of the impact of FinTech on the economic, social, and environmental aspects of sustainable development.

The study showed that the active use of financial technologies among agricultural companies remains limited. Mobile payments, online banking, and automation of financial processes are the most common financial instruments. It was found that insufficient awareness of companies, financial barriers, and technical difficulties hinder the active implementation of financial technologies.

For the first time, an assessment of the level of implementation of FinTech in the agricultural sector of Poltava region was carried out and the main tools used by agricultural companies were identified. Further research may focus on studying the impact of individual FinTech innovations on the productivity of agricultural businesses.

Keywords: financial technologies; financial instruments; agricultural; sustainable development; online banking.

JEL Classification: Q01; Q14; Q16; C12; E44.

Introduction

Agriculture is the backbone of the global economy, supporting millions of lives and playing a key role in ensuring food security and economic development, especially in developing countries (Fan and Rue 2020). Smallholder farmers, who account for about 84% of all farms in the world (Ricciardi *et al.* 2021), play a crucial role in meeting the growing demand for food, thereby significantly contributing to the achievement of the Sustainable Development Goals (SDGs). However, their ability to invest is severely limited by a lack of financial capacity, which hampers agricultural development. The defining condition for modern management is the realization that the production potential of agricultural enterprises should be used rationally, considering the limited number of available resources (Vinichenko *et al.* 2023)

So, in this context, FinTech is changing agriculture in many ways, going beyond Ensuring financing for essential investment in irrigation, mechanization, and land expansion is crucial to fostering the development of the agricultural sector (Chavas and Nauges 2020).

So in this context, FinTech is changing agriculture in many ways, going beyond financial services. Global access to mobile phones is fundamentally changing the way farmers access price information, find buyers, and build brands as they try to move up the value-added chain. New technologies in risk management, such as index insurance, are often marketable. Therefore, some of the enthusiasm for new fintech solutions for agriculture, such as blockchain, remains unproven (Green 2023).

The Fourth Industrial Revolution, together with technological advances, is transforming the global economy (Sharma *et al.* 2024a; Nikonenko *et al.* 2022), emphasizing the importance of social entrepreneurship, supported by digital technologies (Guo, Yan & Zhuan 2025). Agricultural technologies are considered essential to ensure sustainable development and meet consumer needs for safe and quality food (FAO, WHO, WFP, UNICEF, IFAD, 2020).

The development of financial technologies (FinTech) in Ukraine has enormous potential for the agricultural sector, especially given the positive trends in investment in this industry. According to the Vestbee report (2024), financial technologies have become an important investment direction in Central and Eastern Europe, accounting for 20% of the 50 largest financing rounds. This indicates that investors consider financial innovations promising, which also applies to the Ukrainian market, where 256 FinTech companies currently operate, 47% of which operate internationally (UAFIC 2024).

So, FinTech not only facilitate financial processes, but also open up new opportunities for innovation, business model transformation, and greater integration into the market economy (Wang 2025).

The aim of this study is to assess the impact of FinTech in ensuring the sustainable development of agricultural businesses using the example of the Poltava region of Ukraine. The aim involved the fulfilment of the following research objectives:

1. Analyse data from agricultural companies in the Poltava region of Ukraine regarding the use of FinTech in their practical activities;

2. Identify the main barriers to the implementation of FinTech in the activities of agricultural companies in the Poltava region:

3. Determine the impact of the use of FinTech on the sustainable development of companies.

The scientific novelty of the study lies in identifying and quantifying the relationship between the level of use of financial technologies and indicators of sustainable development of agricultural enterprises. Unlike the vast majority of previous works that focus on individual aspects of the impact of FinTech or are exclusively qualitative in nature, this study uses a combination of correlation analysis and ANOVA to comprehensively measure the economic, social and environmental effect. The proposed approach can be adapted for further comparative studies in different sectors of the economy, which increases its theoretical value.

1. Literature Review

FinTech play an important role in ensuring the sustainable development of agricultural companies, which is confirmed by the analysis of recent studies. The researchers Rayhan *et al.* (2024) emphasized the importance of implementing FinTech solutions among smallholder farmers, because FinTech, according to the authors, reduce transaction costs and increase the transparency of financial processes, which contributes to the overall efficiency of agricultural value chains. The authors found that Agri-FinTech solutions is an important way to improve living standards and promote the sustainability of agriculture in developing countries. The authors state that the integration of FinTech solutions for agricultural credit mechanisms and product market promotion accelerates opportunities for pre-production financing and ensures fair prices for smallholder farmers at the post-production stage, while neutralizing the potential for exploitation in the value chain.

A similar conclusion was made by other researchers Gonzalez-Ruiz *et al.* (2024), who studied social financial instruments and their impact on farmers' economic opportunities, which emphasized the importance of social responsibility and support for sustainable development in this area.

Further analysis showed that digital finance also facilitated the adoption of green technologies. The authors Liu *et al.* (2024) demonstrated that the use of digital financial services helped farmers to adopt environmentally friendly practices, which positively impacted the sustainability of the agricultural sector and contributed to green development. Besides, Tikku and Singh (2023) focused on the role of mobile banking in the financial inclusion of agricultural traders in India. Their study demonstrated that the availability of mobile financial services increased financial inclusion, allowing farmers to more easily engage in financial markets and expand their economic opportunities. Su *et al.* (2021) supported this thesis by examining how the adoption of e-commerce facilitated farmers' participation in digital financial markets, thereby facilitating market access and improving sales efficiency. Reznik *et al.* (2025) analysed innovative approaches to managing foreign economic activities of agro-food enterprises, focusing on digital transformation tools that indirectly include financial technologies. The authors emphasized the role of ERP systems, digital platforms for international trade, and data-driven risk analysis in optimizing financial and operational decisions.

On the other hand, Putra *et al.* (2023) showed that the successful use of agricultural applications developed based on the UTAUT2 method depended on positive user experience and community behaviour. Such digital tools contributed to the improvement of farmers' activities, ensuring the sustainable development of agricultural companies. The authors found that experience with agricultural applications helps to modulate the behavioural intention variable, which affects the usage intention variable, and also contributes to building confidence in using opportunities for agribusiness development.

The study of Hrosul *et al.* (2023) focuses on the impact of digital solutions on the efficiency of agricultural companies in Ukraine. The authors found a direct relationship between activity in the information and communication technologies segment and investment in software. However, it is worth noting that the results of their study do not take into account possible negative aspects of the implementation of digital technologies, such as cybersecurity risks or the need for specialized knowledge that may limit farmers' access to new technologies.

The study by Sharma *et al.* (2024b) presents a systematic review of the impact of financial technology on the agricultural economy in India, focusing on Fin-Tech products and services such as mobile banking and digital insurance. While the authors highlight the potential of these technologies to transform financing in agriculture, it is important to note that their analysis may be limited by the specifics of the Indian context, which does not fully reflect the situation in other countries, in particular in Ukraine.

Finally, the study by Saruchera and Mpunzi (2023) focuses on the impact of digital capital on the efficiency of small and medium-sized agricultural companies, as well as its role in reducing social and economic inequalities. However, the authors did not examine in detail the barriers to access to digital tools, which may reduce the overall effectiveness of their implementation.

So, despite the large number of studies on FinTech in the agricultural sector, their impact on sustainable development in the current conditions of digital transformation requires additional studies.

2. Methodology

2.1. Research Design

The first stage of the research involved determining the main objectives, developing the research design, and preparing data collection tools. It was decided to use a quantitative correlation approach to analyse the relationship between the FinTech usage rate and indicators of sustainable development of small businesses. The questionnaire structure was also developed at this stage. At the second stage, the data were collected through a questionnaire. Each enterprise filled out an online questionnaire, which assessed the rate of use of FinTech solutions and sustainable development indicators (economic, social, and environmental aspects). The final stage included the analysis of the collected data.

2.2. Research Methods

Survey. A structured online questionnaire was developed, including ten questions to determine the impact of FinTech on the sustainable development of companies. The first question asked respondents to assess the level of implementation of fintech technologies in their companies on a scale from 1 to 5, which made it possible to determine the overall level of use of technologies such as mobile payments, blockchain, e-wallets, etc. The following questions examined the frequency of use of FinTech solutions, the types of technologies used, as well as their impact on the efficiency and sustainable development of companies. Questions about the level of

knowledge of employees about FinTech and the possibility of their training were aimed at identifying the companies' readiness to adapt to new technological challenges. The questionnaire also examined the factors that influenced the implementation of FinTech and the problems that companies faced during this process. The last question about the prospects of FinTech provided an opportunity to assess the respondents' expectations regarding the development of FinTech in their companies in the future.

Quantitative correlation analysis was used to determine the statistical relationship between the level of use of FinTech and sustainable development indicators.

ANOVA was used to assess the strength and direction of the relationship between the independent variable (use of FinTech solutions) and the dependent variables (economic, social, and environmentally sustainable development indicators).

2.3. Sample

A sample of 30 small businesses from the Poltava region of Ukraine was selected for the study. The selection of thirty small agricultural companies from the Poltava region of Ukraine is determined the fact that the Poltava region is one of the main granaries of the country, occupying leading positions in the production of grain, sugar beet, soybeans, as well as livestock products, in particular milk and meat. This makes this region important for studying the implementation of FinTech in the context of agricultural production. The selection criteria included: the company scale (small companies), the field of activity (agricultural sector), as well as geographical location (Poltava region). The total number of small agricultural companies in this region is more than 200. Thirty enterprises were selected, in particular, because a significant part of small business representatives refused to participate in the study for various reasons, in particular because of time constraints or insufficient understanding of issues related to FinTech. Despite these refusals, it was possible to form a sample that provides the necessary representativeness for the analysis.

2.4. Instruments

Five-point Likert scale was used to assess the respondents' attitude to various aspects of FinTech (Winter and Dodou 2010). Each respondent had to assess the FinTech usage rate and the corresponding indicators of sustainable development of the company on a scale from 1 to 5 (1 - "strongly disagree", 5 - "strongly agree"). The survey was conducted anonymously, and respondents could fill out the questionnaire independently at a convenient time. Calculations were performed in Microsoft Excel, which ensured the accuracy and clarity of the results (Table 1).

Table 1. Relationship between the FinTech Usage and Sustainable Development Indicators of Small Businesses in the Agricultural Sector

Company	FinTech Usage (X)	Sustainability Indicators (Y)	Product (XY)	FinTech Squared (X^2)	Sustainability Squared (Y^2)
1	X_1	Y_1	XY_1	X^2_1	Y^2_1
2	X_2	Y_2	XY_2	X^2_2	Y^2_2
3	X_3	Y_3	XY_3	X^2_3	Y^2_3
...	...	...	...	...	...
30	X_{30}	Y_{30}	XY_{30}	X^2_{30}	Y^2_{30}
Total	ΣX_n	ΣY_n	$\Sigma X_n Y_n$	ΣX_n^2	ΣY_n^2

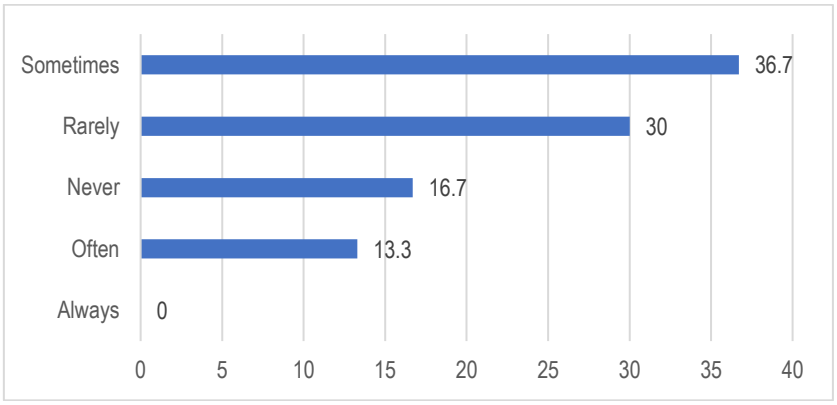
Source: developed by the author

The obtained results give grounds to draw conclusions about the relationship between the FinTech usage and sustainable development indicators of small businesses in the agricultural sector of the Poltava region.

3. Results

Agriculture is the basis of the agro-industrial complex of the Poltava region, which is distinguished by a high level of production of grain and industrial crops, as well as livestock products. The agro-industrial complex of the Poltava region is increasingly using FinTech, as this is determined by the need to adapt to the growing level of market digitalization and increase its competitiveness. Figure 1 graphically depicts the fintech use frequency by agricultural companies of the Poltava region.

Figure 1. FinTech Use Frequency by Agricultural Companies in the Poltava Region, %



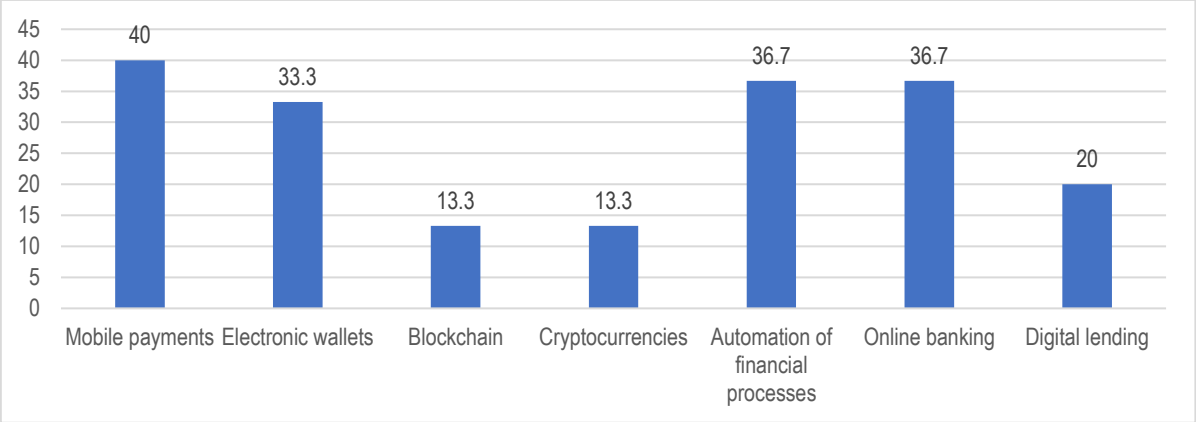
Source: developed on the basis of Appendix 1

The analysis of the FinTech use among agricultural companies in the Poltava region showed that a significant part of companies uses FinTech irregularly: the majority (66.7%), and only 13.3% of companies use FinTech in their activities often, and no company uses them on a permanent basis. This indicates that FinTech have not yet become an integral part of the activities of the agricultural sector in the region. However, the favourable conditions of the Poltava region for agricultural business and the growing demand for digital solutions indicate the potential for expanding the use of FinTech, which can contribute to more effective management and increased productivity of companies.

An analysis of the FinTech use among agricultural companies in the Poltava region revealed that the most common tools are mobile payments (40%), online banking (36.7%), and automation of financial processes (36.7%). Online banking, which some companies have chosen, also plays an important role, providing access to banking services without the need for a physical presence in the bank (Figure 2).

Digital lending used by 20% of companies has great potential for further development, as it can significantly facilitate access to financing for small and medium-sized agricultural companies, which often face difficulties in attracting traditional loans. Although blockchain and cryptocurrencies occupy a smaller share (13.3% each), their use still indicates a strive for more secure and decentralized financial transactions and may indicate attempts by some companies to ensure data security and explore the possibilities of new technologies.

Figure 2. Distribution of the Most Common FinTech Tools Used by Agricultural Companies in the Poltava Region, %



Source: developed on the basis of Appendix 1, Appendix 2

Therefore, it can be argued that agricultural enterprises in Poltava region are at the initial stage of implementing financial technologies, but their gradual use can positively affect the development of the industry.

Analysis of the impact of financial technologies on the efficiency of agricultural enterprises in Poltava region showed that 30% of enterprises noted a low impact of fintech on their business processes, which indicates their insufficient use. At the same time, 43.3% of enterprises indicated an average impact, which demonstrated partial integration of financial technologies, but without achieving optimal results. Only 26.7% of enterprises noted a high impact of fintech, emphasizing that, although the majority of agricultural enterprises recognize a certain level of positive impact of financial technologies on their efficiency, only a small part of them maximally realizes their potential in their activities.

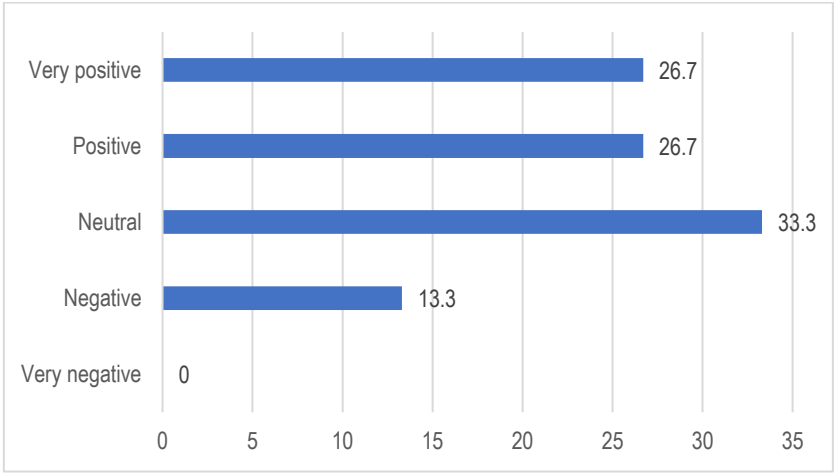
Therefore, it can be argued that agricultural companies in the Poltava region are at the initial stage of implementing FinTech, but their gradual use can positively affect the development of the industry.

Analysis of the impact of FinTech on the efficiency of agricultural businesses in the Poltava region showed that 30% of companies noted a low impact of fintech on their business processes, which indicates their insufficient use. At the same time, 43.3% of companies indicated an average impact, which demonstrated partial integration of FinTech, but without achieving optimal results. Only 26.7% of companies noted a high impact of FinTech, emphasizing that, although the majority of agricultural companies recognize a certain level of positive impact of FinTech on their efficiency, only a small part of them maximally realizes their potential in their activities.

Agricultural companies in the Poltava region are implementing FinTech for various reasons, the most significant of which are market needs, high competition, and technological progress. A significant number of companies focused on market needs, which indicates the importance of adapting business processes to market requirements. Companies that implement FinTech in response to market needs have the opportunity to increase their competitiveness by reducing their costs. It should also be noted that support from management is a key factor in the implementation of FinTech, as the management initiatives stimulate the implementation of new technologies and provide resources for their implementation. Technological progress also plays an extremely important role in this process, as companies that are aware of the advantages of advanced technologies are ready to implement them to improve their activities.

The analysis of the impact of FinTech on the sustainable development of agricultural companies revealed a variety of assessments, which indicates a different level of awareness of these innovations in the industry. Most companies believe that FinTech either do not affect their sustainable development or have a positive effect. This indicates that agricultural producers are beginning to realize the potential of FinTech as a tool that can contribute to their sustainable development (Figure 3).

Figure 3. The Impact of Using FinTech on the Company's Sustainable Development



Source: developed on the basis of Appendix 1, Appendix 2

This statement is confirmed by a quantitative correlation approach, which was used to study the relationship between the FinTech usage rate and sustainable development indicators of small businesses (Table 2, Table 3).

Table 2. Results of the Analysis of the Relationship between the FinTech Usage Rate and Sustainable Development Indicators for Agribusinesses of the Poltava Region

Company	FinTech Usage (X)	Sustainability Indicators (Y)	Product (XY)	FinTech Squared (X^2)	Sustainability Squared (Y^2)
1	4	4	16	16	16
2	3	3	9	9	9
3	5	5	25	25	25
...	...	...	...	...	...
30	3	3	9	9	9
Total	104	103	385	388	383

Table 3. Results of ANOVA Correlation Analysis

Regression statistics					
Multiple R	0.983540977				
R-squared	0.967352854				
Normalized R-squared	0.966186884				
Standard error	0.18504226				
Number of observations	30				
ANOVA					
	Df	SS	MS	F	Significance of F
Regression	1	28.4079288	28.4079288	829.6553586	2.37158E-22
Residual	28	0.958737864	0.034240638		
Total	29	29.36666667			
	Coefficients	Standard error	t-statistics	P-value	
Y-intersection	-0.09223301	0.12697645	-0.726378865	0.473635536	
Coefficient for X 1	1.016990291	0.035307579	28.80373862	2.37158E-22	

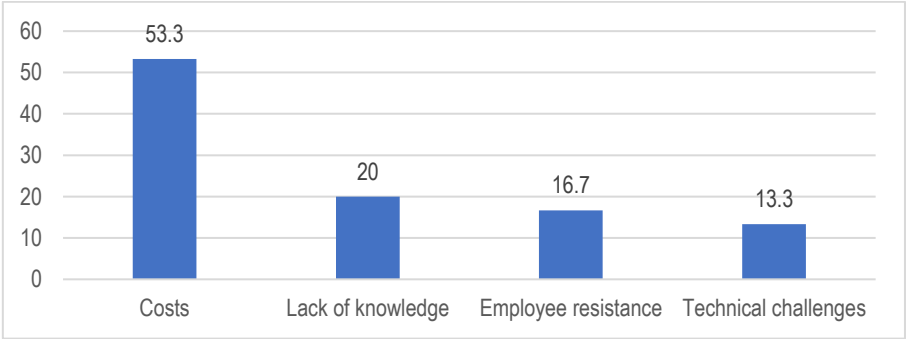
The results of the regression analysis confirm that financial technologies have a positive impact on the sustainable development of agricultural companies: the multiple correlation coefficient (0.9835) indicates a strong relationship between the use of FinTech and sustainability indicators. The R-squared value (96.74%) indicates that almost all the variation in sustainability indicators can be explained by changes in the FinTech implementation. The high F value (829.6554) and very low probability of chance confirm the significance of the model. The coefficient of 1.0170 indicates an increase in sustainability indicators with increasing use of FinTech, emphasizing the importance of these technologies for achieving SDGs in the agricultural sector.

Analysis of the results of a survey of agricultural companies in the Poltava region on the FinTech implementation revealed important aspects related to the level of knowledge, training, and existing problems. The average level of companies' knowledge about FinTech is estimated at 68.3%, which indicates moderate awareness. At the same time, 16.7% of respondents assessed their knowledge at the maximum level, and 33.3% of companies have a medium level of knowledge, which emphasizes the need for advanced training in this area.

The majority of businesses confirmed that they had received training in FinTech or were familiar with its basics. This positively affects their readiness to implement new technologies, as the average level of knowledge of those who had received training was 72%, which is higher than the 62.1% of those who had not received training. This emphasizes the importance of educational initiatives in creating awareness of the opportunities of FinTech.

The survey also identified a number of challenges that businesses face when implementing FinTech (Figure 4). A total of 53.3% of respondents indicated costs, noting that financial barriers are significant. Lack of knowledge was indicated by 20%, employee resistance - by 16.7%, and technical challenges - by 13.3%.

Figure 4. Distribution of Problems Faced by Companies when Implementing FinTech



Source: developed on the basis of Appendix 1, Appendix 2

The obtained results indicate the need for the development of training programmes, change management, and improvement of technical aspects for the successful FinTech implementation in the agricultural sector. Therefore, the problems identified during the survey of agricultural companies in the Poltava region directly affect their sustainable development. The costs mentioned by the respondents can significantly limit the financial resources needed for investment in modernization and implementation of new technologies. Under fierce competition, agricultural companies must ensure a high quality of their products, and financial barriers can prevent the implementation of these important investments.

The inability to adapt to new market conditions threatens to reduce the companies' competitiveness. This can lead not only to the loss of market positions, but also to general economic instability. In view of such challenges, it is important that agricultural companies have the opportunity to effectively invest in innovations and technologies, which will ensure their long-term survival and development.

Employee resistance and technical issues also seriously impact opportunities for sustainable development. Resistance to change, whether due to fear of new technologies or lack of motivation, can lead to a decrease in the effectiveness of implementing FinTech innovations. At the same time, technical issues, such as the need to update systems, can cause delays in implementing new solutions. As a result, companies may lose opportunities to optimize processes, increase productivity, and reduce costs, which directly affects their ability to develop sustainably in a competitive agricultural environment.

The prospects of FinTech for agricultural companies in the Poltava region open up new horizons that can significantly change the nature of agribusiness. The assessments give grounds to argue that companies are beginning to realize not only the economic, but also the social potential of FinTech. For example, thanks to the introduction of mobile payments and online banking, agricultural producers are able to establish closer contact with customers, directly interacting with them through new digital platforms.

4. Discussion

The results of this study showed that the use of financial technologies significantly contributes to the increase in the efficiency of small agricultural enterprises, supporting their sustainability and innovative development. This finding is consistent with the work of other authors Sari and Padmantyo (2024), who pointed out the positive impact of financial technologies on agricultural businesses in the Mojolaban region. They emphasized that FinTech extend access to finance, which contributes to increased productivity. The study by Zhao et. al. (2022) also confirmed the findings of our study. In their work, they noted that the use of digital finance has a positive impact on the adoption of sustainable agricultural practices among smallholder farmers in China. Their data reinforced the thesis of the importance of implementing financial innovations to increase the sustainability of agricultural businesses, which is also reflected in our study. However, the results of Maryam and Ahamad (2021), who studied the use of FinTech through Islamic financial institutions, indicated some limitations in access to financial services for farmers. This is not entirely consistent with the findings of our study, as this work focuses on the general availability of financial instruments for agricultural companies.

An interesting comparison can be made with the work of Buzaubayeva *et al.* (2023), who drew attention to the specific challenges of digital development in the agricultural sector of Kazakhstan. The authors identified insufficient infrastructure and the need for training as problems that hinder the further development of FinTech use by agricultural companies, which has something in common with the findings of our study.

In their study, More and Aslekar (2022) dealt with the role of ICT and FinTech in the Indian agricultural sector. Their findings demonstrated that the integration of digital tools in agriculture allows for a significant increase in the efficiency of resource management and financial flows. This coincides with the results of our study, as this work also found that FinTech play an important role in improving access to capital and reducing transaction costs.

The study by other authors Hinson *et al.* (2019) emphasized the transformative role of FinTech in supporting sustainable agribusiness development in developing countries. Their findings are reflected in our study — digital financial instruments contribute not only to economic development, but also to social and environmental benefits.

The works of Mapanje *et al.* (2023) and Benami and Carter (2021) indicate the need to expand access to financial services through innovative platforms. This coincides with the conclusion of our study on the potential of digital lending, which was found to be used by only 20% of surveyed companies.

Convenience and simplicity were also mentioned by Savitha *et al.* (2022), and Goh (2022), which correlates with the results of our study, where mobile payments and online banking are the most popular tools among agricultural enterprises in the Poltava region.

Conclusions

The financial sector plays a crucial role in enabling agriculture to contribute to economic growth and poverty reduction. The use of innovative financial instruments contributes not only to increasing the efficiency of resource management, but enhances financial inclusion, which is a key factor in strengthening the economic sustainability of the agricultural sector. FinTech solutions make it possible to overcome traditional barriers to access to finance, in particular by optimizing lending and risk sharing through the use of modern technologies, such as blockchain, digital lending, mobile platforms, etc. The introduction of financial innovations is becoming an integral element of adaptation strategies for agricultural companies in the context of growing challenges related to climate change and the need to adhere to the sustainable development principles.

The study showed that the FinTech implementation has a significant positive impact on the sustainable development of agricultural companies, increasing their efficiency and productivity. However, the active use of FinTech is constrained by the low level of awareness among companies, as well as financial and technical barriers that complicate the process of adaptation to new solutions. This emphasizes the need to overcome existing obstacles in order to fully realize the FinTech potential in the agricultural sector.

Credit Authorship Contribution Statement

The authors equally contributed to the present research, at all stages from the formulation of the problem to the final findings and solutions.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Appendix 1

Questionnaire on the implementation of financial technologies and sustainable development

1. The financial technologies (FinTech) usage rate. How do you rate the level of FinTech implementation in your company on a scale from 1 to 5, where 1 means "very low level" and 5 means "very high level"?(FinTech may include mobile payments, e-wallets, blockchain, cryptocurrencies, accounting automation, online banking, digital lending, and others).

2. FinTech use frequency. How often does your company use FinTech solutions??

(1) Never
(2) Rarely
(3) Sometimes
(4) Often
(5) Always

3. FinTech types. Which of the following FinTech does your company use? **(Select all that apply)**

Mobile payments
E-wallets
Blockchain
Cryptocurrencies
Accounting automation
Online banking
Digital lending
Other (specify): _____

4. The impact of FinTech on efficiency. What impact do you think FinTech has had on your company's performance?

(1) Negative
(2) Neutral
(3) Positive

5. Sustainable development. How do you assess the impact of implementing FinTech on the sustainability of your company?

(1) Very negative
(2) Negative
(3) Neutral
(4) Positive
(5) Very positive

6. Knowledge about FinTech. What is your assessment of the level of knowledge about FinTech in your team?

(1) Very low level
(2) Low level
(3) Medium level
(4) High level
(5) Very high level

7. Training and development. Have your company's employees been trained in the use of FinTech?

Yes
No

8. FinTech implementation factors. What factors influenced the FinTech implementation in your company? **(Select all that apply)**

Market needs
Competition
Technological progress
Management support
Other (specify)_____

9. FinTech implementation challenges. What challenges have you faced while implementing financial technologies? **(Select all that apply)**

Lack of knowledge
Costs
Employee resistance
Technical problems
Other (specify): _____

10. FinTech. How do you assess the future use of financial technologies in your company?

(1) Very pessimistic
(2) Pessimistic
(3) Neutral
(4) Optimistic
(5) Very optimistic

Appendix 2

Company	FinTech usage rate (1-5)	FinTech use frequency (1-5)	FinTech types (mobile payments, e-wallets, blockchain, cryptocurrencies, automation, online banking, digital lending)	Impact of FinTech on efficiency (1-3)	Impact of FinTech on sustainable development (1-5)	Level of knowledge about FinTech (1-5)	Learning on FinTech (Yes/No)	FinTech implementation factors	FinTech implementation challenges	FinTech prospects (1-5)	Additional comments
Company1	4	4	Mobile Payments, Online Banking	2	4	3	Yes	Market needs, competition	Costs	4	More training recommended
Company2	3	3	E-Wallets, Automation	3	3	4	Yes	Technological progress	Lack of knowledge	3	Technical support needed
Company3	5	5	Blockchain, Cryptocurrencies, Mobile Payments	1	5	5	No	Management support	Employee resistance	5	High future potential
Company4	2	2	Digital Lending, Online Banking	3	2	2	Yes	Competition	Technical problems	2	Infrastructure improvements needed
Company5	4	4	E-Wallets, Mobile Payments	2	4	4	Yes	Market needs	Costs	4	Investment needed
Company6	3	2	Automation, Online Banking	3	3	3	No	Technological progress	Lack of knowledge	3	Development strategy needed
Company7	4	4	Mobile Payments, Blockchain	1	5	5	Yes	Management support	Costs	5	High competition
Company8	3	3	Digital Lending, Automation	2	3	4	Yes	Market needs	Employee resistance	4	More time needed
Company9	5	5	Cryptocurrencies, Mobile Payments	1	5	5	Yes	Competition	Technical problems	5	High implementation costs
Company10	3	3	E-Wallets, Online Banking	2	3	3	No	Technological progress	Costs	3	Service improvements needed
Company11	2	2	Automation	3	2	2	Yes	Market needs	Employee resistance	2	Financial support needed
Company12	4	4	Blockchain, Digital Lending	2	4	4	Yes	Management support	Technical problems	4	More research needed
Company13	3	3	Mobile Payments, Cryptocurrencies	3	3	3	No	Competition	Costs	3	Government support needed
Company14	5	5	Electronic wallets, Automation	1	5	5	Yes	Technological progress	Employee resistance	5	Great potential
Company15	3	3	Online banking, Digital lending	2	3	3	No	Market needs	Costs	3	Training improvements needed
Company16	4	4	Blockchain, Mobile payments	2	4	4	Yes	Competition	Technical problems	4	Cost reduction needed
Company17	2	2	Automation	3	2	2	Yes	Management support	Employee resistance	2	More resources needed
Company18	4	4	Cryptocurrencies, Online Banking	1	5	5	Yes	Market needs	Costs	5	High demand for services
Company19	3	3	Mobile Payments, E-Wallets	2	3	3	No	Competition	Technical problems	3	Expanding capabilities needed
Company20	5	5	Automation, Blockchain	1	5	5	Yes	Technological progress	Costs	5	Developing new solutions needed
Company21	3	3	Digital Lending,	3	3	3	No	Management	Costs	3	Costs

Company	FinTech usage rate (1-5)	FinTech use frequency (1-5)	FinTech types (mobile payments, e-wallets, blockchain, cryptocurrencies, automation, online banking, digital lending)	Impact of FinTech on efficiency (1-3)	Impact of FinTech on sustainable development (1-5)	Level of knowledge about FinTech (1-5)	Learning on FinTech (Yes/No)	FinTech implementation factors	FinTech implementation challenges	FinTech prospects (1-5)	Additional comments
			Mobile Payments					support			optimization needed
Company22	2	2	E-Wallets	3	2	2	Yes	Market needs	Employee resistance	2	Investment attraction needed
Company23	4	4	Cryptocurrencies, Blockchain	1	5	5	Yes	Competition	Technical problems	5	High competition
Company24	3	3	Automation, Online Banking	2	3	3	No	Technological progress	Costs	3	Accessibility improvements needed
Company25	4	4	E-Wallets, Mobile Payments	2	4	4	Yes	Market needs	Employee resistance	4	High potential
Company26	2	2	Digital Lending	3	2	2	Yes	Management support	Costs	2	More investment needed
Company27	5	5	Blockchain, Online Banking	1	5	5	Yes	Technological progress	Technical problems	5	More research recommended
Company28	3	3	Mobile Payments, Automation	3	3	3	No	Competition	Costs	3	Technical capabilities need to be improved
Company29	4	4	Cryptocurrencies, Electronic Wallets	2	4	4	Yes	Market needs	Costs	4	The system needs to be improved
Company30	3	3	Online Banking, Automation	3	3	3	No	Technological progress	Costs	3	New technologies need to be adapted

So, the formula for the Pearson correlation coefficient is presented below:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

where:

- rrr — Pearson correlation coefficient,
- nnn — number of pairs of observations,
- xxx — value of the first variable (*e.g.*, FinTech usage),
- yyy — value of the second variable (*e.g.*, sustainability indicators),
- Σxy\Sigma xyΣxy — sum of products of pairs of observations,
- Σx\Sigma xΣx — sum of values of the first variable,
- Σy\Sigma yΣy — sum of values of the second variable,
- Σx2\Sigma x^2Σx2 — sum of squares of values of the first variable,
- Σy2\Sigma y^2Σy2 — sum of squares of values of the second variable.

This formula determines the degree of linear relationship between two variables. The value of rrr ranges from -1 to +1, where:

- r=1r = 1r=1 indicates a perfect positive correlation,
- r=−1r = -1r=−1 indicates a perfect negative correlation,
- r=0r = 0r=0 indicates no correlation.

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J. M. Keynes, *The General Theory* and George Boole: Keynes's Uncertainty is based on Boolean Uncertainty as analyzed in *The Laws of Thought*

Michael Emmett BRADY
Department of Operations Management
Dominguez Hills College of Business Administration and Public Policy
California State University, USA
mebrady@csudh.edu

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Abstract: This paper contributes to the literature on Keynes by showing that Keynes's understanding and analysis of the role of uncertainty in decision making originated from his reading of George Boole's *The Laws of Thought*. Boole's *The Laws of Thought* was the first mathematically and logically advanced treatise(Thomas Aquinas and Adam Smith had both recognized that real world decision making could not be based on the purely mathematical laws of the probability calculus) on uncertainty, demonstrating that the purely mathematical laws of the probability calculus, based on additivity and linearity were, at best, only a limiting, special case that would rarely occur in the real world of decision making which were characterized by non-additivity and non-linearity. Keynes then developed the basic foundational analysis of Boole further in his *A Treatise on Probability* and *General Theory* .Keynes advanced Boole's theory by developing his own version of Boole's logical, objective, probability relation, theory of groups, upper-lower, interval bounded imprecise probabilities, as well as the evidential weight of the argument, which would allow a treatment of uncertainty in the form of a decision weight approach instead of by interval estimates. Keynes called this approach his conventional coefficient of weight and risk, c, in Chapter XXVI of the *A Treatise on Probability*.

Keywords: Boole, Keynes; missing/unavailable data or information; non-probabilistic uncertainty; decision weights; imprecise probability; interval valued probability.

JEL Classification: D81; E12.

Introduction

The paper will be organized in the following manner. Section Two will examine Boolean Uncertainty, which, like Keynesian uncertainty, is based on a decision situation composed of both partial ignorance and partial knowledge. Partial ignorance means that only a partial ordering of the probability space is possible, which means that measurement must be incomplete. Section Three will examine Boole's understanding that the formation of expectations can't possibly be based on purely precise probability and strict or exact mathematical expectations because mathematical expectation calculations do not deal with/incorporate missing/unavailable information and/or incorporate 'animal spirits', which involve the mental and emotional aspects involved in the expectations formation of the decision maker. Section Four will cover Boole's criticisms of the Laplace approach to probability, a criticism which Keynes incorporated into his (1973), for which he was heavily criticized. None of Keynes's critics pointed out that Keynes's criticisms of Laplace are just a more emphatic and vocalized version of the criticisms first made by Boole in (1854):

> "The most usual mode *of endeavouring to evade the necessary arbitrariness of the solution of problems in the theory of probabilities which rest upon insufficient data, is to assign to some element whose real probability is unknown all possible degrees of probability; to suppose that these degrees of probability are themselves equally probable*; … It has been said that the principle involved in the above and in similar applications is that of the equal distribution of our knowledge, *or rather of our ignorance - the assigning to different states of things of which we know nothing, and upon the very ground that we know nothing, equal*

degrees of probability. I apprehend, however, that this is arbitrary method of procedure." (Boole 1854, 369-370; italics added).

Boole's rejection of any equal distribution of ignorance assumption, in order to support the assumption of equal a priori probabilities, leads directly to Keynes 's major modifications of the Principle of Indifference in (Keynes 1921/1973; 1973), which is that the knowledge must be positive and symmetric for all alternatives. Given the problems of meeting this condition in actual practice, it means that the priori probabilities will usually be imprecise:

"15. This distinction enables us to formulate the Principle of Indifference at any rate more precisely. There must be no relevant evidence relating to one alternative, unless there is corresponding evidence relating to the other; *our relevant evidence, that is to say, must be symmetrical with regard to the alternatives, and must be applicable to each in the same manner. This is the rule at which the Principle of Indifference somewhat obscurely aims.* We must first determine what parts of our evidence are relevant on the whole by a series of judgments of relevance, not easily reduced to rule, of the type described above. *If this relevant evidence is of the same form for both alternatives, then the Principle authorizes a judgment of indifference.*" (Keynes1921,1973, 55-56, italics added).

Keynes's symmetrical requirement now allows us to clear up the very severe confusions of philosophers regarding Keynes's Principle of Indifference in theory, if not in practice. Contrary to current thought, Keynes never rejected the Principle of Indifference (POI) in (Keynes 1936). What he rejected was the Bernoulli-Laplace Principle of Non -Sufficient Reason:

"Nor can we rationalize our behaviour by arguing that to a man *in a state of ignorance* errors in either direction is equally probable, so that there remains a mean actuarial expectation based on equi-probabilities. For it can easily be shown that the assumption of arithmetically equal probabilities based *on a state of ignorance leads to absurdities.*" (Keynes 1936, 152; italics added).

What Keynes has rejected above on page 152 of Keynes (1936) is the Bernoulli -Laplace version of the POI, based on equally balanced ignorance, that appears on p. 42 of Keynes (1921, 1973) and not his version of the POI, which is based on equally balanced, positive knowledge, as first pointed out by Boole, that appears on pp.54-56 and p.160 of Keynes (1921, 1973).

Keynes supports Boole's development of techniques to estimate, as opposed to calculating, the priori and a posteriori probability by incorporating constants into the a priori formulations of the probabilities that stand for the missing or unavailable information. These techniques are illustrated by Keynes in chapters XV, XVI and XVII of Keynes (1921, 1973). Section 5 will conclude the paper.

1. Review of the Literature on the Boole - Keynes Connection

Unfortunately, there is no literature to review from economists, philosophers, social scientists and behavioral scientists except for the work of Hailperin (1986). Hailperin, a mathematician, recognized Keynes's debt to Boole as regards the application of Boole's relational, propositional logic and interval valued probability. Outside of Hailperin's work, there is simply no literature to review. Consider the following assessments of Boole's work made by Corcoran and Burris, who are both logicians:

"Accordingly, this article does not discuss many other historically and philosophically important aspects of Boole's book, *e.g*. his confused attempt to apply differential calculus to logic, his misguided effort to make his system of 'class logic' serve as a kind of 'truth-functional logic', *his now almost forgotten foray into probability theory*, or his blindness to the fact that a truth-functional combination of equations that follows from a given truth-functional combination of equations need not follow truth-functionally. One of the main conclusions is that Boole's contribution widened logic and changed its nature to such an extent that he fully deserves to share with Aristotle the status of being a founding figure in logic. By setting forth in clear and systematic fashion the basic methods for establishing validity and for establishing invalidity, Aristotle became the founder of logic as formal epistemology. By making the first unmistakable steps toward opening logic to the study of 'laws of thought'—tautologies and laws such as excluded middle and non-contradiction—Boole became the founder of logic as formal ontology." (Corcoran 2003, 261, italics added).

Consider now Burris's apparently unfinished manuscript that aims to explain Boole's book using comments in the margins that are appended to Boole's original text. The following one sentence comment is all that appears as regards Boole's chapters in Boole (1854), XVI to XXII:

"*Boole viewed Logic as a prerequisite for Probability Theory*." (Burris 2022, 13).

This is the only mention made of probability in Burris's excellent explanation of what Boole is doing in chapters I to XV of LT. Consider Keynes's summary of his position that classical and neoclassical economic theory were special cases of his general theory:

"I shall argue that the postulates of the classical theory are applicable to a special case only and not to the general case, the situation which it assumes being a limiting point of the possible positions of equilibrium. Moreover, the characteristics of the special case assumed by the classical theory happen not to be those of the economic society in which we actually live, with the result that its teaching is misleading and disastrous if we attempt to apply it to the facts of experience." (Keynes 1936, 3).

Keynes's conclusion follows directly from Boole's general theory of decision making, that incorporated precise probability and strict mathematical expectations as being special cases of the general case of imprecise probability and approximate expectations.

Of course, the postulates of classical, neoclassical, new classical and new neoclassical economics are all fundamentally based on the purely mathematical laws of the calculus of probability, which require additivity and linearity as being necessary to perform any type of economic analysis. Modern neoclassical economists are as ignorant of Boole's logic based, relational, propositional system as are all heterodox economists. Keynes, following Boole, recognizes that all economic results based on mathematical expectations can, at best, be only special cases of a general case. The general case requires the incorporation of non-linearity and non-additivity into economic analysis, which is required for the existence of Boolean and Keynesian uncertainty.

Similarly, ideas such as Keynes's views on the Principle of Indifference, expectations, and 'animal spirits' derive from Boole's discussions and analysis of these topics that are contained in Boole (1854).

Since there have been no papers written in either the 20th or 21st centuries on what can be called the Boole-Keynes connection, except for my papers and those of my co-authors, all past and current work on Keynes's (1921,1973; 1973) and/or Keynes (1936) is either (a) incomplete, or (b) deficient and defective. This current state of affairs will require that all past work done on Keynes's (1921, 1973; 1973) and /or Keynes (1936) and/or the connections/links between the two books will have to be restudied, reevaluated, redrafted and rewritten. The economic and philosophy professions can thus be seen to be back at a 1969 position as regards Keynes 's works. It was in 1969 that Hishiyama (1969) pointed out that (Keynes 1921, 1973) had not been read, leading to a situation where the connections between (1921,1973; 1973) and Keynes (1936) had been overlooked. It is impossible to restate Keynes's positions correctly unless it is recognized that Keynes, like Boole, Smith and Aquinas before him, rejected precise, numerical, mathematical probability, in general, while following methods of imprecise and indeterminate, interval valued probability, which is necessary for the specification and analysis of Keynesian uncertainty.

2. Research Result. Wilson on Boole and Keynes

Consider the following statement:

> "Two other quotations may be of interest: (1) "The theory of 'Testimony, …of the combination of the testimony of witnesses, …has occupied so considerable a space in the traditional treatment of Probability that it will be worthwhile to examine it briefly. It may, however, be safely said that the principal conclusions on the subject set out by Condorcet, Laplace, Poisson, Cournot and Boole are demonstrably false. The interest of the discussion is chiefly due to the memory of these distinguished failures" (p. 180). Never perhaps since ancient biblical times has such a redoubtable army of philistines been so deftly slain (Keynes, XV, 15)." (Wilson 1923, 319).

Keynes is correct here, in general. However, he should have noted that Boole is correct based on his deployment of the POI, although this was a case where Boole should not have used the POI, about which Boole correctly stated that it could be used only if there was positive knowledge (Boole 1854, 368-371).

Now consider the following statement:

> "To understand Keynes, one has constantly to bear in mind that he is of the philosophic not of the mathematical school, that he derives from Leibniz, Hume and Venn rather than from Bernoulli, Laplace, and Charlier. He is seeking to lay a logical foundation for probability and to examine that foundation in the light of a wide reading of philosophic, mathematical, and statistical works on probability." (Wilson 1923, 320).

Unfortunately, Wilson, because he skipped Part II of Keynes (1921, 1973) in his first review of Keynes (1921, 1973), failed to realize that, in fact, Keynes is building on only one predecessor, George Boole. He is not building on Hume, Locke, von Kries, or Leibniz, because the content of the contributions of Hume, Locke, von Kries, or Leibniz, while discernable, is actually quite small when compared to Keynes's conclusion that Boole,

alone, had made the only major contribution of which Keynes was aware in Keynes (1921, 1973, 157). Since Boole had already laid out a complete logical foundation for probability, and Boole's target was Laplace, Wilson is correct about Keynes, but has erred with regard to Boole, who is not mentioned in his first review, It is only in Wilson's second review in 1934, after Wilson had had the time to digest Part II of Keynes (1921, 1973), that Wilson was finally able to see what it was that Keynes's position was.

Wilson corrected these omissions in his second, disguised review of Keynes (1921, 1973) in Wilson (1934). By then it was clear to Wilson what the Keynes-Boole connection was. It is unfortunate that this second review was never read, but that was Wilson's intention-he sought to make sure that no one else would grasp the Boole-Keynes connection, due to his great envy and jealousy of Keynes. Wilson missed the entire point of both Boole (1854) and Keynes (1921, 1973; 1973), which was that real world decision making usually requires inexact and imprecise probability carried out under conditions of Boolean uncertainty. Of course, so did all other academicians in the 20th and 21st centuries.

There is no citation or mention made of Boole or the Keynes -Boole connection in any of the five centenaries in 2021 that were celebrating the publication of both Keynes's and Knight's 1921 books in the *Cambridge Journal of Economics, Review of Political Economy, Journal of the History of Economic Thought, History of Economic Ideas,* or by the *Alan Turing Institute.*

3. Discussion I. Boolean Uncertainty

The necessary and sufficient condition for the existence of uncertainty (partial ignorance and partial knowledge) is non additivity. A complete order is defined and required to calculate additive, precise, numerical probability, while a partial order is required to estimate non additive, imprecise and non-numerical probabilities. The partial order leads directly to uncertainty, while a complete order leads to risk.

Boole's attack on the purely mathematical conceptualization of additive probability rejects the claim that all probability calculations will always result in a precise answer. The assumption of precision means that there can never be any decision situation where there is any missing or unavailable information, data, evidence or knowledge:

"Are we, however, justified in assigning to a and c particular values [author's note - Boole's technique specifies that the a and c values represent unknowns in the a priori probability estimates. If a decision maker is unable to calculate them in the future, then the a posteriori probability is "indeterminate "(uncertain)]*? I am strongly disposed to think that we are not*. The question is of less importance

in the special instance than in its ulterior bearings. In the applications received of the theory of probabilities, arbitrary constants do not explicitly appear; but in the above, and in many other instances sanctioned by the highest authorities, some virtual determination of them has been attempted. And this circumstance has given to the results of the theory, especially in reference to questions of causation, a character of definite precision, which, while on the one hand it has seemed to exalt the dominion and extend the province of numbers, even beyond the measure of their ancient claim to rule the world; on the other hand has called forth vigorous protests against their intrusion into realms in which conjecture is the only basis of inference*. The very fact of the appearance of arbitrary constants in the solutions of problems like the above, treated by the method of this work, seems to imply that a definite solution is impossible, and to mark the point where inquiry ought to stop. We possess indeed the means of interpreting those constants, but the experience which is thus indicated is as much beyond our reach as the experience which would preclude the necessity of any attempt at solution whatever.*" (Boole 1854, 368; italics added).

Boole's final summary above is very clear that the usual case facing a decision maker is missing or unavailable data in the real world, both a priori and a posteriori, and not situations where all possible outcomes are known in advance:

> "26. These results only illustrate the fact that when the defect of data is supplied by hypothesis, the solutions will, in general, vary with the nature of the hypotheses assumed; so that the question still remains, only more definite in form, whether the principles of the theory of probabilities serve to guide us in the election of such hypotheses. I have already expressed my conviction that they do not - a conviction strengthened by other reasons than those above stated. Thus, a definite solution of a problem having been found by the method of this work, an equally definite solution is sometimes attainable by the same method when one of the data, suppose Prob. $x = p_1$ is omitted. But I have not been able to discover any mode of deducing the second solution from the first by integration, with respect to p supposed variable within limits determined by Chap. XIX. This deduction would, however, I conceive, be possible, were the principle adverted to in Art. 23 valid. Still *it is with diffidence that I express my dissent on these points from*

mathematicians generally, and more especially from one who, of English writers, has most fully entered into the spirit and the methods of Laplace; and I venture to hope, that a question, second to none other in the Theory of Probabilities in importance, will receive the careful attention which it deserves." (Boole 1854, 375; italics added).

Note that Boole is criticizing Laplace above in the same manner as Keynes did later, but not as harshly. Boole's uncertainty approach, that it is usually going to be the case that the final answers are going to turn out to be indefinite, can be understood simply by reading the last six pages at the end of chapter XX of Boole (1854) alone. This does not require that the reader has ever actually studied/mastered any of the very demanding material that is involved in the study of Boole's technical approach in chapters XVI to XXII of Boole (1854). The question that still needs to be answered is why is it the case in 2025 that there are practically no academicians who have any knowledge of Boole's creation of an imprecise, logical theory of probability 171 years ago, which was long before Keynes put forth his improved version of Boole's original theory of logical probability in 1921?

I will repeat Boole's severe criticism of the Bernoulli-Laplace Principle of Non -sufficient reason, as it also represents a very severe criticism of F P Ramsey's assertion (1922, 1926, 1931) that all probabilities MUST be precise and additive [see 1-2 for the errors made by Ramsey in his discussions of Keynes]:

"The *most usual mode of endeavouring to evade the necessary arbitrariness of the solution of problems in the theory of probabilities which rest upon insufficient data, is to assign to some element whose real probability is unknown all possible degrees of probability; to suppose that these degrees of probability are themselves equally probable; … It has been said, that the principle involved in the above and in similar applications is that of the equal distribution of our knowledge, or rather of our ignorance—the assigning to different states of things of which we know nothing, and upon the very ground that we know nothing, equal degrees of probability.* I apprehend, however, that this is an arbitrary method of procedure." (Boole 1854, 369-370; italics added).

Ramsey's entire theory of subjective probability in (1922, 1926, 1931) is an endeavor on his part

"…to evade the necessary arbitrariness of the solution of problems in the theory of probabilities which rest upon insufficient data…" (Boole 1854, p.369).

by pretending that there are no such problems that actually have insufficient data.

It is easy to see that Keynes's Evidential Weight of the Argument, V, in Keynes (1921, 1973; 1973) is a technical way of being able to deal exactly with those problems in decision making that have insufficient data while circumventing the difficult interval approach to probability, so that V(a/h)=w, where 0<w<1, allows one to estimate a decision weight answer that is numerical, while also incorporating BOTH risk and uncertainty. Uncertainty for Keynes in Keynes (1936) is carefully discussed on pp. 148-153 of Keynes (1936). Uncertainty is defined as an inverse function of V= w, so that problems impacted by the confidence one has in the data, discussed by Boole on pp. 381, 398, and 403 of Boole (1854), usually result from decision making situations whenever the decision maker is faced with "insufficient data."

We can now incorporate Boole's emphasis on the existence of insufficient data with our original discussion concerning the generality of his approach in economics. All neoclassical schools of thought operationalize the concept of precise probability as being additive, which means that there is never any cases of insufficient data .This means that there can never be any uncertainty as there is never any missing and/or unavailable data .Keynesian uncertainty, built on Boolean uncertainty, states that there is usually cases of insufficient data in many decision situations being faced by real world decision makers.

4. Discussion II. Boole on the Mental and Emotional Aspects of Expectations Formation

Boole, like Keynes, never made the mistake made by all neoclassical economists, which was to have asserted, following Bentham, that expectations that are rational are the result only of purely mathematical and statistical calculations:

"Though our expectation of an event grows stronger with the increase of the ratio of the number of the known cases favourable to its occurrence to the whole number of equally possible cases, favourable or unfavourable, *it would be unphilosophical to affirm that the strength of that expectation, viewed as an emotion of the mind, is capable of being referred to any numerical standard. The man of sanguine temperament builds high hopes where the timid despair, and the irresolute are lost in doubt*. As subjects of scientific inquiry, there is some analogy between opinion and sensation. The thermometer and the carefully prepared photographic plate indicate, not the intensity of the sensations of heat and light, but

> certain physical circumstances which accompany the production of those sensations. So also, the theory of probabilities contemplates the numerical measure of the circumstances upon which expectation is founded; and this object embraces the whole range of its legitimate applications. The rules which we employ in life-assurance, and in the other statistical applications of the theory of probabilities, *are altogether independent of the mental phænomena of expectation. They are founded upon the assumption that the future will bear a resemblance to the past; that under the same circumstances the same event will tend to recur with a definite numerical frequency; not upon any attempt to submit to calculation the strength of human hopes and fears*." (Boole 1854, pp.244-245; italics added)

It is clear that Boole is talking about the same kind of variable that Keynes labelled as 'animal spirits 'in Keynes (1936) on pp. 161-163, a variable that Keynes had omitted from discussion in Keynes (1921, 1973; 1973).

Boole's understanding of the intermingling of the objective, mathematical expectation estimations, along with the subjective nature of the mental and emotional aspects of a decision about what to do in the future, given the present data and the particular disposition that one has to act, is made even clearer later in LT:

> "Let it be granted that there exists such a feeling as expectation, a feeling of which the object is the occurrence of events, and which admits of differing degrees of intensity. Let it also be granted *that this feeling of expectation accompanies our knowledge of the circumstances under which events are* produced*,* and that it varies with the degree and kind of that knowledge. Then, without assuming, or tacitly implying, *that the intensity of the feeling of expectation, viewed as a mental emotion, admits of precise numerical measurement, it is perfectly legitimate to inquire into the possibility of a mode of numerical* estimation which shall, at least, satisfy these following conditions, viz., that the numerical value which it assigns shall increase when the known circumstances of an event are felt to justify a stronger expectation, shall diminish when they demand a weaker expectation, and shall remain constant when they obviously require an equal degree of expectation." (Boole 1854, p.272; italics added).

Thus, the correct mathematical treatment of expectations requires Keynes'(Boole's) 'animal spirits' characterization as being a supplemental and supporting aspect of the mathematical handling of expectations, which necessitates 'reasonable' calculation in the form of imprecise probability estimates.The use of strict or exact mathematical expectation calculations is merely a version of J. Bentham's calculation of Maximum Utility with exact and precise mathematical probabilities and utilities, which is what neoclassical economists mean by economic analysis. Keynes correctly called this kind of rationality" pseudo rational".

3. Discussion III. Boole's Criticisms of the Laplacian Approach in LT are Very Similar to Keynes's Heavy Criticisms of the Laplacian Approach in the TP

It is interesting to note Boole's criticisms of what Keynes would later identify as the Laplacian approach to probability in his TP. Keynes was roundly criticized for his correct criticisms of precise probability assessment. No one has ever published a critique of Boole for levelling what is essentially the same critique as made by Keynes, but without the fervor demonstrated by Keynes. Apparently, no economist or philosopher has read Boole's book since 1854. Thus, just as Hishiyama pointed out in 1969, that economists and philosophers did not read Keynes (1921/1973; 1973). Economists and philosophers have not read (Boole 1854). This type of severe and extreme ignorance can only lead to the acceptance of a non (anti?) - scientific basis for economics and philosophy as regards the evaluation of Keynes's work, as of the year 2025.

Conclusions

Keynes learned about Boole's contributions from both his father, John Nevile Keynes, and William Ernest Johnson, who was also an advocate of logical probability and of his 'worth of the evidence' analysis, which was a precursor of Keynes's evidential weight of the argument analysis. Keynes thus based (1921/1973; 1973) completely on Boole's

- formal, mathematical, symbolic, relational, propositional logic
- interval valued probability (imprecise probability), as opposed to precise numerical probability
- analysis of propositions about outcomes of events, as opposed to the outcomes or events themselves
- opposition to the general use of the Principle of Indifference
- requirement that a logical analysis must always precede any type of mathematical analysis
- problem X ,which is the foundation for Keynes's mathematical theory of induction in Part III of the TP

- understanding of the nexus between mathematical expectations analysis and the individual psychological impact upon the decision makers' expectations of his emotions, feelings, and mental and psychic states
- discussions of the limitations of mathematical analysis
- mention of the role of confidence in estimating expectations as depending on the strength of the data independent of any probability analysis
- discussion of the role of perception and Intuition in the application of Boolean logic
- objective, logical, probability relation that holds between related propositions and not Ramsey's unrelated propositions

Keynes added to Boole's logical theory of probability in his Keynes (1921/1973; 1973) by rigorously expanding the Boolean, relational, propositional logic to

- incorporate Keynes's theory of groups in chapters X and XI of the Keynes (1921/1973; 1973) before any discussion is devoted to the mathematical definitions and axioms of the calculus of pure mathematical probability, which take place in chapters XII to XIV of Keynes (1921/1973; 1973). Chapters XV to XVII of Part II of Keynes (1921/1973; 1973) further develop Boole's original interval valued approach to probability
- expand the logical analysis of probability to incorporate Keynes's new logical relation, the evidential weight of the argument, in chapters VI and XXVI of Keynes (1921/1973; 1973).
- create the world's first decision weight approach, the conventional coefficient of weight and risk, in Chapter XXVI, pp.312-315, p.315 ft.2
- specify a Least Risk (Safety -First analysis). The special case was analyzed on page 315 and p.315, ft.1 of Keynes (1921/1973; 1973) and the general case was analyzed on pp.353-358 of Keynes (1921/1973; 1973).

Thus, Keynes advanced the theory in Boole (1854) of imprecise theory using his logical probability in Keynes (1921/1973; 1973) and used this approach as the foundation for both his A Treatise on Money (1931, Vol.1, chapters 6, 7 and 8) and Keynes (1936), chapters 4,12 and 17. Given that E. Borel, F. Y. Edgeworth and E. B. Wilson, all world class mathematicians, admitted that they could not follow Keynes in Part II of Keynes (1936), it is not surprising that there were no academicians, economists or philosophers in the 20th or 21st century who were able to figure out the nature of Keynes's many contributions in Keynes (1921/1973; 1973). It was Hishiyama (1969), however, who first pointed out the severe problem facing economists, who were trying to assess the role of the connections between Keynes's A Treatise on Money and Keynes (1936) without having first read Keynes (1921/1973; 1973) - a blind spot had resulted in their analysis, a blind spot that still exists today.

Keynes (1921/1973; 1973) is built on the shoulders of an intellectual giant, G. Boole. The fact that his major contributions to decision making under risk and uncertainty are still unknown some 170 years after the publication of Boole (1854) is incomprehensible and a scandal that merits investigations into the existing publication structures existing in academia.

It is clear that, from Keynes's perspective, there was no one else before him who had made any advance technically in constructing a general theory of decision making that had the goal of making imprecision the general case and precision a special case:

> "Several modern writers have made some attempt at a symbolic treatment of Probability. But with the exception of Boole, whose methods I have discussed in detail in Chapters XV., XVI., and XVII., no one has worked out anything very elaborate." (Keynes 1921, 155)

The publication of a number of articles' (Gerrard 2022, 2023a, 2023b, 2023c), as well as the recent publication in 2023 of Clarke (2023) by Cambridge University Press, containing an entire chapter supposedly detailing Keynes's acceptance of Ramsey's empty diatribes against logical theories of probability, demonstrates severe and ongoing ignorance. The over 100 years of ignorance about the imprecise, logical approach to probability contained in Keynes (1921/1973; 1973) and the 170 years of ignorance of the imprecise, logical probability approach in Boole (1854) could not have happened in physics, electronics, engineering, chemistry, or biology. The failure to correct errors in the economics and philosophy literature simply means that economics and philosophy are not sciences, not arts, not artistic and not scientific. Fields where errors are not corrected over time but are amplified and magnified in the ongoing literature over hundreds of years, can't possibly be viewed as being scientific if one is using the standard philosophy of science definition, which is that real sciences correct their errors over time.

Therefore, the claim that economics and philosophy are scientific, while major errors continue to go on as time goes by unabated, means that some other criteria is being used to satisfy the claims of scientific creditability. Apparently, the criteria being applied is that these fields use a lot of mathematics and statistics notation.

The ignorance of Boole's contributions are difficult to understand as, starting in 1855, Boole switched his approach to modeling uncertainty to the technique devised by Henry Wilbraham. Apparently, Boole's use of Wilbraham was overlooked, leaving readers with the a nearly impossible task of mastering (Boole 1854, chapters XVI to XXII). However, this does not explain why the much more readable chapters of (Boole 1854, I to XV) were also usually ignored.

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The author is a member of Editorial Board and was not involved in the editorial review or the decision to publish this paper.

Declaration of Use of Generative AI and AI-assisted Technologies

The author declares that he has not used generative AI and AI-assisted technologies during the preparation of this work.

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Unravelling the Export-Employment Nexus: Empirical Evidence from the Organization of Turkic States

Latif ZEYNALLI
Academy of Public Administration under the President of the Republic of Azerbaijan, Azerbaijan
ORCID: 0000-0001-5887-7946
latif.zeynalli@gmail.com

Ilham RUSTAMOV
Azerbaijan State Oil and Industry University, Azerbaijan
ORCID: 0000-0002-7300-9458
i.rustamov@asoiu.edu.az

Elchin ABASOV
Academy of Public Administration under the President of the Republic of Azerbaijan, Azerbaijan
ORCID: 0009-0009-8059-6193
abasov_e@mail.ru

Murteza HASANOGLU
Academy of Public Administration under the President of the Republic of Azerbaijan, Azerbaijan
ORCID: 0000-0003-3734-4045
m_hasanoglu@yahoo.com.tr

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Abstract: This study explores the complex relationship between export dynamics and employment trends in the member states of the Organization of Turkic States (OTS). While existing literature presents varying findings on this relationship, this research utilizes panel data analysis covering the period from 2000 to 2023 to provide empirical insights. By employing employment and export data, the study applies the Hausman test to identify the most appropriate econometric model, ultimately opting for the Random Effects Model for estimation. The empirical findings indicate a positive and statistically significant relationship between export growth and employment expansion. Specifically, a 1% increase in exports is linked to a corresponding rise in employment levels, supporting the hypothesis that trade activities contribute to improvements in the labor market within OTS economies. However, the magnitude of this effect varies based on sectoral differences and macroeconomic conditions. The results highlight the critical importance of export-oriented policies in promoting employment opportunities while emphasizing the need for structural reforms to address potential imbalances in the labor market. This study adds to the broader discussion on trade and employment by providing policy recommendations for OTS countries to enhance their economic strategies.

Keywords: organization of Turkic States; export; employment; panel data model; Hausman test.

JEL Classification: E24; F10; C12.

Introduction

The relationship between exports and employment remains a complex and contested issue within economic discourse. The diversity of conclusions drawn from various empirical studies underscores this complexity. Theoretical foundations of this relationship are deeply rooted in classical and neoclassical trade theories, notably the Heckscher-Ohlin and Ricardian models, which emphasize factor endowments and comparative advantage. While these models offer valuable insights into sectoral labour demand shifts, they do not fully capture the broader employment effects of trade dynamics.

Export expansion can simultaneously induce job losses in import-competing industries while generating employment growth in export-oriented sectors. The net effect of exports on employment is influenced by multiple factors, including a country's macroeconomic conditions, industrial structure, and labour market flexibility. Empirical research presents divergent findings-some studies highlight export-driven job creation, while others emphasize that productivity gains may mitigate labour demand. Consequently, the extent to which exports contribute to employment growth depends on labour market adaptability, trade policies, and structural economic conditions.

In the globalized economy, nations strategically pursue export diversification to bolster economic resilience and achieve sustainable growth. Classical economic thought suggests that reliance on a narrow range of exports presents inherent risks, whereas economies with diversified export portfolios demonstrate greater stability.

Assessing the employment effects of export dynamics necessitates rigorous empirical analysis. Employment outcomes are shaped by factors such as demand elasticity and export responsiveness. While export expansion may elevate labour force participation rates, industries heavily dependent on foreign markets may also encounter significant employment challenges.

Employment is a fundamental driver of economic growth, facilitating the optimal utilization of production factors and reflecting advancements in technological sophistication. To maximize its potential, employment policies must be robust and forward-looking, addressing labour market mismatches while fostering economic stability. A well-calibrated policy framework promotes equitable income distribution and enhances societal welfare, mitigating challenges such as poverty and unemployment.

This research paper aims to empirically examine the intricate relationship between exports and employment within the member states of the Organization of Turkic States (OTS). Established in 2009, the OTS - formerly known as the Cooperation Council of Turkic-Speaking States - is pivotal in enhancing economic and trade cooperation among its members.

Between 2012 and 2018, the Organization of Turkic States (OTS) concentrated on implementing joint economic projects, cultural exchange programs, and educational initiatives to strengthen a collective identity and enhance cooperation among its member states. Since 2018, the organization has broadened its international relations, increasing its global visibility and influence. During this period, it has prioritized strategic collaborations in areas such as energy, transportation corridors, and security, thereby enhancing the OTS's regional and global impact (Salihi & Mehmetcik, 2025).

One of the most important reasons for the establishment of the OTS is that it acts as a unifying force, helping Turkic states navigate the complex geopolitical landscape of Central Asia and the Caucasus, where several great powers are competing for influence (Kocak, 2023). The Eurasian region, with its distinctive historical and cultural context, provides a compelling framework for this investigation. By employing robust econometric methodologies, this research seeks to generate novel insights into the employment implications of export expansion within the OTS economies, contributing to the broader discourse on trade and labour market dynamics.

It should be noted that Azerbaijani state institutions are increasingly prioritizing the monitoring of local product exports and the promotion of these products in both developed countries and the markets of the Organization of Turkic States (OTS). The state plays a direct role in facilitating the export of export-oriented goods and services to these markets, thereby contributing to the expansion of the country’s export potential through strengthened institutional support (Abasova & Hasanzade, 2025).

This research paper is one of the few empirical investigations that examines the relationship between exports and employment across the member states of the Organization of Turkic States using long-term panel data. The application of the Hausman test to determine the appropriate econometric model, along with the consideration of sectoral and macroeconomic heterogeneity, enhances the reliability and robustness of the findings. By empirically confirming the positive impact of exports on employment, the study not only contributes to the existing body of literature but also provides practical policy recommendations tailored to the specific context of the Turkic States. In doing so, it offers a valuable contribution to scientific discourse on regional labor market development and export-driven economic strategies.

1. Literature Review

This literature review aims to investigate existing studies on the relationship between exports and employment, with a particular focus on the Organization of Turkic States (OTS). The connection between exports and employment is widely recognized as a key driver of economic development, making it a central goal in the

economic policies of numerous countries. However, the nature and strength of this export-employment link remain subjects of ongoing debate.

As a key regional and global center of power, the OTS should achieve its objectives by integrating the economies of its member states, which will enhance its influence in the region. Therefore, prioritizing increased integration in the agricultural sector is essential (Fikretzade *et al.* 2024).

To provide a comprehensive understanding, the review will analyze various theoretical frameworks, methodologies, and findings from previous research, specifically highlighting how exports impact employment within the distinct economic, political, and social contexts of OTS countries. Different theoretical approaches may yield varied results regarding the impact of exports on different sectors of the economy and across various levels of development.

Moreover, special attention will be given to empirical studies that enhance our understanding of how exports influence the labor market, as well as research evaluating this relationship across different regions and stages of economic development.

In the subsequent sections, we will discuss the practical significance of the export-employment relationship for OTS countries and explore policy recommendations. This analysis will consider how exports can be leveraged as a tool to create jobs and promote economic growth.

Export-based theory suggests that a region's economic development is largely driven by external demand for its products and services. When exports increase, they generate income, create jobs, and stimulate local businesses, leading to overall economic growth. This theory emphasizes the crucial role of external markets in regional development, indicating that growth driven by exports can enhance productivity through benefits like economies of scale, the sharing of knowledge, and innovation. Additionally, a robust export sector can attract investment, improve infrastructure, and increase competitiveness. However, it's important for economic resilience to diversify; relying too heavily on exports can leave regions vulnerable to fluctuations in the global market (Leichenko, 2000)

According to compelling research by Sandrey *et al.* (2011), there is a robust positive relationship between employment and exports, highlighting how an increase in exports can drive job growth (Sandrey *et al.* 2011).

Research by Aswicahyono *et al.* (2011) examined the period from 1995 to 2005 in Indonesia and found a decline in job creation linked to exports in the manufacturing sector by 2005, compared to the period before the crisis. This decline was attributed to sluggish growth in manufacturing exports and a notable shift away from light industries. In contrast, employment in the services industry saw an increase, largely due to indirect connections to key export sectors. The study identified several supply-side obstacles to job growth through exports, including inadequate infrastructure, an uncertain investment climate, and strict labor regulations (Aswicahyono *et al.* 2011).

Aktakash *et al.* (2013) conducted a panel data analysis and found a positive and significant relationship between sectoral exports and sectoral employment. However, their dynamic analysis revealed a negative and significant relationship. Additionally, this dynamic analysis indicated that the influence of exports per employee on employment growth, as well as the effect of sectoral exports on sectoral employment growth, is both positive and significant (Aktakash *et al.* 2013).

Economic growth is a primary goal for governments, yet opinions on its determinants differ significantly. Neoclassical theories emphasize macroeconomic stability, proposing that policy shocks are temporary and that markets will naturally return to equilibrium. In contrast, structuralist economists contend that trade policies have a profound impact on employment and long-term economic outcomes. They point out that trade imbalances can persist and negatively influence labor markets and industrial development. While neoclassical economists focus on aggregate factors, such as capital accumulation and productivity, structuralists highlight the importance of sectoral dynamics and advocate for targeted policy interventions. Ultimately, achieving sustainable growth requires a balanced approach that integrates macroeconomic stability with strategies designed to address employment challenges and the structural transformations brought about by trade (Özdemir *et al.* 2014).

Dizaji and Badri (2014) conducted a study using the ARDL bounds testing approach to explore the relationship between various macroeconomic variables and employment in Iran, covering the period from 1976 to 2005. Their research revealed significant findings: in the long term, employment in Iran is positively influenced by several key economic factors, such as economic growth, capital accumulation, and prevailing labor market conditions (Dizaji & Badri, 2014).

The growth in exports is viewed as a key sign of improved competitiveness in the sector. An increase in exports is expected to result in higher levels of output and employment (Arora, 2015). However, the research by Rajesh Raj and Sasidharan (2015) presents a different perspective, questioning whether exports actually contribute positively to employment growth (Rajesh Raj & Sasidharan, 2015).

Nguyenin's (2015) research on input-output analysis highlights the significant impact of manufacturing exports on employment between 2000 and 2007. During this period, it is estimated that approximately seven million additional jobs were created, largely due to spillover effects across various sectors of the economy. Notably, export-oriented manufacturing was responsible for more than half of the overall increase in manufacturing employment from 2000 to 2007 (Nguyen, 2015).

Kiyota's (2016) study employs input-output analysis to explore the impact of exports on employment across several East Asian economies, specifically focusing on China, Indonesia, Japan, and Korea during the period from 1995 to 2009. By utilizing input-output analysis, Kiyota examines the interrelationships among industries within these economies and assesses how fluctuations in export demand affect domestic production and employment levels (Kiyota, 2016).

A study conducted by Bulmer (2016) used panel causality analysis to examine the impact of labor market expansion in Laos on export growth from 2009 to 2012. The findings revealed a slight positive correlation between employment - in total, skilled, and unskilled labor forces - and exports. Notably, the effect was more pronounced for unskilled workers. Additionally, the study indicated that wages in exporting businesses are on the rise (Bulmer & Hollweg, 2016).

Although many countries have seen improvements in trade performance, the impact on job creation and skill demand has varied. In emerging nations, an increase in exports - especially in the industrial sector - initially boosts the demand for low-skilled workers. This is particularly noticeable in industries like textiles, ready-made apparel, plastics, and processed foods. However, as manufacturing processes become more advanced and the production structure evolves, the need for low-skilled workers declines. As production shifts towards being more capital-intensive, the demand for skilled workers in the export industry increases (Tarjáni, 2017).

A study by Tacero *et al.* (2017) found that as Spain's export sector becomes more involved in global production chains, the number of new jobs created by exported products is likely to decrease (Tacero *et al.* 2017).

Altuntepe's (2018) research highlights a short-term positive relationship between exports and employment. However, it finds no significant long-term impact. Similarly, the study identifies a short-term positive connection between imports and employment, but again, no lasting relationship is observed (Altuntepe, 2018).

Traditional economic theory explains that trade liberalization impacts labor markets through two main channels. First, companies that face strong competition from imports may reduce their operations or even shut down entirely. This can result in job losses and displace workers, leading to structural unemployment. As a result, workers may need to change industries to find new employment. On the flip side, companies that gain access to international markets can experience growth. This growth often leads to increased production and the creation of new job opportunities. Additionally, it can result in higher wages, improved productivity, and the development of new skills among the workforces. Ultimately, the overall impact of trade liberalization on labor markets depends on various factors, including labor mobility, wage flexibility, and how easily displaced workers can transition to new sectors within the economy (Feenstra *et al.* 2019).

Policies related to employment have significant effects on both the economy and society. Countries that struggle to increase employment levels often face higher costs in various sectors. Therefore, initiatives aimed at improving job opportunities are crucial for these nations. Economists and policymakers are deeply concerned with finding effective ways to boost employment rates. Research indicates that a 1% increase in exports is linked to a 0.15% rise in employment (Tandoğan, 2019).

Liu *et al.* (2019) suggests that technological and manufacturing capabilities have a positive impact on export growth. This increase in exports, in turn, contributes to job creation. Moreover, export growth fully mediates the relationship between technological capability and job creation, while it partially mediates the relationship between manufacturing capability and job creation (Liu *et al.* 2019).

Exporting to foreign countries contributes significantly to job creation in the exporting nations (Sasahara, 2019).

As per Whang (2019), the findings of the research indicate that, primarily, changes in export composition are intricately linked to the reduced influence of exports. Additionally, an increase in exports contributes to job creation within the production sector; however, the relationship between exports and employment diminishes as capital intensity rises. Conversely, an increase in the share of export goods from small and medium-sized enterprises (SMEs) amplifies the effect of exports on employment (Whang, 2019).

According to the findings of Yilmaz (2021), there is a significant relationship between export growth and employment growth. Specifically, while an increase in exports can contribute to higher employment levels, a change in exports has a negative impact on employment changes. For instance, when export growth rises by 1%, employment growth declines by 0.04% (Yilmaz, 2021).

According to the important findings from Taşdemir *et al.* (2023), exporting significantly boosts employment within firms. This effect is especially strong among Turkish manufacturing companies in labor-intensive and low to medium-low technology sectors, particularly those that offer lower wages (Taşdemir *et al.* 2023).

Gasimli *et al.* (2024) argue that Azerbaijan has undertaken substantial initiatives to harness its green energy potential with the aim of promoting energy exports and ensuring a sustainable transition to the post-oil economy. A central component of this strategy is the Green Energy Corridor, in which Azerbaijan assumes a pivotal role. In its first phase, the project seeks to connect Azerbaijan to the European energy market, while in the subsequent phase, it aims to integrate Central Asian countries into this network through the export of zero-carbon electricity. This initiative is expected to enhance economic stability, support ecological sustainability, and foster broader regional energy cooperation. Furthermore, the realization of such large-scale green energy projects is likely to stimulate job creation and contribute to the country's socioeconomic development (Gasimli *et al.* 2024).

The empirical findings presented by Shaheen (2025) demonstrate that trade-related variables including trade volume, export diversification, and the terms of trade index exert a positive and statistically significant impact on wages, labor productivity, and unemployment outcomes. Furthermore, economic growth, as measured by GDP growth, is shown to positively influence both wages and labor productivity, while population growth has a negative effect on labor market outcomes. The study underscores the importance of promoting export-oriented economic policies as a means to enhance labor market performance and improve the income and productivity of the domestic workforce in developing countries. These findings offer valuable insights for policymakers aiming to foster a more inclusive and resilient labor market (Shaheen, 2025).

2. Research Methods and Materials

2.1. Research Methods

Economic research relies on various data formats, requiring models that are suitable for analyzing these different types of data. Econometric analysis integrates mathematical concepts, statistics, and economics to analyze data, aiming to compare reality and make forecasts. Both cross-sectional data, representing a single point in time, and panel data, which combines cross-sectional and time series data, are used to examine correlations between economic variables through statistical and econometric analyses. Utilizing time series and cross-sectional data in financial modeling is essential for comprehensive analysis. By transforming the data into a panel format, an array of factors for assets can be measured over specific periods. This organizational structure greatly facilitates the testing and analysis of complex data sets.

The study's structure was shaped by statistical data provided by the five member countries of the Organization of Turkic States. The study aimed to examine the influence of exports on employment in the member nations. For this purpose, a panel data analysis was conducted using employment (y) and export (x) for the years 2000–2023. This study uses E-Views 12 application data processing.

The main hypotheses of the model were determined as follows:
H0= There is no relationship between the independent variable and the dependent variable.
H1= There is a relationship between the independent variable and the dependent variable.

There are two main models used in panel data estimation: The Random Effects model and the Fixed Effects model. The choice between these models is often guided by econometric tests, such as the Haussmann test, which helps identify the best specification for the data. The Fixed Effects model assumes that individual-specific fixed terms account for variations across units. By introducing dummy variables for each unit, this model captures time-invariant characteristics, making it useful for examining relationships between entities over time. In contrast, the Random Effects model assumes that individual differences are random and uncorrelated with the explanatory variables. If this assumption holds true, it treats these variations as part of the error term, allowing for more accurate estimations. The Random Effects model is frequently used when analyzing broad trends across units, whereas the Fixed Effects model is better suited for capturing variations within units. Ultimately, the decision between the two models depends on which one provides the most objective and reliable findings. Fixed Effects Model. The fixed effects model estimation show as follows:

$$Yit=\alpha i+\beta Xit+\epsilon it \quad (1)$$

where:
Yit - Employment for entity i at time t
Xit - Export for entity i at time t

β0 - Intercept
β1 - Coefficient for exports
ϵit - Error term
αi: Entity-specific intercept, which captures the effect of unobserved variables that are constant over time.

Random Effects Model. Assumes that individual entity differences are random and uncorrelated with the independent variables.

$$Yit=\beta0+\beta1Xit+ui+\epsilon it \quad (2)$$

where:
ui - Random entity-specific effect

2.2. Materials

This research analyzes the information on employment to population ratio and exports of goods and services statistics for Azerbaijan from 2000 to 2023. The study utilized the EViews 12 software for the analysis. In this research, the employment-to-population ratio, exports of goods and services, foreign direct investment, and labor force participation rate are analyzed using data sourced from the official website of the World Bank. To ensure consistent representation of all variables, logarithmic values were calculated for each. Table 1 provides detailed descriptions of the variables.

Table 1. Variables

	Variables	Description	Unit
1	lnEMP	Employment to population ratio	Dependent variable
2	lnEXP	Exports of goods and services (billion USA dollars)	Independent variable

Member nations are committed to avoiding alarms to other regional powers and striving for peaceful communication to support regional peace and order. The OTS has played a pivotal role in shaping norms and fostering identity, especially within cultural and economic contexts. It has successfully instilled a sense of unity among member states and bolstered their shared consciousness and fraternal connections (Yesevi, 2022).

They will have the ability to collaborate across numerous domains, leveraging their shared history, culture, and ancestry. OTS has emerged as a catalyst for unity, bringing together the Turkic community and fostering impactful relationships and a collaborative ethos. The current member countries of the Organization of Turkic States are Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan, and Turkey. These countries, with a combined population of over 200 million, possess significant economic potential, energy resources, transportation routes, and modern military capabilities. They demonstrate mutual support, solidarity, and consideration of national interests. The member countries have established cooperative relationships in both multilateral and bilateral formats.

With its clearly defined strategic objectives, the Organization of Turkic States (OTS) possesses all the characteristics of a fully-fledged international organization representing the entire Turkic world. In terms of land area, the OTS is approximately one-fourth the size of Russia and half the size of China, accounting for around three percent of the world's total land mass (Cetinkaya & Demirel, 2024).

Table 2. Real GDP in OTS countries (billion dollar)

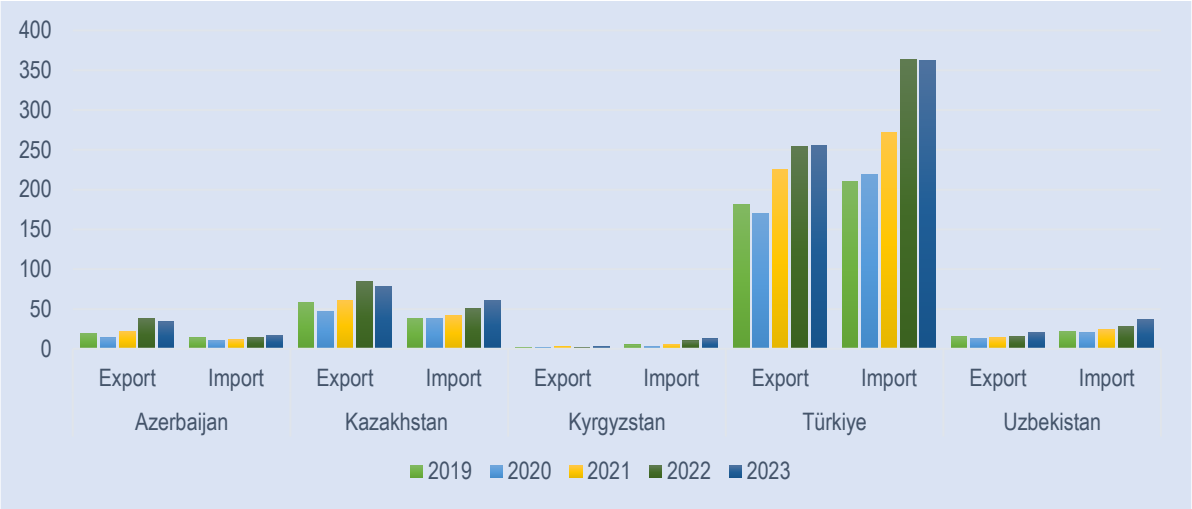
	2019	2020	2021	2022	2023
Azerbaijan	48.17	42.69	54.83	78.81	72.36
Kazakhstan	181.67	171.08	197.11	225.5	261.42
Kyrgyzstan	9.37	8.27	9.25	12.13	13.99
Türkiye	761.01	720.34	819.87	907.12	1108.02
Uzbekistan	60.28	60.22	69.6	81.14	90.89

Source: World Bank national accounts data, and OECD National Accounts data files (2024)

The data in Table 2 illustrates the GDP production of the countries that are part of the Organization of Turkic States from 2019 to 2023. The average annual GDP growth during this period was 10.7% in Azerbaijan, 9.5% in Kazakhstan, 10.5% in Kyrgyzstan, 9.8% in Turkey, and 10.8% in Uzbekistan. These tables demonstrate the impressive economic performance and growth potential of these nations. The combined GDP of the member

states exceeds $1.5 trillion, positioning them as the 13th largest in the world. Impressively, the OTS members' share of the global GDP stands at approximately 1.8%, a testament to their significant economic influence.

Figure 1. Exports and imports in OTS countries (billion dollar)



Source: World Bank national accounts data, and OECD National Accounts data files (2024)

In 2023, the total value of merchandise exports from Azerbaijan amounted to $33 billion, marking an 11.1% decrease from 2022. Specifically, merchandise exports decreased by $4.24 billion. Meanwhile, Kazakhstan's merchandise exports totaled $78 billion in 2023, indicating a 6.7% decrease compared to 2022, with merchandise exports declining by $5.65 billion. On the other hand, the Kyrgyz Republic saw its merchandise exports reaching $3.3 billion in 2023, reflecting a 46% increase from 2022, with merchandise exports growing by $1.05 billion. Turkey's merchandise exports totaled $255 billion in 2023, showing a 0.632% increase from 2022, with goods exports growing by $1.6 billion. Lastly, Uzbekistan's merchandise exports amounted to $21 billion in 2023, representing a 37% increase from 2022, with goods exports growing by $5.72 billion.

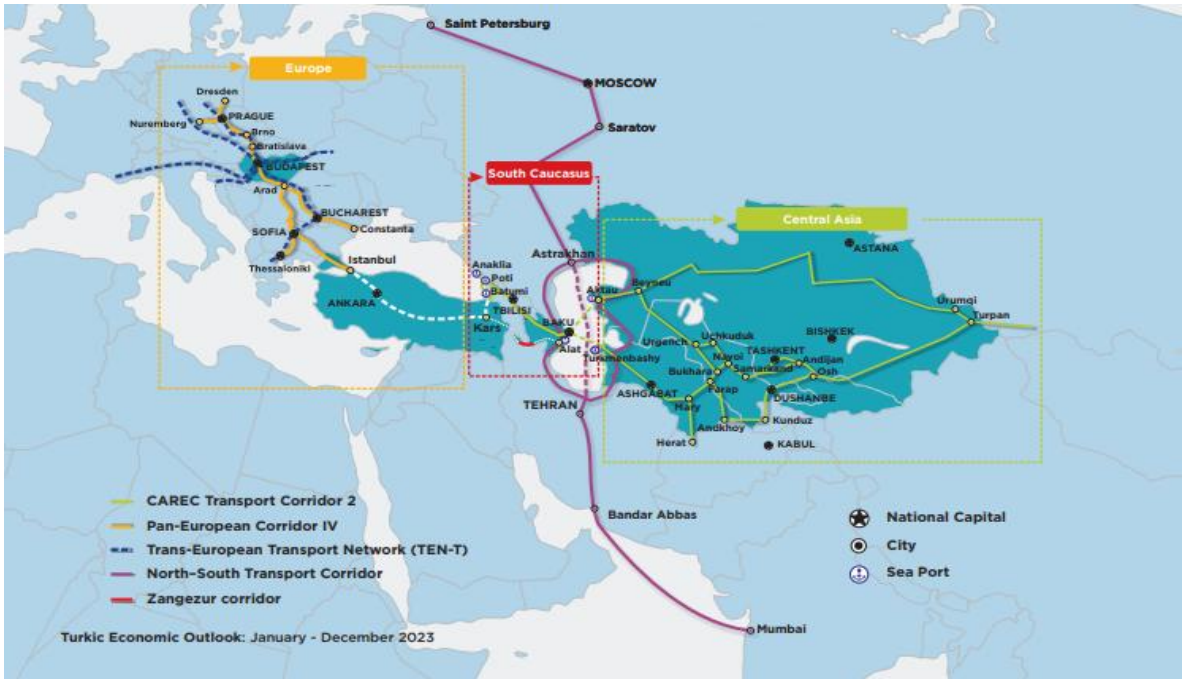
Figure 2. Unemployment, total (% of total labor force) in OTS countries

	2019	2020	2021	2022	2023
Uzbekistan	4.9	5.3	5.3	4.5	4.5
Türkiye	13.7	13.1	12.0	10.4	9.4
Kyrgyzstan	4.3	4.6	4.1	4.1	4.0
Kazakhstan	4.8	4.9	5.6	4.9	4.8
Azerbaijan	5.0	7.2	6.0	5.7	5.6

Source: World Bank national accounts data, and OECD National Accounts data files (2024)

In 2023, the average unemployment rate among member countries of the Organization of Turkic States (OTS) was an encouraging 5.7%. This figure emphasizes the vital link between real GDP growth and employment trends, illustrating the crucial role of sustainable economic policies in ensuring long-term labor market stability across OTS nations. By prioritizing these strategies, member states can foster resilience and prosperity for their workforces.

Figure 3. Conditional Schematic Transport Corridors of the Turkic World



Source: CAERC, Turkic Economic Outlook (2024)

Furthermore, the findings support the correlation between exports and employment in transitional economies, indicating that employment growth has a significant impact on export growth in numerous countries. This outcome indicates that these nations have relative strengths in industries that require a lot of manual labor. With this benefit, transitional countries can address their dual challenges of high unemployment rates and a shortage of foreign currency (Kadi, Osman & Filiz Kadi, 2016).

The global economy is at a pivotal moment, facing significant transformations driven by globalization, the rise of developing nations, technological advancements, and climate change. These dynamics have given rise to a new international economic order. It is imperative for developing countries to adapt to these changes and capitalize on the opportunities they present as the world navigates this evolving landscape.

3. Results and Discussion

The descriptive analysis measures the variation levels of export (EXP) and employment (EMP), including maximum, minimum, mean, and standard deviation.

Table 3. Descriptive Statistic Results

	EMP	EXP
Mean	13.28800	65.24400
Median	9.400000	22.20000
Maximum	58.70000	255.6000
Minimum	2.700000	1.800000
Std. Dev.	12.96753	82.44273
Observations	240	240

Source: Devised by the authors.

Table 3 provides an initial understanding of the relationships and interactions among key variables by presenting preliminary statistical insights. However, using the appropriate econometric methods is essential for thoroughly evaluating how export growth impacts employment growth within the model's parameters. Depending on the underlying assumptions and the type of data, these methods may include time-series approaches, panel data models, or regression analysis. By employing these econometric techniques, it becomes possible to separate causal effects, account for potential confounding variables, and generate more robust findings regarding the impact of export growth on employment dynamics.

Table 4. Correlation coefficient matrix

Covariance analysis:	Ordinary	
Date:	12/20/2024	
Time:	11:19	
Sample:	2019 2023	
Included observations:	240	
Correlation t-statistic Probability		
	EMP	EXP
EM	1.000000	

EX	0.854039	1.000000
	7.873429	----------
	0.000000	----------

Source: Devised by the authors.

The correlation coefficient matrix shows a strong connection between the dependent variables, employment (EMP) and the export factors (EXP), which indicates the presence of multicollinearity. This indicates that changes in a variable can be closely related to changes in the other, which could negatively influence the reliability of the regression analysis and the interpretation of the model.

Table 5. Panel Data Analysis Results with Fixed and Random Effects Model

Dependent variable: EM	Fixed effects			Random effects		
Independent variable	Coefficient	t-statistics	Prob.	Coefficient	t-statistics	Prob.
EXP	0.071583	1.073515	0.2965	0.127053	4.780135	0.0001
R-squared		0.834402		0.500295		
Adjusted R-squared		0.790823		0.478569		
Probability F-statistic		0.000001		0.000077		
Durbin-Watson		3.011227		2.432159		

Source: Devised by the authors.

According to the results of both fixed and random effects model of the Panel data analysis seen in Table 5, H0 hypothesis is rejected. In other export levels are effective on employment. Finally, by performing the Hausman Test, it is determined whether the fixed effects model or the random effects model will be used.

The hypotheses created for the test are as follows:

H0: There are random effects

H1: No random effects.

Table 6. Results of the Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.822728	1	0.3644

Source: Devised by the authors.

Hausman testing is used to determine the best model between Fixed Effect Model and Random Effect Model. If the chi-square cross- section value > 0.05 means using the Random Effect Model. If the chi-square cross-section value < 0.05, it means using the Fixed Effect Model. Based on the table above, the result of the chi-square cross-section in data processing is 0.3644> 0.05. That is, based on the results, the best model used in this study is the Random Effect Model. The following are the results of regression analysis using the REM model:

Table 7. Results of Balanced Panel Regression Analysis Method

Variable	Coefficient	Std. Error
C	4.523576	1.771588
Export (EX)	0.134333	0.017062

Source: Devised by the authors.

The table above shows the influence between independent variables, namely Export (EXP) on the dependent variable, namely Employment (EMP). Thus, the regression equation found:

$$EMP = 4.523576 + 0.134333*EXP$$

Table 8. Results of Partial Test (T-Test)

Variable	t-Statistic	Prob.
C	2.553402	0.0178
Export (EXP)	7.873429	0.0000
R-Squared	0.729383	
Adjusted R-squared	0.717617	

Source: Devised by the authors.

The table presented above illustrates the relationship between the dependent and independent variables, as explained through the results of the t-test analysis. The findings for Export (EXP) indicate that the significance value is less than α (0.0000 < 0.05), with a t-count coefficient of 7.873429 and a t-table value of 2.069. This implies that t-count > t-table, with degrees of freedom (df) equal to 23 (calculated as 25 - 1 - 1) and a significance level of 5% (0.05). Therefore, it can be concluded that Export (EXP) has a statistically significant impact on Employment (EMP). The Adjusted R-Squared value is 0.729383, or 72.93%, which suggests that the independent variable, Export (EXP), explains 72.93% of the variation in the dependent variable, Employment (EMP). The remaining 27.07% of the variation in Employment is attributable to other factors not included in the model.

Conclusion

Analyzing panel data can offer valuable insights into the correlation between employment and exports. Considering differences across sectors and changes over time helps to gain a comprehensive understanding of how exports affect employment and how this connection develops over time. The outcomes can provide insight into how well-focused export-focused growth strategies work, as well as the advantages and difficulties of participating in the global economy.

There is a mutual relationship between employment and exports. While it is typically believed that exports lead to more jobs, having more jobs can also have a positive impact on the performance of exports. An increased, more experienced labor force can enhance production capacity, innovation, and competitiveness, which are essential for promoting export expansion. Hence, measures aimed at boosting employment, enhancing skills, and fostering innovation can positively influence a nation's export competitiveness, ultimately boosting its economy.

As the number of people employed goes up, wages might also go up, resulting in increased production expenses. If expenses see a notable rise, it could result in a country's exports becoming pricier and less attractive in the international marketplace, leading to a possible decrease in export quantities.

Increased employment can result in higher levels of income, which can in turn boost domestic demand. If the demand for products within the country increases more than the ability to produce them, companies may choose to focus on selling domestically, causing a decrease in the number of products available for export.

Having a more proficient and larger labor force can result in improved products and services, ultimately boosting the appeal of a country's exports in the global market.

Increased employment and economic expansion can impact a nation's currency exchange rate. A more robust currency could lead to higher prices for exports, potentially lowering their competitiveness in the global market.

This study analyzed the impact of export change on employment in OTS (Organization of Turkic) member countries on a macro scale and using panel data techniques. The findings of this study reveal that export growth positively affects employment growth in 5 OTS (Organization of Turkic) countries in the years 2000-2023. The

estimation results obtained as a result of the empirical analysis mean that the hypothesis H1 (There is a relationship between the independent variable and the dependent variable) determined in the study is accepted.

Credit Authorship Contribution Statement

Latif Zeynalli: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Validation, Writing – review and editing, Visualization,
İlham Rustamov: Conceptualization, Methodology, Formal analysis, Writing – original draft, Validation, Writing – review and editing.
Elchin Abasov: Conceptualization, Investigation, Software, Writing – original draft, Validation, Writing – review and editing.
Murteza Hasanoglu: Investigation, Writing – original draft, Data curation, Writing – review and editing, Visualization**,**

Declaration of Competing Interest

No known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper have been declared by the authors of this study.

Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Economic Stability and Financing Quality: Key Determinants of Islamic Bank Growth

Muhammad IQBAL
Islamic Economics Department, Faculty of Economics and Business
Perbanas Institute, Indonesia
ORCID: 0000-0002-3736-5412
iqbal@perbanas.id

Dian KURNIAWATI
Acounting Department, Faculty of Economics and Business
Perbanas Institute, Indonesia
ORCID: 0000-0001-9406-2381
dian.kurniawati@perbanas.id

RIDARMELLI
Acounting Department, Faculty of Economics and Business
Perbanas Institute, Indonesia
ORCID: 0000-0002-5619-3580
ridarmelli@perbanas.id

Irawati JUNAENI
Management Department, Faculty of Economics and Business
Perbanas Institute, Indonesia
ORCID: 0000-0001-9851-6571
irawati@perbanas.id

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Abstract: The significant increase in Islamic bank financing indicates a positive outlook for Islamic banks. The expansion of Islamic bank financing within a country should be analyzed independently from the country's overall economic climate. It is believed that uncertain economic conditions, such as economic growth, inflation, exchange rates, and interest rates, substantially impact financing disbursement in Islamic banks. This study aims to examine this relationship using Islamic banking data from Indonesia. The research utilizes time series data from January 2005 to December 2023 and employs VAR and VECM data analysis techniques. The research findings show that the primary factor driving the growth of Islamic bank financing is the quality of Islamic bank financing itself. In addition, the research findings also show that shocks in macroeconomic indicators, including economic growth, exchange rates, inflation, and interest rates, affect the growth of Islamic bank financing. Consistent economic growth supports the expansion of Islamic bank financing, while high volatility in economic growth hinders it. Likewise, a strong exchange rate and stable inflation are conducive to the growth of Islamic bank financing, thus accelerating the financing prospects. Therefore, the government plays a vital role in maintaining the growth of Islamic bank financing through financial stability, such as economic growth, exchange rates, and inflation.

Keywords: Islamic bank financing; economic growth; inflation; exchange rates; interest.

JEL Classification: G21; O43; E31; E43; C10.

Introduction

The Indonesian economy has experienced significant developments in recent years. External and internal factors, including macroeconomic variables, profoundly impact the dynamics of the country's economy. In this context, the

Islamic banking sector is also experiencing changes that align with the overall economic transformation. Islamic banks in Indonesia have become essential players in the national financial system, making significant contributions to financing and fund allocation in various sectors. However, the sustainability of the growth and stability of this sector depends on various factors, including the dynamics of macroeconomic variables that impact demand, supply, and risks in the Islamic banking business (Butt *et al.* 2023).

Macroeconomic variables, including the rate of economic growth, prevailing interest rates, levels of inflation, and fluctuations in exchange rates, can substantially impact the operations and performance of Islamic banks, mainly their financing activities. Stable economic change can positively impact people's income and their ability to invest, thereby potentially increasing demand for financing (Hafizh *et al.* 2020; Riyadi *et al.* 2021). Economic growth is reciprocal with Islamic bank financing in the long term (Anwar *et al.* 2020; Naz and Gulzar 2022). The growth in economic activity will encourage demand for financing offered by Islamic banking (Ayyubi *et al.* 2017). Meanwhile, interest rates influence the financing level, ultimately impacting the financing itself (Hafizh *et al.* 2020; Rahmayanti *et al.* 2023). Inflation as an indicator of the value of money also impacts existing financing. Controlled inflation cannot encourage growth in Islamic bank financing (Mubarok *et al.* 2020; Nastiti and Kasri 2019). As a measure of economic competitiveness, exchange rates can also impact capital and investment flows, affecting Islamic bank financing (Mubarok *et al.* 2020).

However, the uncertainty and volatility in these macroeconomic variables can challenge the stability of Islamic bank financing growth. External and internal fluctuations can trigger the Islamic banking business's credit, liquidity, and operational risks (Kusnandar 2022). Therefore, it is crucial to analyze the impact of macroeconomic variables' volatility on the stability of Islamic bank financing growth to identify efforts that can be made to minimize risk and improve efficiency in this sector.

Within this specific framework, the primary objective of this comprehensive study is to delve into the intricate effects of various macroeconomic variables, including but not limited to economic growth, interest rates, inflation, and exchange rates, on the landscape of Islamic bank financing in the dynamic economic environment of Indonesia. A key focus of this investigation is to gain a profound understanding of how fluctuations in these macroeconomic factors influence the overall stability and trajectory of Islamic bank financing growth. The resultant findings from this rigorous analysis are anticipated to furnish invaluable insights that can be instrumental in shaping strategic risk management protocols and facilitating robust business expansion strategies for Islamic financial institutions, particularly in adapting to the continually evolving economic milieu.

This research endeavor will significantly contribute to the broader comprehension of the intricate interplay between macroeconomic variables and the domain of Islamic banking. With a heightened grasp of the multifaceted impacts exerted by these pivotal factors, key stakeholders, including regulatory bodies, industry practitioners, and scholarly researchers, can collaboratively explore and implement tailored measures to effectively combat risks and foster sustainable progress within the Islamic banking sector in Indonesia. The Indonesian economy has experienced significant developments in recent years. External and internal factors, including macroeconomic variables, profoundly impact the dynamics of the country's economy. In this context, the Islamic banking sector is also experiencing changes that align with the overall economic transformation. Islamic banks in Indonesia have become essential players in the national financial system, making significant contributions to financing and fund allocation in various sectors. However, the sustainability of the growth and stability of this sector depends on various factors, including the dynamics of macroeconomic variables that impact demand, supply, and risks in the Islamic banking business (Butt *et al.* 2023).

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The novelty of this study lies in the focus of the study to identify the volatility of macroeconomic variables on financing growth, which is the main activity of Islamic banks. The speed of financing growth in Islamic banks is the main determinant of Islamic bank growth. The complexity of the interaction between macroeconomic variables and the quality of financing on future financing is also one of the novelties of this study. The findings of this study are important for predicting the growth of Islamic banks in the future and their resilience to the economic conditions of a nation.

1. Literature Review

1.1. Islamic Bank Financing

Distribution of financing to Islamic banks should be the main activity in their operations. The primary nature of banks in the Islamic economic concept is financial intermediaries from those who have excess/surplus capital to those who lack/deficit capital (Junaeni *et al.* 2023). This intermediary function is also a form of responsibility of Islamic banks in encouraging the growth of the real sector in society. According to Amelia & Hardini (2017), the critical role of Islamic banks in channeling financing to the community is to create jobs for the small people who receive them and ultimately reduce the high unemployment rate. The greater the distribution of financing by Islamic banks, the more small people will be helped by their economy, thereby increasing community welfare (Dyatama and Yuliadi 2015).

Karim (2016) explains that existing financing in Islamic banks can be grouped into four (based on their objectives). First, financing is based on buying and selling principles, which usually use murabahah, qardh, and istishna contracts. Second, financing is based on the principle of profit sharing, which usually uses mudharabah and musyarakah. Third, financing is based on the rental principle, which usually uses an ijarah contract. Fourth is financing with complementary contracts, which Indonesian banking often uses salam contracts. Various Islamic bank financing schemes are considered fairer than conventional banks, encourages the growth of productive sectors in society (Saleem *et al.* 2025).

1.2. Economic Growth

A rise in economic activity can boost the production of goods and services, promoting economic expansion within a nation. Yearly economic growth can be assessed using a key indicator, Gross Domestic Product (GDP). GDP represents the value of the additional output of all producers in a country. It measures the worth of goods and services manufactured and bought by end users (final goods and services) during a specific time frame (Callen *et al.* 2020). GDP also shows economic growth from overall economic activity and describes the total monetary value of goods and services produced within a country's territory during a certain period, usually measured annually or quarterly. GDP can be measured using current (nominal) or constant (actual) prices. GDP at current prices reflects a country's economic resources and is used to identify shifts and changes in the economic structure.

Conversely, GDP at constant prices signifies the overall sector's economic growth rate yearly and is utilized to determine economic expansion. An increase in a country's economic output implies a growth in production activities, indicating expansion in the business sector with rising production levels. As production increases, there is a greater need for financial support, particularly from the banking sector, in the form of credit and financing. Therefore, higher production levels require increased financing. Consequently, the growth in

financing also increases. This illustrates the positive impact of economic growth on the growth of Islamic bank financing (Farah *et al.* 2025; Büyükbaşaran *et al.* 2022; Anwar *et al.* 2020). Economic growth has an impact on the ability of Islamic banks to carry out their role as financial intermediary institutions through financing and productive investment in the real sector (Saleem *et al.* 2025).

1.3. Inflation

Inflation is one of the essential factors to pay attention to in monetary policy. When inflation rates increase, monetary authorities often respond by raising interest rates. This monetary policy aims to control the inflation rate by increasing borrowing costs. The impact of this increase in interest rates is not limited to the conventional banking sector but applies to Islamic banks (Mubarok *et al.* 2020). This increase in interest rates increases financing costs for individuals, businesses, and investment projects. An increase in inflation followed by an increase in interest rates will impact decreasing financing in Islamic banks (Bareut 2024; Rahmayanti *et al.* 2023).

Per research conducted by Nastiti and Kasri (2019), a rise in the inflation rate can lead to a decrease in the volume of profit-sharing financing. This impact occurs because inflation indirectly influences the growth of financing. The volatility of inflation, manifested in changes in commodity and service prices, can diminish people's purchasing power, leading to reduced demand for financing. Consequently, an increase in inflation can cause shifts in the financial sector. This includes heightened financing costs and reduced demand for profit-sharing financing. Considering the impact of inflation is crucial when making decisions related to monetary and banking policies, particularly in the context of Islamic banking.

1.4. Exchange Rate

Exchange rates, which reflect how much one currency can be exchanged for another, are essential in the global economic context Chien *et al.* (2020). In the context of the exchange rate between the Indonesian rupiah and the United States dollar, fluctuations in this exchange rate have the potential to have a substantial impact on the total financing available within the Islamic banking sector (Mubarok *et al.* 2020; Rifai *et al.* 2017). The significance of currency exchange rates in financing agreements is also clarified by Lin *et al.* (2018). They point out that financing has the potential to impact trade outcomes and the volatility of exchange rates. On the other hand, Zeev (2019) explains that exchange rate depreciation can create opportunities for increasing access to profitable loans.

However, there are also exciting findings from Magud & Vesperoni (2015), which show that the level of flexibility in exchange rates can play an essential role in reducing the impact of financing changes. However, it is important to remember that exchange rate flexibility cannot always fully protect the economy from fluctuations in credit. Therefore, policies focusing on more flexible exchange rate settings can help regulate financing cycles by imposing additional capital charges. On the other hand, in the context of a more rigid exchange rate policy, measures to control excessive financing growth could provide more significant benefits. Thus, the exchange rate is an essential indicator in economic calculations and impacts how financing and economic growth can develop in Islamic banking.

1.5. Interest Rate

The reference interest rate of a bank is the rate that needs to be paid when exchanging one unit of currency for the same currency in the future. If interest rates increase substantially, this can cause additional financial burdens for the banking sector regarding interest payments. This can lead to a reduction in financial institutions' profits. However, the upside is that a rise in interest rates can lead to increased demand for financing from Islamic banks. When interest rates on loans increase in traditional commercial banks, customers may seek alternative financing options with more competitive costs, such as the profit-sharing rate offered by Islamic banks (Elkamiliati and Ibrahim 2014). An increase in interest rates can ultimately be advantageous to Islamic banks by increasing the amount of financing they provide (Bareut 2024; Citra and Suman 2022). A rise in the benchmark interest rates of banks may put pressure on the banking sector by increasing interest costs. Nevertheless, it may also present opportunities for Islamic banks to attract more customers seeking affordable financing. This illustrates market dynamics related to changes in interest rates within the banking industry.

On 19 August 2016, Bank Indonesia enhanced the monetary operations framework by introducing a new reference rate or policy interest rate called the BI 7-Day (Reverse) Repo Rate, replacing the BI Rate. According to the findings of Priyanto *et al.* (2016), interest rates impact Islamic bank financing. Pragmatically, Islamic banks continue to rely on conventional market interest rates as they lack specific references to determine profit-sharing levels. Conversely, Islamic banks still have to compete with traditional banks.

2. Method

This research employed a quantitative approach to analyze the impact of macroeconomic variables on the growth of Islamic bank financing in Indonesia. The study used Vector Autoregression (VAR) and Vector Error Correction Model (VECM) analysis methods. The secondary data used in this study included Islamic banking statistics from Bank Indonesia (Central Bank) and the Financial Services Authority, and macroeconomic variable data from the Central Bureau of Statistics. The data spanned a monthly period from 2005 to 2023.

The Islamic bank financing data (FIN) comprised Sharia Commercial Banks and Sharia Business Units. Additionally, economic growth (GDP) and inflation (INF) data were sourced from the Central Statistics Agency, with the periods of economic growth and inflation considered on a year-on-year basis. The interest rate (RATE) data used was the reference interest rate issued by the Central Bank, and the exchange rate (EXC) data represented the rupiah exchange rate against the American dollar, both obtained from Bank Indonesia.

The VAR/VECM analysis method sought to assess the influence of macroeconomic conditions on changes in Islamic bank financing in Indonesia over the short and long term (Engle and Granger 1987). The analysis process involved several stages, beginning with testing the stationarity of the data and determining the optimal lag for building an accurate VAR. Subsequent stages included stability testing, cointegration testing to establish long-term relationships between variables, and Granger causality testing to confirm two-way relationships between variables. The analysis was capped off by evaluating the Impulse Response Function (IRF) and Variance Decomposition (VD). The VECM equation used in this research is:

$$\Delta LnFIN_t = \rho_0 + \sum_{1}^{n} \rho_i \Delta LnFIN_{t-i} + \sum_{1}^{n} \sigma_i \Delta LnGDP_{t-i} + \sum_{1}^{n} \tau_i \Delta LnEXC_{t-i} + \sum_{1}^{n} \varphi_i \Delta INF_{t-i} + \sum_{1}^{n} \omega_i \Delta RATE_{t-i} + e_t$$

Where:

LnFIN = natural logarithm of Islamic bank financing
LnGDP = natural logarithm of gross domestic product
LnEXC = natural logarithm of exchange rates
INF = inflation rate
RATE = interest rate

3. Research Results

According to the data calculations, Table 1 provides descriptive statistics for Islamic bank financing (FIN), economic growth (GDP), exchange rate (EXCR), inflation rate (INF), and interest rate (RATE). The research results' descriptive statistics indicate that the lowest Islamic bank financing variable was observed at the start of the research period in January 2005, while the highest occurred in December 2023. Financing data describes the accumulated financing distributed by all Sharia banks in Indonesia. The average growth in Islamic bank financing distribution in Indonesia reached 1.74% monthly, and annual growth reached 23.43%. Sharia bank financing growth of this magnitude shows extraordinary results compared to banking credit growth in Indonesia, which was only 11.35% (year-on-year) until the end of December 2022 (Bank Indonesia 2023). The advancement of Islamic bank funding is double that of conventional bank loans, indicating substantial potential for growth in Islamic bank financing in Indonesia and suggesting that the market potential continues to expand.

Table 1. Statistic Descriptif

Variable	Mean	Std. Dev.	Max.	Min.
LnFIN	4.82363	1.13885	6.34300	2.46000
LnGDP	6.64096	0.59598	7.47900	5.33200
LnEXC	2.45348	0.20451	2.79500	2.14100
INF	5.52351	3.44908	18.38000	1.32000
RATE	6.54140	2.09684	12.75000	3.50000

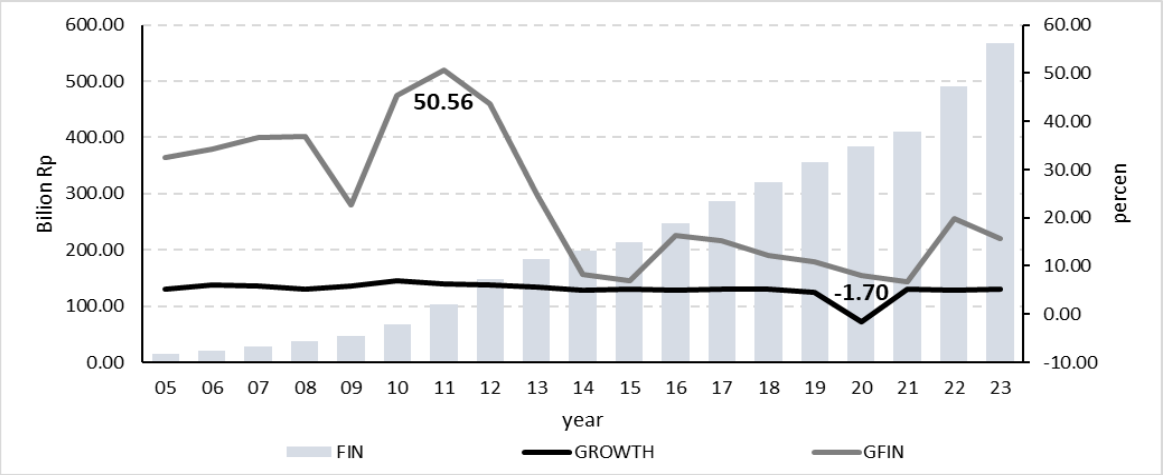
Source: calculated by authors based on (Financial Services Authority & Central Bureau of Statistics)

The growth and development of Islamic bank financing in Indonesia must be balanced with Indonesia's macroeconomic conditions. The growth movement in Islamic bank financing is more or less in line with trends in macroeconomic indicators (Figure 1). In the early 2010s, relatively high economic growth encouraged the growth

of sharia bank financing. Likewise, with stable economic growth in the mid-2010s, the development of sharia bank financing, although not as high as at the beginning, still shows a progressive increase. At the beginning of 2020, which coincided with the COVID-19 pandemic, Indonesia's economic growth was negative, and growth in Islamic bank financing reached its lowest point (8.6% in 2020 and 7.0% in 2021). Data movements of other macroeconomic indicators, such as inflation (INF), exchange rates (EXC), and interest rates (RATE), move almost in tandem with the other two variables (financing and economic growth). The highest inflation occurred at the end of 2005 and the lowest at the beginning of the Covid-19 period (August 2020).

Meanwhile, the highest exchange rate of the rupiah against the US dollar occurred at the start of COVID-19 (March 2020). At that time, the rupiah depreciated quite significantly against the US dollar. The rupiah exchange rate was still strong in the early 2010s, with the exchange rate per one USD reaching around 8,500. Meanwhile, the Indonesian government reduced interest rates to 3.5% during the COVID-19 pandemic, which is one form of government policy during times of crisis.

Figure 1. Economic Growth, Financing and Growth of Islamic Bank Financing



Source: Financial Services Authority (2005-2023)

Once the distinctive characteristics of each research variable during the observation period are comprehended, it becomes essential to conduct a stationarity test to ensure that the data does not demonstrate a definite pattern for each variable (Gujarati *et al.* 2017). The findings of the stationarity test, performed using the unit root test, are presented in Table 2. The unit root test utilized two methods, namely Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP). The t-statistical probability values from the two methods exhibit varying outcomes at the level and the first differential. The stationarity test utilizing the ADF method reveals that nearly all variables are non-stationary at the level, with only inflation (INF) demonstrating stationarity (probability value less than α).

Meanwhile, in the PP method stationarity test, only financing (LnFIN) and economic growth (LnGDP) are stationary. The stationary tests using the ADF and PP methods at the first differential level show different results. In the ADF method, the financing variables (LnFIN) and economic growth (LnGDP) are still not stationary, whereas in the PP method, all variables are stationary. Even though they are different, these results are enough to prove that all research variables have stationarity in the first differentiation (Gujarati *et al.* 2017).

Table 2. Results for the Stationarity Test

Variable	Level				First Difference			
	ADF		PP		ADF		PP	
	t-Stat	Prob.	t-Stat	Prob.	t-Stat	Prob.	t-Stat	Prob.
LnFIN	-2.4167	0.1383	-4.3111**	0.0005	-1.4272	0.5685	-12.923**	0.0000
LnGDP	-2.4201	0.1374	-3.5799**	0.0069	-2.3590	0.1548	-6.6233**	0.0000
LnEXC	-0.8843	0.7920	-0.8772	0.7941	-12.026**	0.0000	-14.284**	0.0000
INF	-3.1595*	0.0239	-2.5927	0.0959	-9.6313**	0.0000	-12.378**	0.0000
RATE	-2.4884	0.1196	-1.8236	0.3684	-4.8196**	0.0001	-6.5472**	0.0000

Notes: *significant at 5 percent; **significant at 1 percent
Source: developed by authors

The results in Table 2 illustrate that all research variables have reached the same level of stationarity, namely at the first difference level. This finding has important implications in the data analysis process because a consistent level of stationarity facilitates further interpretation and analysis of the data. Data analysis at the first difference level can avoid the complexity that may arise in the analysis process with different levels of stationarity. The first level of difference follows the (Engle and Granger 1987) approach, making it easier to estimate the VAR model more precisely. This is because the first level of difference eliminates trends or non-stationary patterns in the data so that analysis can focus more on the relationship between variables and their impact without being distorted by time trends. In other words, using the first level of difference in the data allows a more in-depth and accurate analysis of the relationships between variables in the VAR model. Before carrying out a stability test, the model with the optimum lag will be selected first.

Table 3. Selection of Optimal Lag in VAR

Lag	AIC	SC	HQ	LR	FPE
1	-14.11400	-13.72712*	-13.95775	-	5.11E-13
2	-14.32919	-13.55543	-14.01669	92.69234	4.12E-13
3	-14.62510*	-13.46446	-14.15635*	106.9407	3.07E-13*
4	-14.58459	-13.03707	-13.95960	37.37341	3.20E-13
5	-14.47443	-12.54003	-13.69318	22.92037	3.58E-13
6	-14.49264	-12.17136	-13.55514	46.59212	3.53E-13
7	-14.53443	-11.82627	-13.44068	49.69847*	3.40E-13
8	-14.50123	-11.40619	-13.25123	34.92501	3.54E-13

Source: developed by authors

After identifying the model with the most suitable lag, the subsequent stage involves conducting a stability assessment on the chosen optimal lag model. The findings of the optimal lag test from VAR estimation are presented in Table 3. The lag three yields the lowest Akaike information criterion (AIC), Hannan-Quinn information criterion (HQ), and final prediction error (FPE) values, while the tiniest Schwarz information (SC) values are observed at lag one, and the lowest likelihood ratio (LR) values are detected at lag seven. Of the five indicators, three reveal the optimal lag to be three, leading to the selection of lag three as the optimal lag length for VAR equation estimation (Widarjono 2017). The outcomes of the stability test at lag three are displayed in Table 4. The highest modulus value of the VAR model at lag three does not exceed one, indicating that the chosen model has successfully passed the stability test, meaning the VAR model at lag three is stable.

Table 4. VAR Optimal Lag Stability Test

Root	Modulus
0.922448	0.922448
0.767175	0.767175
0.582801 - 0.483656i	0.757351
0.582801 + 0.483656i	0.757351
-0.387885 - 0.607879i	0.721090
-0.387885 + 0.607879i	0.721090
-0.650469	0.650469
-0.061810 - 0.472979i	0.477001
-0.061810 + 0.472979i	0.477001
-0.331540 - 0.286951i	0.438474
-0.331540 + 0.286951i	0.438474
0.406031	0.406031
0.121793 - 0.352453i	0.372903
0.121793 + 0.352453i	0.372903
0.092072	0.092072

Source: developed by authors

The next step is determining which VAR or VECM model will be selected. The cointegration test is carried out to see whether there is a long-term relationship. However, before carrying out a cointegration test, it is necessary to test causality between variables. The causality test is carried out to determine whether each pair of research variables is related (Granger 1986). The causality test uses the Granger Causality test, the results of which can be seen in Table 5. Initial identification shows that economic growth, exchange rates, and interest rates influence Islamic bank financing. Even exchange rates and interest rates have a reciprocal influence on Islamic bank financing. Only inflation does not have a reciprocal influence on Islamic bank financing. Sharia bank financing does not affect economic growth, but economic growth influences Sharia bank financing. In this research, all macroeconomic variables do not have a reciprocal relationship. Economic growth has a unidirectional influence on exchange rates, inflation, and interest rates. Interest rates also affect inflation. The exchange rate does not influence inflation and interest rates.

The test results obtained using the Johansen test (Johansen 1988), which are documented in Table 6, provide valuable insight into the relationship between the variable Islamic bank financing (FIN) and the variables economic growth (GROWTH), inflation (INF), exchange rate (EXCR), and interest rates (RATE). In this context, the value of the trace statistic and the maximum eigenvalue at r = 0 (None) indicate the extent to which the variables are cointegrated. A result much greater than the relevant critical value indicates a strong relationship between these variables in the long run. In this case, cointegration shows that these variables influence each other over a long period. It is also essential to look at the p-values recorded in the table. A p-value more minor than the 1% significance level indicates that this cointegration did not occur by chance.

Table 5. Test Pairwise Causality: Granger

Null Hypothesis:	Obs	F-Statistic	Prob.
LNGDP → LNFIN	225	3.1857*	0.0247
LNFIN → LNGDP		0.8611	0.4621
LNEXC → LNFIN	225	13.093**	0.0000
LNFIN → LNEXC		4.3397**	0.0054
INF → LNFIN	225	1.4354	0.2334
LNFIN → INF		1.9493	0.1226
RATE → LNFIN	225	2.6346*	0.0507
LNFIN → RATE		4.8849**	0.0026
LNEXC → LNGDP	225	2.1610	0.0936
LNGDP → LNEXC		3.7773**	0.0113
INF → LNGDP	225	1.0977	0.3510
LNGDP → INF		2.7533*	0.0435
RATE → LNGDP	225	1.1573	0.3270
LNGDP → RATE		6.1262**	0.0005
INF → LNEXC	225	0.1970	0.8984
LNEXC → INF		2.1453	0.0955
RATE → LNEXC	225	1.0932	0.3529
LNEXC → RATE		2.2198	0.0868
RATE → INF	225	22.057**	0.0000
INF → RATE		2.3158	0.0767

Notes: *significant at 5 percent; **significant at 1 percent
Source: developed by authors

The available statistical evidence convincingly supports a robust and enduring connection between Islamic bank financing factors and key economic indicators such as economic growth, inflation, exchange rates, and interest rates. These findings form a robust foundation for further examination of how macroeconomic variables like economic growth, inflation, exchange rates, interest rates, and Islamic bank financing interact over the long term. Identifying long-term effects through cointegration tests confirms that the model used transitions from the VAR model to the VECM model, which can effectively account for both long-term and short-term effects simultaneously. The upcoming section will delve into a detailed analysis of macroeconomic variables' long-term and short-term impact on Islamic bank financing.

Table 6. Co-Integration Test: Johansen

Rank Test	Hipotesis: r	Eigen Value	Trace/Max Eigenvalue	Critical Value	p-value
Trace	None	0.2313	199.9864	69.8189	0.0000**
	1	0.2208	141.3321	47.8561	0.0000**
	2	0.1865	85.7031	29.7971	0.0000**
	3	0.0933	39.6853	15.4947	0.0000**
	4	0.0769	17.8447	3.84150	0.0000**
Maximum Eigenvalue	None	0.2313	58.6544	33.8769	0.0000**
	1	0.2208	55.6290	27.5843	0.0000**
	2	0.1865	46.0178	21.1316	0.0000**
	3	0.0933	21.8406	14.2646	0.0027**
	4	0.0769	17.8447	3.84150	0.0000**

Notes: *significant at 5 percent; **significant at 1 percent
Source: developed by authors

4. Discussions

The long-term VECM equation model of the influence of macroeconomic variables on Islamic bank financing is shown in Table 7. Three macroeconomic variables are economic growth, exchange rates, and inflation, which influence Islamic bank financing. The research results show that in the long term, economic growth, exchange rates, and inflation in the previous period will influence the growth of Islamic bank financing in the current period.

Table 7. Vector Error Correction Model: Long-Term Equations

Variable	Coefficient	t-Statistik
LNFIN(-1)	1.0000	
LNGDP(-1)	-3.030848	-10.6970**
LNEXC(-1)	2.865736	4.12417**
INF(-1)	-0.142619	-3.4579**
RATE(-1)	-0.005047	-0.0617
C	9.103165	

Notes: *significant at 5 percent; **significant at 1 percent
Source: developed by authors

The negative coefficient of the economic growth variable suggests that over the long term, the previous period's economic growth dampens the growth of Islamic bank financing. These results indicate that rapid economic growth slows the growth of Islamic bank financing, emphasizing that stability in economic growth has a more significant impact on the growth of Islamic bank financing than high economic growth volatility. These findings corroborate the research of Anwar *et al.* (2020), Butt *et al.* (2023), Naz & Gulzar (2022), and Riyadi *et al.* (2021), particularly in the long term.

The research suggests that fluctuations in exchange rates significantly impact the growth of Islamic bank financing. A strengthening exchange rate in the preceding period will spur growth in Islamic bank financing. In contrast, a weakening rupiah exchange rate against the dollar would likely slow down this growth. The study underscores the importance of exchange rate stability in supporting the movement of Islamic bank financing. These findings are consistent with previous research by (Zeev 2019) and (Mubarok *et al.* 2020), indicating that exchange rate movements are pivotal in shaping financing dynamics. However, it is essential to note that the findings diverge from those of (Nastiti and Kasri 2019), who posited that the exchange rate does not significantly impact Islamic bank financing.

Like economic growth, prolonged inflation from previous periods negatively impacts the growth of Islamic bank financing in subsequent periods. Continual price increases can instill reluctance among market players to invest in the real sector, consequently impeding the growth of Islamic bank financing, which relies on the real sector. Rahmayanti *et al.* (2023) corroborate these findings by indicating that an inflation upsurge is typically followed by an increase in reference interest rate, ultimately affecting customers who postpone their financing applications. Moreover, inflation influences a reduction in the volume of profit-sharing financing in Islamic banks, particularly those based on the real sector. Such financing is highly sensitive to price fluctuations, as inflation-

induced decreases in purchasing power lead to diminished demand for profit-sharing financing (Priyanto *et al.* 2016; Nastiti and Kasri 2019).

Table 8. Vector Error Correction Model: Short-Term Equations

Error Correction:	D(FIN)	
	Coefficient	t-Statistics
CointEq1	-0.0063	-2.4352**
D(LNFIN(-1))	-0.0011	-0.0174
D(LNFIN(-2))	0.1038	1.76213
D(LNFIN(-3))	0.3694	6.29238**
D(LNGDP(-1))	0.0922	1.03655
D(LNGDP(-2))	-0.0504	-0.4854
D(LNGDP(-3))	0.2614	2.86468**
D(LNEXC(-1))	-0.0554	-1.6434
D(LNEXC(-2))	-0.1044	-3.1534**
D(LNEXC(-3))	-0.0514	-1.4745
D(INF(-1))	-0.0005	-0.4885
D(INF(-2))	0.0012	1.16591
D(INF(-3))	0.0002	0.17161
D(RATE(-1))	-0.0053	-0.9289
D(RATE(-2))	-0.0028	-0.4580
D(RATE(-3))	-0.0058	-0.9909
C	0.0062	3.28529**
R-squared	0.4233	
Adj. R-squared	0.3787	
F-statistic	9.49630**	

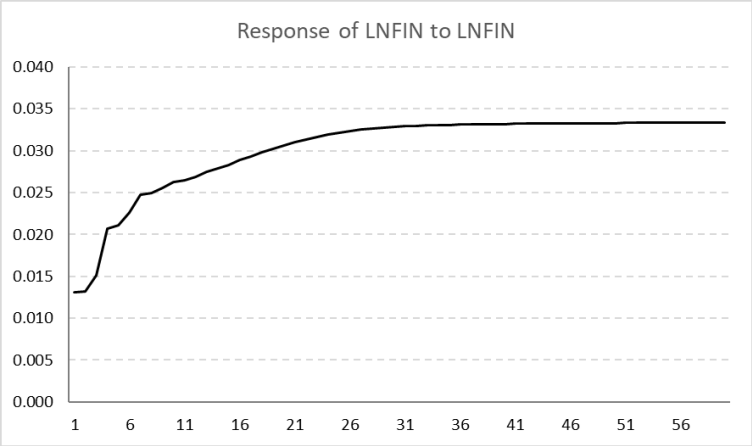
Notes: *significant at 5 percent; **significant at 1 percent
Source: developed by authors

The VECM model was used to analyze the short-term influence of macroeconomic variables on Islamic bank financing. The results, presented in Table 8, indicated a significant cointegration coefficient value of up to one percent, confirming the suitability of the VECM model for explaining the interaction of macroeconomic variables on Islamic bank financing growth in the short term. The model revealed that the growth of Islamic bank financing in the current period is influenced by the growth of Islamic bank financing in the three previous periods. However, the influence of Islamic bank financing on itself is short-term, as previous Islamic bank financing takes at least three months to influence future Islamic bank financing. The short-term effect of Islamic bank financing in the previous three months on Islamic bank financing in the current period was found to be significantly positive, indicating that an increase in financing in the previous three months results in a boost in financing in the current period.

Furthermore, it was observed that the positive impacts that occur do not last continuously. In the long term, financing growth will decline, ultimately leading to stability. Figure 2 illustrates the stability of the influence of Islamic bank financing on itself after 26 months, suggesting that after more than two years of volatility in financing growth, financing growth itself will stabilize.

This model also reveals that economic growth and exchange rate volatility significantly influence financing growth in the short term. Meanwhile, inflation and interest rates do not influence the growth of Islamic bank financing in the short term. This condition illustrates how macroeconomic variables contribute to changes in Islamic bank financing over a shorter period. This provides a deeper understanding of the dynamics of the relationship between these variables and can be used as a basis for designing more effective policy strategies in the future.

Figure 2. Impulse Response Function FIN against FIN



Source: developed by authors

The lag of economic growth's influence on financing growth is the same as that of financing's influence on financing itself in the short term. The influence of economic growth has the same duration of time in influencing Islamic bank financing as Islamic bank financing itself. At least economic growth will affect Islamic bank financing after three months. Economic growth influences the growth of Islamic bank financing significantly positively in the short term. The improving economic conditions in the last three months will encourage financing growth. Conversely, slowing economic growth will also reduce the distribution of financing to Islamic banks.

Changes influence the growth of Islamic bank financing in the short term in the exchange rate. Unlike economic growth, the exchange rate hurt financing in the previous period. If the dollar exchange rate strengthens against the rupiah, it will decrease the distribution of Islamic bank financing. In simple terms, a weaker domestic currency leads to reduced distribution of Islamic bank financing. Conversely, a more robust domestic currency will promote the growth of financing distribution to Islamic banks in the short term. The short-term influence of the exchange rate indicates that fluctuations strongly affect the domestic market in terms of currency exchange. This is mainly due to the high consumption of imported goods domestically. Therefore, when the exchange rate weakens, the demand for financing also decreases.

Conversely, inflation does not impact the growth of Islamic bank financing in the short term but does have an effect in the long term. The effects of inflation are only realized after a certain period. Fluctuations in the prices of new goods are typically experienced over a period longer than three months.

Furthermore, interest rates do not impact Islamic bank financing in the short or long term. The lack of influence of interest rates on Islamic bank financing indicates that customers do not consider interest rates a deciding factor when seeking credit at Islamic banks. This finding aligns with Hafizh *et al.* (2020) and Mubarok *et al.* (2020) conclusions. However, it contradicts the findings of Priyanto *et al.* (2016) and Šeho *et al.* (2020), suggesting that interest rates influence Islamic bank financing.

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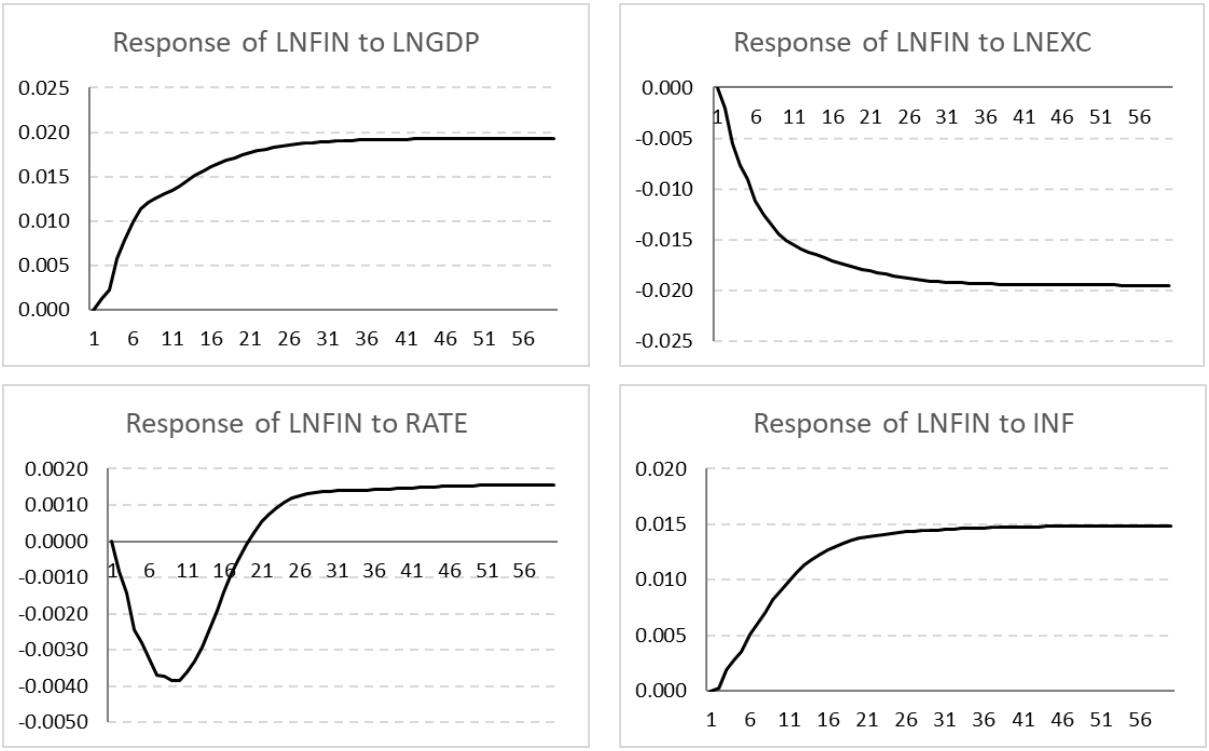
Figure 3. Impulse Response Function GDP, EXCR, RATE, and INF against FIN



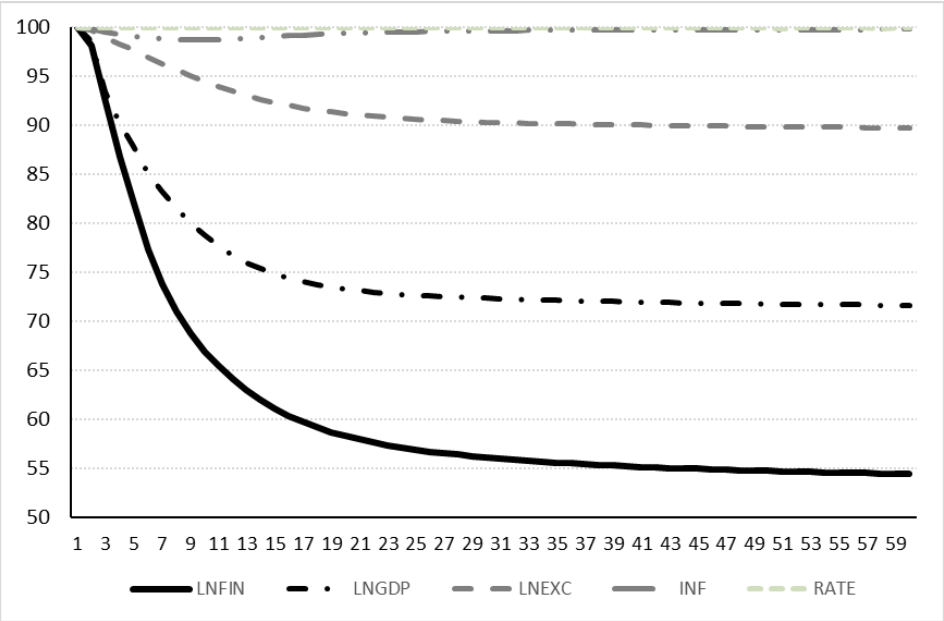
Source: developed by authors

The response of Islamic bank financing (FIN) to shocks that occur in economic growth (GDP), exchange rates (EXCR), interest rates (RATE), and inflation (INF) is illustrated in Figure 3. Based on the results of the impulse response function (IRF) analysis, the response of Islamic bank financing (FIN) to economic growth (GDP) has a relatively similar pattern to the response of Islamic bank financing itself. The response to economic growth was only visible within three months, with a relatively slow upward trend. The shocks resulting from the volatility of economic growth on Islamic bank financing within two years will still be high and stabilize after two years. This means that after two years of volatility, economic growth will constantly influence financing growth. Other macroeconomic variables also have relatively similar patterns to economic growth in terms of the duration of shock stability. Shocks that occur in all macroeconomic variables will stabilize after two years.

In general, the percentage influence of growth in Islamic bank financing is still dominated by growth in Islamic bank financing itself in previous periods. This means that the quality and quantity of Islamic bank financing in the future is determined by the quality and quantity of Islamic bank financing in the past. The better the quality of Islamic bank financing, the better the quality will be in the future, and the quantity will continue to increase. This is from the percentage bar chart of the financing variable (LNFIN) in Figure 4. The Variance Decomposition of LNFIN is consistently above 54%. Gradually, in the following months, economic and exchange rate growth took relatively the same role in influencing the growth of Islamic bank financing. Both remained at the end of the observation period at 17% - 18%. The composition of the influence of interest rates compared to other macroeconomic variables is the smallest. The percentage does not reach 1%. Overall, the variance decomposition illustration in Figure 4 is consistent with the results of previous data analysis. This result also

confirms that successive growth in financing in Islamic banks is influenced by financing growth, economic growth, exchange rate growth, inflation, and ending with the reference interest rate.

Figure 4. Variance Decomposition of FIN



Source: developed by authors

Conclusions and Further Research

Shocks from macroeconomic variables such as economic growth, exchange rate fluctuations, and inflation tend to disrupt increases in Islamic bank financing. Economic growth shocks positively impact the growth of Islamic bank financing in the short term and tend to suppress the growth of Islamic bank financing in the long term. Exchange rate fluctuations disrupt the growth of Islamic bank financing both in the long and short term. Strengthening exchange rate stability will encourage growth in Islamic bank financing, while a weakening exchange rate will hamper growth in Islamic bank financing. Stable inflation will encourage Islamic bank financing in the long term, but inflation fluctuations in the short term do not affect the growth of Islamic bank financing.

Apart from macroeconomic variables, the quality of Islamic bank financing itself is also a determining factor in the growth of Islamic bank financing. The influence is higher than macroeconomic variables. The better the quality of Islamic bank financing distribution is, the better the future development of Islamic bank financing will be. However, the impact on the quality of this financing will be positive in the long term. In the short term, the funding quality will be detrimental to the financing itself.

One of the policy recommendations that refers to the results of this research is the need for the government's role in maintaining economic stability. Several indicators that can reflect financial stability, such as economic growth, exchange rates, and inflation, need to receive more attention to encourage the development of Islamic bank financing. If an economic shock occurs, government intervention must be carried out through a stability policy, as was done during the COVID-19 pandemic. One thing that has proven effective is the Indonesian banking financing/credit restructuring policy package.

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Credit Authorship Contribution Statement

Muhammad Iqbal: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Validation, Visualization.
Dian Kurniawati: Conceptualization, Project administration, Data curation, Validation, Visualization, Funding acquisition.

Ridarmelli: Investigation, Project administration, Data curation, Validation, Writing – review and editing, Funding acquisition**.**
Irawati Junaeni: Investigation, Formal analysis, Supervision, Writing – review and editing**.**

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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The Impact of Macro-Economic Indicators on Corporate Investment Decisions. A Financial Management Approach

Jamal VALIPOUR
Department of Management, Financial Management
Azad University, Tehran, Iran
Jamal.vp@gmail.com

Zahra NAJAFABADIPOUR
Department of Business Management, Faculty of Management
Islamic Azad University, Firoozkooh, Iran
Zahranajafabadi6565@gmail.com

Samira MOHAMADI
Department of Business Administration, Santamonica Training Academy
Hermes elm Gostar Institute, Esfahan, Iran
samiramohamadiir@smcertificate.com

Pourya ZAREEIHEMAT
Department of Business Management
Faculty of Management, Kermanshah Branch
Islamic Azad University, Kermanshah, Iran
Pourya.zareihemat@gmail.com

Hero ISAVI
Faculty of Management
Islamic Azad University, Firoozkooh, Iran
Corresponding author: Hero.Isavi@iau.ac.ir

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Abstract: This study investigates the impact of key macroeconomic indicators - including inflation, interest rates, and economic growth - on corporate investment decisions across three major industries: technology, automotive, and energy. Utilizing quarterly data from 2019 to 2024 and applying econometric techniques such as Vector Autoregression (VAR) and Impulse Response Functions (IRFs), the analysis explores how these macroeconomic shocks influence investment behavior. The results reveal that economic growth above the 3% threshold significantly boosts investment in the automotive sector. Conversely, a 1% increase in interest rates leads to a sharp short-term decline in investment within the technology sector, highlighting its sensitivity to monetary tightening. Additionally, the energy sector exhibits a marked reduction in investment levels when inflation exceeds 5%, reflecting the adverse effects of rising input costs and economic uncertainty. These findings underscore the critical role of macroeconomic conditions in shaping investment strategies, particularly in capital-intensive industries.

Keywords: sectoral investment response; macroeconomic shocks; monetary policy; inflation sensitivity.

JEL Classification: E31; E27; E52; C15.

Introduction

Corporate investment decisions are central to both firm growth and broader economic expansion. Macroeconomic volatility - characterized by fluctuations in inflation, interest rates, and GDP growth - plays a crucial role in shaping these decisions. Early seminal research established that financing constraints significantly affect investment behavior (Fazzari, Hubbard, & Petersen, 1988; Abbasi *et al.* 2024). In addition, Keynes's (1936) accelerator

principle suggests that shifts in aggregate demand can trigger disproportionate changes in investment, while Oh *et al.* (2007) q theory highlights that firms tend to invest more when their market valuations exceed replacement costs.

More recent studies have reinforced these theoretical perspectives by documenting the sensitivity of corporate investment to changes in the economic environment. For instance, Campello, Graham, and Harvey (2010) demonstrated that during financial crises, firms experiencing tighter financing conditions drastically reduce their investment levels. Similarly, Bernanke and Gertler (1988) emphasized that increased borrowing costs in adverse macroeconomic conditions can constrain corporate investment.

Empirical evidence using panel data methods further supports these theoretical insights. Love (2003) found that financial development is positively correlated with dynamic investment behavior, indicating that firms operating in more stable financial environments are better able to invest. Steigum (1983) also underscored the role of capital costs in determining investment levels, while Dib (2010) illustrated how credit market imperfections amplify the cyclical nature of investment.

Building on these foundations, recent research has examined how macroeconomic factors influence investment decisions across different industries. For example, Farooq, Ahmed, and Khan (2020) used a generalized method of moments approach to show that higher inflation and interest rates are associated with reduced investment, whereas robust GDP growth tends to stimulate investment activity. Moreover, Khan *et al.* (2018) provided evidence that financial development can mitigate the adverse effects of financing constraints on corporate investment.

This study addresses this gap by examining how key macroeconomic indicators - inflation, interest rates, and GDP growth - affect corporate investment decisions in three critical sectors: technology, automotive, and energy. Using quarterly data from 2019 to 2024 for 100 publicly listed firms and applying advanced econometric methods such as Vector Autoregression (VAR) and Impulse Response Functions (IRFs), the research explores sectoral heterogeneity in response to macroeconomic shocks.

The novelty of this study lies in its disaggregated, sector-based approach, which allows for more precise insights into how macroeconomic conditions influence investment across different industries. Its significance rests in providing actionable knowledge for corporate financial managers, investors, and policymakers aiming to formulate adaptive investment strategies in the face of economic volatility.

The primary objective of this study is to analyze the impact of macroeconomic indicators on corporate investment decisions across selected industries and to identify sectoral variations in their responsiveness to these indicators.

1. Research Background

The literature on corporate investment decisions has evolved from early theoretical models to sophisticated empirical analyses that incorporate both firm-level and macroeconomic determinants. Early seminal works laid the theoretical foundation: Keynes's (1936) accelerator principle posits that changes in aggregate demand drive investment, while Steigum (1983) emphasized the role of capital costs in determining investment behavior. Oh et al (2007) further advanced this discourse by introducing the concept of Oh *et al.* suggesting that firms invest more when their market valuations exceed the replacement costs of their capital.

Empirical investigations soon followed. Fazzari, Hubbard, and Petersen (1988) provided pivotal evidence that investment is highly sensitive to internal cash flows, highlighting the critical role of financing constraints in investment decisions. Bernanke and Gertler (1988) expanded on this by demonstrating that credit market imperfections - manifested in higher borrowing costs - can significantly depress investment, particularly during economic downturns. Complementing these findings, Dib (2010) illustrated how cyclical fluctuations in credit conditions can amplify the variability of investment.

Subsequent research applied advanced econometric techniques to further unpack these relationships. Love (2003) employed a panel VAR framework to capture the dynamic interactions influencing investment behavior, underscoring the importance of financial development. Campello, Graham, and Harvey (2010) documented that financial constraints become especially binding during periods of crisis, leading to more pronounced reductions in investment. More recently, Farooq, Ahmed, and Khan (2020) utilized a generalized method of moments (GMM) approach to investigate the impact of macroeconomic factors on corporate investment decisions across 12 Asian countries, reinforcing the significance of macroeconomic stability. Additionally, Khan *et al.* (2018) demonstrated that robust financial development can mitigate the adverse effects of financing constraints on investment.

Broader geopolitical and policy contexts have also been shown to influence investment climates. Ghalamkari (2024a) discusses how deviations from classical strategic frameworks in China's Middle East policy - particularly the Tehran-Riyadh duality - affect regional stability and, consequently, economic decision-making. Similarly, Ghalamkari (2024b) explores Russia's regional realignment and its implications for economic cooperation with Iran. In the context of Turkey, Omidi and Ghalamkari (2019) emphasize the role of development-oriented foreign policy in facilitating economic growth between 2002 and 2017, further reinforcing the need to view investment decisions through both economic and geopolitical lenses.

In addition to these foundational works, more recent studies have expanded the scope of investigation into areas closely linked to corporate investment decisions. For instance, Valipour *et al.* (2023) designed a model of credit risk management within the network of after-sales service companies, highlighting how the integration of financial components and meta-innovative approaches can enhance risk management - a increasingly pertinent factor in investment decision-making. Similarly, Kazemian and Sanusi (2015) examined the relationship between earnings management and ownership structure in Iran, comparing firms with institutional versus individual investors, which adds depth to our understanding of how internal financial strategies influence investment outcomes. Taherinia *et al.* (2024) further contributed by exploring capital structure adjustment speed and expected returns, emphasizing the moderating role of information asymmetry in investment decisions. Complementing these insights, Valipour (2011) investigated the impact of privatization on earnings management in developing countries, providing an important perspective on the effects of policy changes on corporate financial behavior.

Moreover, the application of advanced analytical and computational techniques has broadened the empirical toolkit available for studying investment decisions. Recent contributions by Zareeihemat *et al.* (2025) and Salehipour *et al.* (2025) have demonstrated the use of reinforcement learning-based feature selection approaches in forecasting stock market volatility, thereby offering novel methods that can enhance predictive accuracy in investment environments. Furthermore, Wang and Zareeihemat (2025) introduced a novel Q-learning and mutual learning-based artificial bee colony algorithm for multi-channel advertising budget allocation, linking strategic marketing decisions to broader corporate investment strategies. Additionally, Valipour (2024) investigated the relationship between the quality of management's expected profit and equity, shedding light on internal financial expectations as a determinant of firm value and potential investment behavior.

Despite these advances, several gaps remain in literature. Many studies have predominantly focused on firm-specific determinants or have utilized aggregate data, often overlooking heterogeneity across different industries. Furthermore, much of the research is region-specific, limiting the generalizability of the findings to other economic contexts. These limitations point to the need for studies that compare the impact of macroeconomic indicators on corporate investment across various sectors and more recent periods.

The present research addresses these gaps by examining a sample of 100 companies from the technology, automotive, and energy sectors over the period 2019–2024. By employing a Vector Auto Regression (VAR) model, this study aims to capture the dynamic interrelationships between macroeconomic indicators and sector-specific investment behaviors, thus positioning the current research as a significant extension of the existing literature.

2. Experimental Methods

This study employed a quantitative approach using time-series data collected from reputable financial databases, including the International Monetary Fund (IMF), Yahoo Finance, and Bloomberg. To assess the dynamic relationship between macroeconomic variables (interest rates, inflation, and economic growth) and corporate investment decisions, we applied the Vector Auto Regression (VAR) model. The VAR model is particularly suited for capturing the interdependencies among multiple time-series variables, allowing each variable to be treated as endogenous and modeled as a function of its lags and those of other variables in the system.

Before implementing the VAR model, stationarity tests (Augmented Dickey-Fuller test) were conducted to ensure the suitability of the time-series data. All variables were transformed into their stationary forms, and the optimal lag length was determined using the Akaike Information Criterion (AIC). The Granger causality test was also used to examine the directionality of relationships between macroeconomic indicators and investment levels. Furthermore, impulse response functions (IRFs) and variance decomposition analyses were employed to assess the magnitude and timing of responses in investment behavior following shocks to macroeconomic variables.

3. Research Results

To assess the influence of macroeconomic indicators on corporate investment decisions, a Vector Auto Regression (VAR) model was applied to quarterly data spanning from 2019 to 2024. The analysis encompasses three major industries: technology, automotive, and energy. Before estimation, all series were tested for stationarity using the Augmented Dickey-Fuller test, and optimal lag selection was conducted via the Akaike Information Criterion (AIC). This section presents the VAR model results, followed by impulse response functions (IRFs) and graphical illustrations that highlight sector-specific investment sensitivities.

Table 1. VAR Model Coefficient Estimates by Sector

Variable	Technology Sector	Automotive Sector	Energy Sector
Interest Rate (%)	-0.024 (p = 0.03)	-0.010 (p = 0.15)	-0.015 (p = 0.08)
GDP Growth (%)	0.005 (p = 0.25)	0.076 (p = 0.01)	0.003 (p = 0.30)
Inflation Rate (%)	0.002 (p = 0.60)	-0.005 (p = 0.50)	-0.041 (p = 0.04)

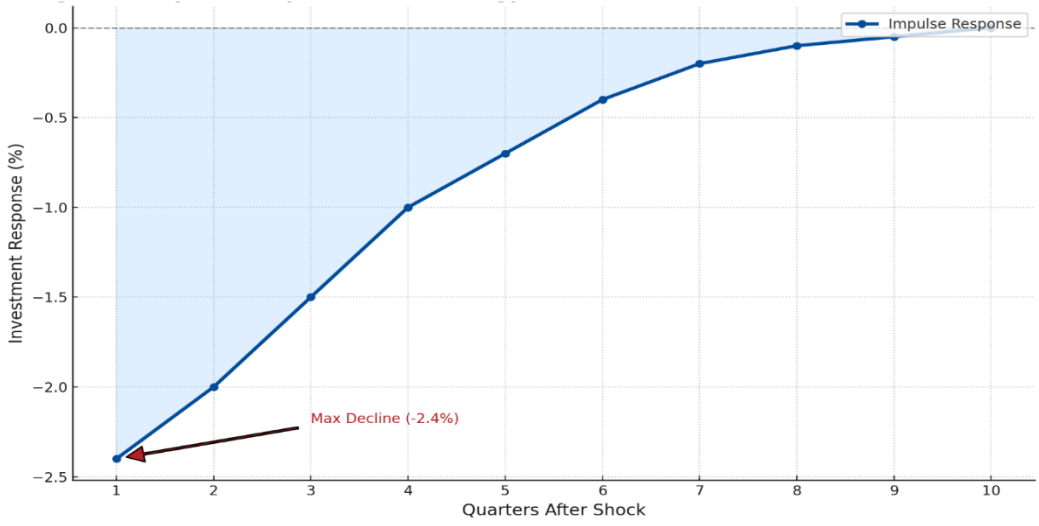
As shown in Table 1, the technology sector demonstrates a statistically significant negative response to interest rate hikes, where a 1% increase leads to a 2.4% decline in investment (p = 0.03). For the automotive sector, investment exhibits a strong positive correlation with GDP growth; a 1% increase in GDP leads to a 7.6% rise in investment (p = 0.01). Meanwhile, the energy sector is negatively affected by inflation, specifically, inflation rates exceeding 5% are associated with a 4.1% reduction in new investments (p = 0.04).

3.1 Impulse Response Analysis

Impulse response functions (IRFs) were generated to further examine the dynamic effects of shocks. Figure 1 presents the IRF for the technology sector, showing how investment responds over a 10-quarter horizon following a 1% shock in interest rates.

According to Figure 1, a 1% increase in interest rates leads to an immediate and sharp decline in technology sector investment. The strongest negative response - approximately -2.4% - occurs in the first quarter following the shock. This adverse effect gradually diminishes over time, with the impact approaching zero by the tenth quarter. This pattern reveals that technological investments are highly sensitive to monetary policy in the short term, while the long-term effects are mitigated as the sector adjusts.

Figure 1. Impulse Response Function for Technology Sector Investment to a 1% Interest Rate Shock



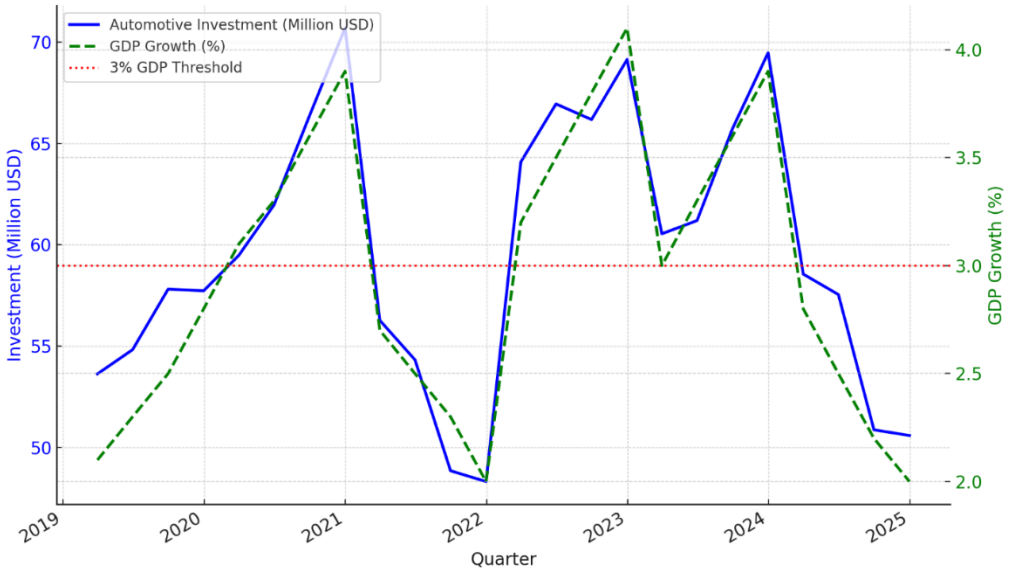
3.2 Time Series and Comparative Analysis

Automotive Sector

Figure 2 displays a time-series line chart that compares quarterly investment levels in the automotive sector with quarterly GDP growth rates. The chart clearly shows that when GDP growth exceeds the 3% threshold, investment increases significantly, consistent with the VAR estimation.

According to Figure 2, automotive sector investment exhibits a strong positive correlation with GDP growth. During periods when economic growth exceeds 3%, investment levels in the automotive industry significantly rise. This co-movement suggests that expansionary economic conditions lead to improved demand expectations, higher capacity utilization, and increased capital expenditures in the automotive sector.

Figure 2. Quarterly Automotive Sector Investment vs. GDP Growth (2019–2024)

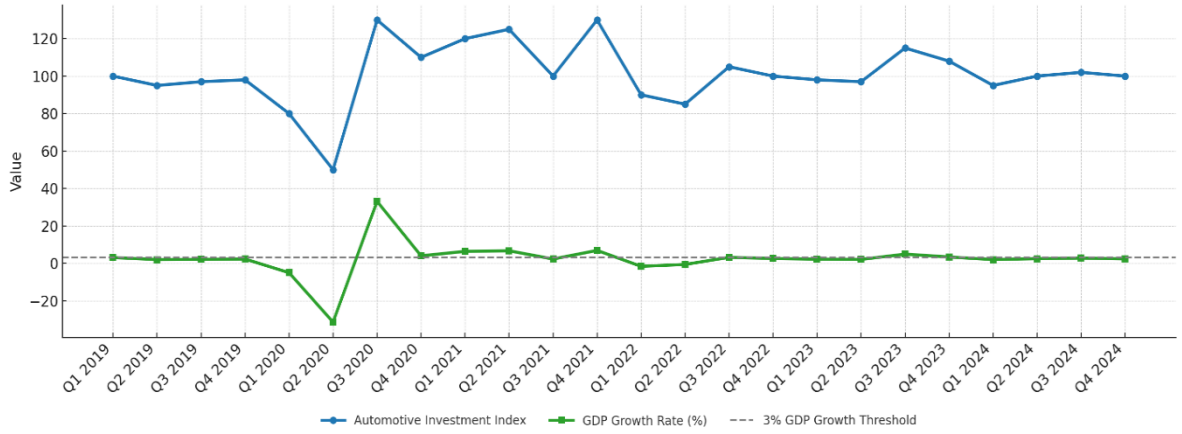


Energy Sector

Figure 3 is a bar chart that depicts the sensitivity of investment in the energy sector to varying inflation rates. The chart categorizes inflation into ranges, and it is evident that when inflation exceeds 5%, investment falls by approximately 4.1%.

According to Figure 3, investment in the energy sector displays a clear negative sensitivity to higher inflation rates. While inflation levels below 3% show negligible impact, inflation above 5% correlates with a decline in investment of approximately 4.1%. This trend indicates that rising input and operational costs associated with high inflation act as a deterrent to capital spending within the energy industry.

Figure 3. Bar Chart of Energy Sector Investment Sensitivity to Inflation Rates



4. Discussions

The findings of this study offer important insights into the sector-specific effects of macroeconomic shocks on investment behavior. The results highlight the heterogeneous sensitivity of the technology, automotive, and energy sectors to fluctuations in interest rates, GDP growth, and inflation, respectively. These differentiated responses have crucial implications for policymakers and investors aiming to navigate a volatile economic landscape.

The impulse response analysis revealed that the technology sector is particularly vulnerable to monetary tightening, with investment dropping sharply in the immediate aftermath of a 1% interest rate shock. This aligns with earlier research suggesting that capital-intensive and innovation-driven sectors are more interest-rate sensitive due to their reliance on external financing (Hauzenberger *et al.* 2025; Gulen & Ion, 2016; Ahmadirad, 2024a). The gradual moderation of the effect over subsequent quarters suggests that while monetary shocks have strong short-term implications, adaptive expectations and market adjustments help dampen long-term impacts.

In contrast, the automotive sector exhibits a strong pro-cyclicality concerning GDP growth. As observed in Figure 2, investment in this sector expands significantly during economic upturns. This pattern supports findings by Bloom (2009), who emphasized that investment in durable goods industries is closely tied to output expectations and consumer demand cycles. Given the automotive sector's dependence on consumer confidence and discretionary income, its responsiveness to economic growth is both expected and consistent with macroeconomic theory (Bernanke, Gertler, & Gilchrist, 1999; Salajeghe *et al.* 2012; Abdoh Tabrizi *et al.* 2013).

The energy sector, however, shows a markedly different profile. As seen in Figure 3, energy investment contracts significantly in response to rising inflation, particularly beyond the 5% threshold. This inverse relationship likely reflects the increased input and capital costs faced by firms operating under inflationary pressures, consistent with the cost-push theory of inflation. Empirical studies such as those by Fama and Schwert (1977) and Aghion *et al.* (2009) have shown that inflation distorts investment incentives by increasing uncertainty and reducing real returns, particularly in sectors with heavy operational and infrastructure-related expenditures like energy.

Taken together, these findings underscore the importance of tailored policy measures**.** A one-size-fits-all approach to macroeconomic management may lead to unintended consequences, especially in sectors that are highly interest rate or inflation-sensitive. For instance, aggressive rate hikes aimed at curbing inflation could disproportionately hinder innovation and technological progress if not carefully calibrated. Similarly, counter-cyclical fiscal policies might be more effective in stabilizing automotive investment during downturns.

In sum, the sectoral heterogeneity uncovered in this study highlights the complex interplay between macroeconomic variables and investment decisions. Future research may benefit from a deeper exploration of firm-level data to uncover how internal characteristics - such as leverage, R&D intensity, or export orientation - mediate the effects observed here.

Conclusions and Further Research

This study provides compelling evidence of the differentiated impact of macroeconomic shocks across key industrial sectors. The findings indicate that while the technology sector is highly sensitive to interest rate changes, the automotive sector responds predominantly to fluctuations in GDP growth, and the energy sector is particularly vulnerable to inflationary pressures. These sector-specific dynamics highlight the need for nuanced economic policies that consider the unique structural characteristics and financial dependencies of each sector. Understanding these variations is essential for designing effective monetary and fiscal strategies that foster investment stability and sustainable economic growth.

Credit Authorship Contribution Statement

Jamal Valipour: Methodology, Providing Survey, Formal Analysis.
Zahra Najafabadipour: Methodology, Providing the Survey, Data Curation.
Samira Mohamadi: Validation, Formal Analysis, Writing.
Pourya Zareeihemat: Writing and Editing, Visualization.
Hero Isavi: Conceptualization, Project administration, Writing and Supervision

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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The Power of Short Video Content on TikTok Shop Consumers in Viet Nam

Giang NGUYEN THI PHUONG
Industrial University of Ho Chi Minh City, Viet Nam
ORCID: 0000-0002-3662-9797
nguyenthiphuonggiang@iuh.edu.vn

Tan THAI DONG
Industrial University of Ho Chi Minh City, Viet Nam
ORCID: 0009-0005-5804-3294
tantd24031@pgr.iuh.edu.vn

Duy NGUYEN BINH PHUONG
Industrial University of Ho Chi Minh City, Viet Nam
ORCID: 0000-0003-1136-6609
nguyenbinhphuongduy@iuh.edu.vn

Nhu TRAN VU QUYNH
Industrial University of Ho Chi Minh City, Viet Nam
22637991.nhu@student.iuh.edu.vn

Ngan TRUONG THANH
Industrial University of Ho Chi Minh City, Viet Nam
22648671.ngan@student.iuh.edu.vn

Lien NGUYEN THI
Industrial University of Ho Chi Minh City, Viet Nam
22635221.lien@student.iuh.edu.vn

Phuong NGUYEN NGOC THAO
Industrial University of Ho Chi Minh City, Viet Nam
22635141.phuong@student.iuh.edu.vn

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Abstract: This study focuses on exploring how short-form video content on TikTok Shop goes beyond being a mere promotional tool, to become a powerful catalyst for consumer shopping behavior in Ho Chi Minh City. By surveying 766 consumers using a questionnaire refined from previous studies, the study sheds light on the factors that positively impact shopping decisions, including engagement, information, entertainment, trustworthiness, and usefulness. The collected data is analyzed through three main steps: descriptive statistical analysis, measurement model evaluation and structural model validation via SMARTPLS-3 software and SPSS 27 additional support software. The results show that short video content has the ability to increase the perceived value of consumers, significantly affecting purchase intentions and behaviors on this platform. From the above findings, the study not only helps to identify the core factors that impact purchase behavior but also proposes specific strategies to optimize video content and improve online business efficiency. Therefore, the research brings practical contributions to businesses doing business on TikTok Shop and other social media platforms in improving user experience and increasing commercial value.

Keywords: TikTok shop; purchase behavior; short video content; digital marketing; e-commerce.

JEL Classification: M31; L81; D91; C10; A12.

Introduction

The exponential development of digital technologies has fundamentally transformed consumer behavior and retail strategies worldwide. In recent years, Vietnam has emerged as one of the most dynamic e-commerce markets in Southeast Asia. According to YouNet ECI (2024), the Gross Merchandise Value (GMV) of major e-commerce platforms in Vietnam - including Shopee, Lazada, TikTok Shop, and Tiki - reached USD 13.82 billion in 2024, representing a 40% increase compared to the previous year. The country's e-commerce market is expected to surpass USD 25 billion, accounting for approximately 9% of national retail sales.

Among these platforms, TikTok Shop has rapidly solidified its market position by combining short-form video content with integrated online shopping features. In 2024, TikTok Shop alone achieved a GMV of USD 3.8 billion, commanding a 26.9% market share and reflecting a remarkable 99% growth in revenue (YouNet ECI, 2024). This model - often described as “shoppertainment” - merges entertainment with commerce, creating an immersive shopping experience that particularly appeals to Generation Z consumers, who are digital natives and active users of social platforms.

Prior literature has increasingly emphasized the power of short-form videos in influencing consumer behavior. For instance, Minh *et al.* (2024) and Meng *et al.* (2024) found that user-generated video content significantly affects online purchase intentions, especially when mediated by factors such as perceived trust, engagement, and value perception. Wu *et al.* (2024) further suggested that short videos stimulate consumer interest by enhancing emotional appeal and delivering product information efficiently. These findings align with the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM), which posit that attitudes and perceived usefulness are critical determinants of behavioral intention (Ajzen, 1991; Davis, 1989).

Despite TikTok Shop's growing prominence, empirical research on its influence on consumer purchase behavior remains limited, particularly in the Vietnamese context. Ho Chi Minh City, as a major urban hub, has one of the highest TikTok user bases in the country. Yet, the mechanisms by which video content characteristics influence purchasing decisions on TikTok Shop are still underexplored. This research gap is particularly salient given that ineffective content strategies may lead to poor consumer engagement, reduced trust, and ultimately, lost sales opportunities for businesses.

In recent years, TikTok Shop has emerged as a potential social commerce platform, especially in Vietnam – where there is a young population structure, high level of social media use, and rapidly changing consumer trends. Ho Chi Minh City, as a dynamic economic hub, is witnessing a sharp increase in shopping behavior through short-form videos and livestreams. According to the We Are Social & Meltwater report (2024) TikTok currently has more than 50 million users in Vietnam, and TikTok Shop recorded a 3-fold increase in orders in 2023 (Thanh Minh, 2024).

In particular, in the first quarter of 2025, TikTok Shop Vietnam recorded revenue growth of nearly 113.8% over the same period last year, helping to increase the market share from 23% to 35% (Vietdata, 2025). This tremendous growth clearly reflects a new consumer trend: consumers are increasingly attracted to short, highly interactive forms of content, and at the same time want an intuitive and entertaining shopping experience.

However, despite being strongly applied in practice, short-form video content on TikTok Shop has not been fully explored from an academic perspective. Currently, very few studies in Vietnam have analyzed content factors such as interactivity, information, entertainment, reliability and usefulness – as well as their indirect influence mechanisms on perceived value, advertising value, purchase intent, etc. and actual purchasing behavior.

Therefore, the novelty of this study lies in building a comprehensive theoretical model, integrating the above content elements along with intermediate variables and output behaviors, and testing it with the PLS-SEM structural equation model – a powerful analytical tool and suitable for the context of modern consumer behavior research.

In practical terms, the research results can help businesses build and optimize video content strategies on TikTok Shop – the platform with the fastest e-commerce growth rate today. Especially in Ho Chi Minh City. Understanding which elements in the video really promote purchase behavior will help businesses increase the efficiency of reaching customers, improve conversion rates and make the most of social commerce opportunities.

Furthermore, it advances theoretical understanding by integrating models of technology acceptance, planned behavior, and advertising value within the context of a fast-growing Southeast Asian market.

In short, the topic not only contributes to filling the academic gap in short-form video marketing in the social commerce environment but also brings high application value to businesses that are participating in or intend to invest in TikTok Shop in the Vietnamese market.

1. Literature Review

1.1. Related Concepts

TikTok is considered the leading platform for short-form video content. While other platforms offer a variety of content formats, TikTok focuses primarily on short-form videos, typically between 15 and 60 seconds or possibly longer. The app has transformed the way users' approach and create content, encouraging creators to produce short, engaging, and creative videos that are different from traditional longform content on other platforms. These videos focus on conveying the message quickly and efficiently, grabbing the viewer's attention in a short time. Additionally, short video content on TikTok is used to introduce products, services, or brands to consumers through the social media platform (Vui, 2024).

The term "consumer purchasing behavior" refers to the entire process from investigation, procurement, use, evaluation to spending on goods and services to meet individual needs. According to Philip Kotler, these are actions related to finding, purchasing, using, and evaluating products and services. The American Marketing Association emphasizes that this process includes decisions before, during, and after a purchase.

TikTok Shop is an e-commerce platform integrated into the TikTok app, allowing brands, sellers, and content creators to introduce, promote, and sell products directly through short videos, live streams, or online stores. Consumers can view product information, interact with sellers, and make shopping transactions right on the app without switching to another platform, according to the TikTok Shop Ecommerce Platform E-commerce Module Presentation Topic in 2025. In addition, TikTok Shop is a combination of entertainment and commercial elements, creating an attractive and convenient shopping experience for users.

1.2. Theoretical Models

The origin and history of TRA development was developed to better understand the relationship between attitudes, intentions, and behaviors (Fishbein & Ajzen, 1977). According to the theory of rational action (TRA), behavior can be predicted largely by an individual's attitude towards the performance of that behavior, through the influence of behavioral intent.

Planned Behavior Theory (TPB) (Ajzen, 1991) is an extension of Reasoned Action Theory (TRA) (Fishbein & Ajzen, 1977), which became necessary due to the latter model's inability to handle behaviors without the individual's ability to control the will completely. According to Ajzen (1991), the fact that an individual performs a certain act is determined by the person's intention to perform that act. For the TPB, attitudes towards target behavior, subjective norms of engaging in behavior, and perceived behavioral control are thought to influence internet purchase intent and behavior.

The Technology Acceptance Model (TAM) was first created by Davis (1989), also based on the theory of rational action (TRA) (Fishbein & Ajzen, 1977) in psychological research. TAM argues that the ease of use and usefulness of technology predicts a user's attitude towards the use of the technology, subsequent behavioral intent, and actual use. Ease of use is also considered to have an effect on the usefulness of technology.

The theory of social influence (SIT) was originally formulated by Kelman (1953) in the early 1950s. This theory is seen as a theoretical framework that explains the conditions under which social influences create changes in attitudes or behaviors. Kelman (1970) defines social influence as a change in behavior in a social context caused by a person or group of people. Social influence theory hypothesizes that there are three modes of acceptance of social influence, namely compliance, identification, and internalization (Kelman, 1970).

The Unified Theory of Technology Adoption and Use is a commonly used model that shows good predictive performance and accurately describes user behavior when new technologies are launched. It was developed by Venkatesh & Davis (1996). According to a study by Pratama (2024), the results of the study show that expectations of performance, social influence, favorable conditions, price value, hedonistic motivation, and habits have a positive effect on attitudes and behavioral intentions. In addition, attitudes also have a positive effect on behavioral intentions, thereby influencing the relationship between consumers' trusting behaviors between behavioral intentions and usage behaviors, reinforcing this relationship. This study provides insights for technology developers and marketers on the key factors driving the adoption of e-commerce through social media platforms such as TikTok Shop, thereby increasing the use of TikTok Shop.

1.3. Hypothesis

1.3.1. Interactivity (INT)

The study by Quan *et al.* (2023) looks at how viral videos on social media affect consumers' purchase intentions. In particular, engagement is defined as the degree to which consumers feel able to engage and respond to video

content. According to Moreno - Albarracín & Blanco-Sánchez (2024) believes that TikTok promotes a culture of engagement through user interaction and entertainment content, creating a symbiosis between creators, brands, and the community. This interaction highlights the role of reviews and commentary in shaping consumer behavior. Han *et al.* (2024) point out that factors such as interaction, presence, and awareness all play an important role in shaping consumer behavior and purchasing decisions. Handranata *et al.* (2024) and Meng *et al.* (2024) also showed that interaction, entertainment, and trending on TikTok positively affect purchase intent, in which brand interaction plays a key role in consumer decisions. Further studies on information quality and engagement suggest that these factors contribute to social presence, which is important for driving purchase intent. The development of measurement frameworks that help optimize engagement to effectively impact consumption decisions (Jiang *et al.* 2024). So, the following hypotheses can be proposed:

H1a: Interactivity positively affects the perceived value of short video content.

H1b: Interactivity positively influences consumers' purchase intention.

1.3.2. Entertainment (ENT)

Valeza & Soriano (2024) points out that entertainment refers to the extent to which watching TikTok videos brings enjoyment, fun, and pleasantness to users. The correlation between TikTok content and purchase intent is further supported by findings that emphasize entertainment as the most influential factor in this relationship. In addition, the entertainment factor is also highlighted by Valeza & Soriano (2024) as the most influential aspect that influences purchase intent, showing that consumers are attracted to content that is not only informative but also entertaining. Research by Rizomyliotis *et al.* (2024) indicates that entertainment content in TikTok ads positively influences purchase intent, in addition to factors such as influence credibility and expertise. Therefore, brands should prioritize the entertainment factor to maximize the impact on consumer behavior. The study Mahmud *et al.* (2024) also demonstrated that the entertainment value of TikTok content has a positive effect on students' purchase intentions. Highly entertaining content helps increase interest and drive shopping behavior. In a study by Ao *et al.* (2023), entertainment value was identified as the strongest influencing factor on influencer interaction, thanks to its ability to bring excitement, attractiveness, and relaxation, thereby attracting viewers, creating positive connections, and promoting purchase intent.

H2a: Entertainment has a positive impact on the perceived value of short video content.

H2b: Entertainment positively impacts consumer purchase intention.

1.3.3. Infomation (INF)

According to Ngoc *et al.* in 2024, information is defined as the extent to which advertising videos on TikTok provide clear and useful information about the product such as detailed descriptions, user manuals, and reviews from users to help consumers understand and make purchase decisions. According to Goldsberry (2024), complete, clear, and reliable information in TikTok videos plays an important role in promoting the purchase intent of consumers, especially Gen Z. Not only the content, but also the persuasiveness and credibility of the sharer also strongly influence the purchase decision. A study by Ngo *et al.* (2024) confirms that the reliability of eWOM information on social media platforms plays an important role in shaping consumers' online purchase intentions. Therefore, businesses should focus on building and maintaining reliable information in their social media marketing strategies to drive customer purchasing behavior. Adapon *et al.* (2024) point out that information acceptance ratings are associated with increased intention to buy local cosmetics, showing how information received and spread on TikTok plays an important role in shaping consumer behavior.

H3a: Information is positively related to consumers' purchase intention.

H3b: Information is positively related to the advertising value of short video content.

1.3.4. Credibility (CRE)

Credibility in the study by Ong *et al.* (2024) is defined as the accuracy and stability of product information on TikTok Shop, which directly affects the level of consumer trust and thereby promotes purchase intent. When product information is judged to be reliable, consumers will tend to strengthen their purchase decisions. In addition, this study shows that reliability is the most important factor influencing purchase intent on TikTok Shop in Indonesia. Consumers trust accurate and reliable product information on this platform, which drives their purchase intent. Sharkasi & Rezakhah (2023) explore the impact of influencer trust on purchase intent on TikTok. The results show that influencer trust has a direct effect on consumer trust and in turn impact their purchase intent. According to Anastasiei *et al.* (2025), the virtual social relationship between consumers and influencers can increase trust and in turn influence consumers' purchase intentions on TikTok. Research by Ferdianto *et al.*

(2024) proves that reliability in the context of content marketing and consumer interaction can be understood as the accuracy, consistency, and reliability of information and interactions between sellers and consumers on a platform like TikTok. This reliability directly affects consumers' purchase intentions, especially Gen Z.

H4a: Credibility has a positive impact on consumer purchase intention.

H4b: Credibility has a positive impact on the advertising value of short video content.

1.3.5. Usefulness (USE)

Usefulness is defined according to research by Su *et al.* (2024) as consumers' perception of the benefits that shopping on TikTok brings, such as saving time and effort, improving the shopping experience, and making it easier for them to access products that match their needs and impact purchase intent, when consumers notice that TikTok offers obvious benefits and saves time, they tend to have higher purchase intent, as the platform effectively meets their needs and improves the shopping experience. Rahman & Huh (2023) have demonstrated that video can be helpful in achieving higher user engagement. Makmor *et al.* (2023) have also shown that perceived usefulness has a strong influence on customer attitudes towards online shopping. Furthermore, TikTok's unique, useful features, such as its short-form video format and social media presence, have been shown to enhance consumer engagement, which in turn influences purchase intent. The interactive nature of TikTok allows for a more immersive experience, potentially leading to higher levels of consumer engagement and impulsive shopping (Obadă & Țugulea, 2024). In research by Minh *et al.* (2024), it was found that usefulness has a positive impact on purchase intent, when consumers perceive UGC videos to be reliable and provide relevant information, making it easier for them to make purchase decisions.

H5a: Usefulness positively impacts consumer purchase intention.

H5b: Usefulness positively impacts the advertising value of short video content.

1.3.6. Perceived Value of Short Video Content (PV)

Zhang (2023) study describes perceived value as a comprehensive consumer evaluation of the usefulness of a product or service, weighing the perceived benefits against the cost of purchase. Over time and with changes in consumer perceptions, perceived values have included psychological aspects. In terms of content marketing, perceived value and purchase intent Hilmiyah *et al.* (2024) conducted research on men's skincare brands in Jakarta and revealed that content marketing has been shown to have a positive impact on brand image, trust in the brand and perceived value. The study highlights the importance of perceived value in influencing consumers' purchase intentions. In the context of content marketing and green innovation, enhancing perceived value can be an effective strategy to drive purchase behavior. There is also research that explores the empirical analysis of green innovation for fashion brands, green value and purchase intent, highlighting the mediating role of cognitive value and the regulatory role of consumer innovation (Jiang & Chen, 2024). In addition, Pratista & Marsasi (2023) shows that emotional connections and attachment to a product or service significantly increase cognitive value through positive experiences, emotional connections, and brand loyalty, regardless of objective attributes. Businesses should focus on creating short video content that is entertaining, provides useful information, and encourages social interaction to enhance the perceived value of short video content and achieve higher marketing effectiveness. Finally, Liu & Wang (2023) showed that informative and entertaining short video content significantly influences purchase intent, with perceived value partly mediating. The degree of product relevance regulates this relationship.

H6: Perceived value of short video content has a positive impact on consumers' purchase intention.

1.3.7. Advertising Value of Short Video Content (ADV)

The advertising value of short video content on TikTok is defined through factors such as entertainment, reliability, personalization, and attractiveness of the content. These factors positively affect the purchase intention of consumers, especially Gen Z, by enhancing perceived value and positive attitudes towards advertising (Ngo *et al.* 2023). One of the key aspects examined is the content characteristics of short-form video ads. A study that analyzed 2,578 TikTok videos found that the specific attributes of these ads significantly influenced consumer purchasing behavior (Meng *et al.* 2024). This is in line with the extended ad value model, which suggests that the awareness generated by short video ads can enhance purchase intent (Dwinanda *et al.* 2022). The model shows that the effectiveness of these ads depends not only on their content, but also on how they resonate with the audience's interests and behaviors. Moreover, the effectiveness of short-form video ads goes beyond mere entertainment; It includes using content strategically to evoke emotional reactions and promote brand loyalty. Research by Saquin *et al.* (2024) has shown that the emotional appeal of short videos can significantly enhance

their effectiveness in driving purchase intent. This emotional connection is crucial in a crowded digital marketplace where consumers are bombarded with multiple advertising messages.

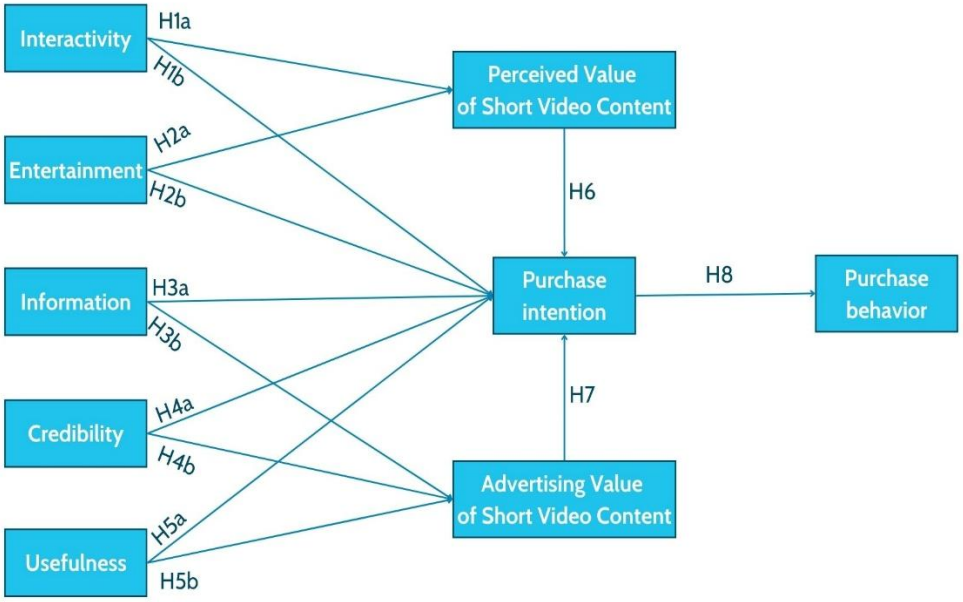
H7: Advertising value through short video content has a positive impact on consumer purchase intention.

1.3.8. Impact of Purchase Intention on Purchase Behavior (PI→PB)

Purchase intent is understood as the level of willingness and desire of consumers to purchase a particular product or service. This is an important mediator between marketing agents (*e.g.*, advertising, social awareness) and actual purchasing behavior. According to Qin *et al.* (2024), the influence of marketing strategies, such as influencer marketing, has been shown to significantly influence purchase intent and behavior. Research indicates that purchase intent has a positive impact on purchasing behavior, especially when mediated by effective marketing interventions. This suggests that strategic marketing can enhance consumer engagement and drive purchase action. In addition, Athaya & Wandebori (2024) examines the relationship between factors of trust, cognition, etc., with purchase intent and ultimately how it influences purchase behavior. İnal & Bil (2023) explores the mediating role of purchase intent in the relationship between influencer perceived characteristics (reliability and similarity) and consumer purchasing behavior. The results show that purchase intent plays an important mediating role, and influencer trust and similarity have a positive and significant effect on both purchase intent and purchase behavior. Research by Damberg *et al.* (2024) suggests that a favorable attitude towards a product can lead to positive purchase intentions, which in turn translates into actual purchase behavior. This is especially evident in the context of eco-labels, where trust in such certifications enhances green shopping intentions and behaviors.

H8: Purchase intention has a strong impact on consumer purchasing behavior.

Figure 1. Proposed research model



Source: Proposed Author

2. Research Method

The authors used a combination of qualitative and quantitative data to deeply explore a research problem. Through the qualitative research method, the factors are measured through 47 representative observation variables, which serve as the basis for the construction of the scale and the design of the questionnaire for the quantitative research stage. On the basis of synthesizing and analyzing previous studies, the authors developed a preliminary research model consisting of 5 independent factors "interactivity, information, entertainment, usefulness, and reliability" affecting 3 intermediate variables "advertising value of short video content, perceived value of short video content and consumer purchase intent", thereby influencing the dependent variable "consumer purchase behavior" to explore the relationship between these factors affecting consumer purchase behavior.

The quantitative research method that the authors conducted was to survey with a Google Forms survey questionnaire from a questionnaire designed with a 5-level Likert scale to help the team save time and be less

expensive but to earn a large amount of information from the questionnaire to serve the group's research. The number of survey responses that the research team collected was 766 samples, after data processing there were 556 valid samples. The team conducts screening, removing blank or inappropriate answers to ensure the accuracy and objectivity of the data. This is an overall size that cannot be determined because the group does not know how many customers have shopped on the TikTok Shop platform in Ho Chi Minh City. HCM. Thus, the minimum sample size required for the study would be 385 people (Yamane, 1969). Finally, the survey data after screening by the authors will be analyzed by Smart PLS 3 software, including descriptive statistics to synthesize basic information, reliability testing, and structural model testing to evaluate the linkages between variables.

The PLS-SEM method is particularly suitable for exploratory studies or when the research model is highly complex, including many potential variables and non-linear relationships. In addition, PLS-SEM has an advantage in cases where small samples or data do not follow standard distributions, which enhances the predictability and generality of the model (Hair *et al.* 2019).

Besides, compared with the traditional SEM method based on the structural equation estimated by the least squares model (CB-SEM), PLS-SEM does not require strict assumptions about data distribution and is more suitable for evaluating models with multiple reflective indicators (Henseler *et al.* 2015). Therefore, depending on the research objectives, researchers need to carefully consider before choosing the appropriate method to ensure the accuracy and practical value of the analysis results (Hair *et al.* 2021)

3. Result

3.1. Descriptive Statistics

After collecting 766 survey votes, the team processed and selected 556 valid votes from consumers in Ho Chi Minh City. Ho Chi Minh City and people who have made purchases on TikTok Shop. The descriptive statistical results show that women account for 55.4%, higher than men (44.6%), showing that women tend to be more interested in and influenced by short videos on TikTok Shop. In terms of age, the 18–30-year-old group accounted for the highest percentage (68.2%), followed by the 31–54-year-old group (19.8%), the group under 18 years old (11.5%) and the above 54 years old (0.5%), reflecting that TikTok Shop mainly attracts young and middle-aged customers. In terms of occupation, the group of students/students with the highest frequency of using TikTok, affirming that this is an important potential customer file (accounting for more than 55%). In terms of income, 72.8% of survey participants have an income of less than 8 million VND/month, showing that this platform attracts the majority of customers in the middle segment. Notably, 75.9% of users watch short videos at least twice a month before making a purchase on TikTok Shop, emphasizing the importance of video content in the decision-making process. These results are an important basis for further analysis of consumer behavior on this platform.

Table 1. Survey Sample Description Statistics

		Frequency	Percentage
Profession	State Civil Servants	55	9.9%
	Students	306	55.0%
	Office Staff	108	19.4%
	Different	87	15.6%
Gender	Male	248	44.6%
	Female	308	55.4%
Age	Under 18 years of age	64	11.5%
	18 – 30 years old	379	68.2%
	31- 54 years old	110	19.8%
	Over 54 years old	3	0.5%
Monthly income	Less than 2 million	89	16.0%
	From 2 – 5 million	174	31.3%
	From 5 – 8 million	142	25.5%
	Over 8 million	151	27.2%

Source: Data from SPSS)

3.2. Measurement Model

The results of the Cronbach's Alpha coefficient test (Table 2) ranged from 0.714 to 0.917, all of which exceeded the threshold of 0.70 which is considered acceptable in quantitative research, confirming the reliability of the scale (Hair *et al.* 2017). According to Hair *et al.* (2017), a CR value of 0.70 or higher is considered satisfactory in terms of aggregate reliability, reflecting the intrinsic consistency between the observed variables of a scale. The CR coefficient (Table 2) ranges from 0.823 to 0.934, which is in the ideal range of 0.70 to 0.95. This suggests that there is no significant redundancy between observations (Hair *et al.* 2018; Hair *et al.* 2022). Scales such as PB (0.934), PI (0.907), and ADV (0.906) have very high aggregate reliability, ensuring stability when applied to practical research.

The mean extract variance (AVE) is an important indicator for assessing the convergence of scales, reflecting the rate of variance of the potential variable explained by the observed variables. According to Hair *et al.* (2017), an AVE value greater than 0.50 indicates a well-convergent scale, meaning that the observed variables measure the conceptual efficiency they represent. All scales in (Table 2) have an AVE greater than 0.50, which meets the convergence standard (Hair *et al.* 2022).

Outer loading is an index that evaluates the contribution of each observed variable to the potential variable. According to Hair *et al.* (2017), an observed variable is considered significant when the outer loading factor is greater than 0.7. If this value is between 0.4 and 0.7, it can be considered retained if it increases the overall reliability of the model, and if it is less than 0.4, it should be discarded. Through testing, all observed variables had an Outer loading > of 0.7, which met the criteria of Hair *et al.* (2017), confirming a significant contribution to the latent variable.

Table 2. Reliability and convergent validity assessment

Factor	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Outer loading
ADV	0.875	0.906	0.616	0.763-0.803
CRE	0.767	0.852	0.59	0.741-0.814
ENT	0.811	0.869	0.571	0.706-0.788
INF	0.769	0.852	0.59	0.741-0.785
INT	0.714	0.823	0.538	0.724-0.751
PB	0.917	0.934	0.67	0.781-0.902
PI	0.883	0.907	0.55	0.713-0.769
PV	0.873	0.908	0.664	0.787-0.856
USE	0.817	0.879	0.646	0.775-0.832

Source: Data from SMART-PLS3

Differentiation is one of the important criteria for evaluating the value of the scale, ensuring that the underlying variables in the model are indeed distinct from each other. To test this, the study used the Heterotrait-Monotrait Ratio (HTMT), as proposed by Henseler *et al.* (2015). If the HTMT values are less than 0.90, the scale is considered to be satisfactory in terms of differentiation. All HTMT values in (Table 3) are below the threshold of 0.90 (Henseler *et al.* (2015), ensuring differentiation between concepts. This proves that the latent variables in the measurement model of the author group have obvious differences, and there is no homogeneity between concepts.

Table 3. HTMT

	ADV	CRE	ENT	INF	INT	PB	PI	PV	USE
ADV	0.785								
CRE	0.85								
ENT	0.832	0.827							
INF	0.865	0.844	0.816						
INT	0.639	0.652	0.623	0.731					
PB	0.621	0.656	0.603	0.632	0.405				
PI	0.862	0.867	0.833	0.879	0.715	0.644			
PV	0.82	0.78	0.736	0.871	0.659	0.595	0.844		
USE	0.793	0.8	0.795	0.793	0.656	0.57	0.84	0.753	

Source: Data from SMART-PLS3

In addition to the HTMT method, the Fornell-Larcker criterion was also used by the authors to test the differentiation of potential variables. According to this criterion, the square root of the AVE (the values on the diagonal) must be greater than all correlations between those variable and other potential variables in the same row or column (Fornell & Larcker, 1981). The results in Table 4 show that the values on the diagonal line (the quadratic root of AVE) are all greater than the remaining values in the same row and column, confirming that each potential variable has good differentiation from the others. This ensures that the scales accurately measure the concept to be studied without duplication with other concepts, contributing to improved model reliability. Thus, the test using the Fornell-Larcker criterion shows that the variables in the model are differentiated, meet the requirements of quantitative studies and can be used for further analysis.

Table 4. Fornell – Larcker

	ADV	CRE	ENT	INF	INT	PB	PI	PV	USE
ADV	0.785								
CRE	0.697	0.768							
ENT	0.7	0.653	0.755						
INF	0.712	0.65	0.645	0.768					
INT	0.506	0.483	0.475	0.543	0.734				
PB	0.558	0.552	0.522	0.533	0.33	0.819			
PI	0.761	0.715	0.707	0.729	0.57	0.582	0.741		
PV	0.717	0.639	0.621	0.717	0.523	0.533	0.742	0.815	
USE	0.671	0.633	0.647	0.631	0.502	0.494	0.717	0.636	0.804

Source: Data from SMART-PLS3

3.3. Structural Model

The results of the verification of the VIF coefficient (Table 5) of the authors' team show that most of the variables have VIF < 3, proving that there is no significant multi-collinear, ensuring the stability of the model. Some variables of PB have VIF from 3 to 5 (PB1, PB4, PB5, PB7) and especially PB3 = 5,306, indicating a correlation level higher than the average but still within the acceptable threshold. This should be kept in mind when interpreting the results.

Table 5. Variance Inflation Factor

Construct	VIF	Construct	VIF	Construct	VIF	Construct	VIF	Construct	VIF
ADV1	1.895	ENT1	1.523	INT2	1.374	PI1	1.872	PV3	2.498
ADV2	1.739	ENT2	1.544	INT3	1.345	PI2	1.708	PV4	1.892
ADV3	1.94	ENT3	1.729	INT4	1.336	PI3	1.83	PV5	2.193
ADV4	1.991	ENT4	1.72	PB1	3.347	PI4	1.689	USE1	1.663
ADV5	1.900	ENT5	1.418	PB2	2.479	PI5	1.78	USE2	1.555
ADV6	1.755	INF1	1.433	PB3	5.306	PI6	1.809	USE3	1.852
CRE1	1.662	INF2	1.507	PB4	3.308	PI7	1.998	USE4	1.769
CRE2	1.427	INF3	1.511	PB5	4.421	PI8	1.985		
CRE3	1.403	INF4	1.485	PB6	2.952	PV1	2.004		
CRE4	1.492	INT1	1.314	PB7	3.468	PV2	1.903		

Source: Data from SMART-PLS3

R Square (R^2) is an indicator that measures the extent to which independent variables can explain the variance of the dependent variable in the research model. According to Hair *et al.* (2017), an R^2 value of 0.75 or more is considered high, between 0.50 and 0.75 is average, and between 0.25 and 0.50 is acceptable. The R Square and R Square Adjusted values of the study variables (Table 6), help to evaluate the model's suitability with the collected data. The R Square results show that the model has relatively good interpretation for the variables PI (0.743) and ADV (0.634), proving that independent variables explain most of the variances of these two variables. The PV (0.452) and PB (0.339) variables have an average level of interpretation, indicating that there are other factors that influence them.

The Q^2 predict index is used to evaluate the predictability of the model in structural regression analysis (PLS-SEM), proposed by Stone (1974) and Geisser (1974). This metric is based on the crossvalidated redundancy method in the PLS model, which tests whether the model can accurately predict the value of the dependent variable. According to Hair *et al.* (2019), a Q^2 value of > 0 indicates a predictive model, in which, Q^2 from 0.02 to 0.15 has a weak prediction level, Q^2 from 0.15 to 0.35 has an average prediction level, and Q^2 > 0.35 with a strong prediction level. The Q^2 values (Table 6) are all greater than 0, indicating that the model has good predictability (Hair *et al.* (2019). Specifically, PI (Purchase Intent) has the highest predictive power (Q^2 = 0.703), followed by ADV (Ad Worth) with Q^2 = 0.632. The other two variables, PV (Perceived Value) and PB (Purchase Behavior), whose Q^2 is 0.443 and 0.335, respectively, still ensure average predictability. This confirms that the model is suitable for forecasting relationships in the study.

Table 6. Evaluation of Explainability (R2) and Prediction of the Model (Q2)

Factor	R Square	R Square Adjusted	Q^2 predict
ADV	0.634	0.632	0.632
PB	0.339	0.338	0.335
PI	0.743	0.74	0.703
PV	0.452	0.45	0.443

Source: Data from SMART-PLS3)

The F Square (f^2) factor is used to evaluate how much each independent variable affects the dependent variable in the model. According to Cohen (1988), a value of $f^2 \geq 0.02$ indicates a small effect, $f^2 \geq 0.15$ is the average, and $f^2 \geq 0.35$ indicates a large effect. The F Square value (Table 7) shows that the PI (Behavioral Intent) variable has the strongest influence on the dependent variable with f^2 = 0.513, exceeding the threshold of 0.35, indicating a large degree of impact. Next, ENT (Entertainment) → PV (Perceived Value) have a significant influence (f^2 = 0.327), close to the high threshold. Some other variables such as CRE (Creative) → ADV (Advertising) and INF (Information) → ADV have f^2 = 0.128 and f^2 = 0.168, respectively, representing an average impact. The remaining variables have f^2 < 0.1, indicating a small but still meaningful effect in the model.

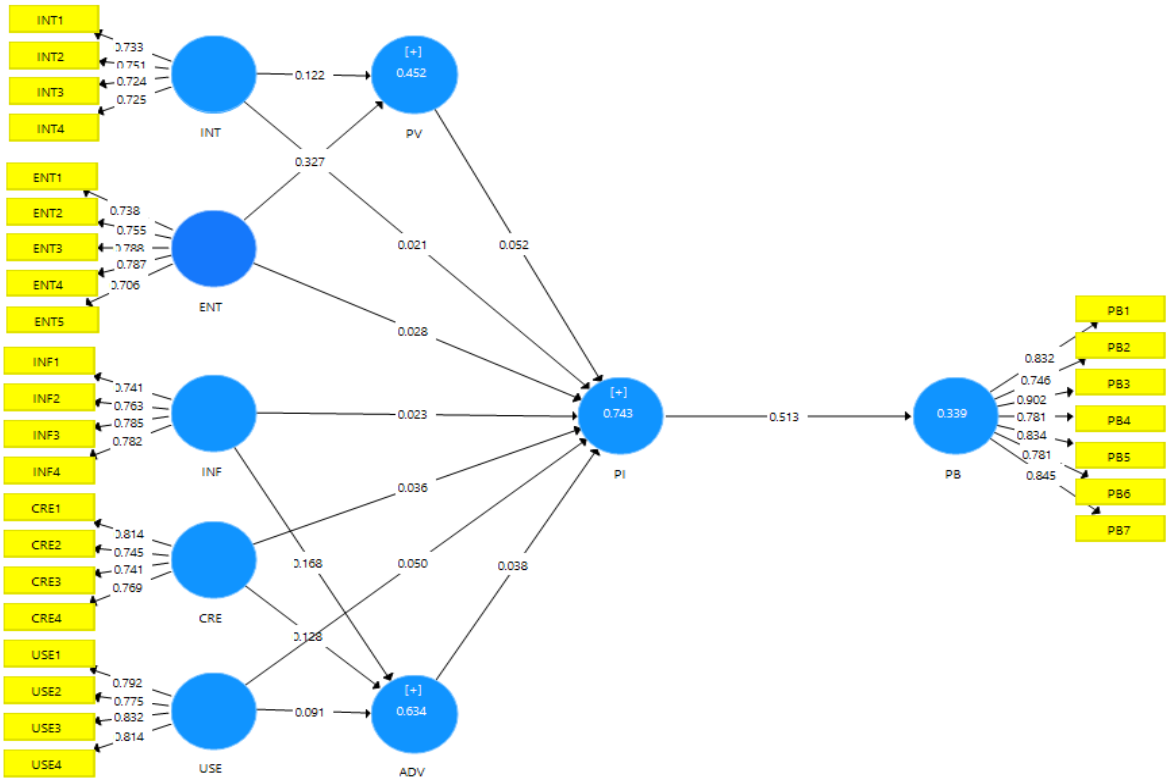
Table 7. Evaluate the impact of each hypothesis (F Square)

	ADV	PB	PI	PV
ADV			0.038	
CRE	0.128		0.036	
ENT			0.028	0.327
INF	0.168		0.023	
INT			0.021	0.122
PI		0.153		
PV			0.052	
USE	0.091		0.05	

Source: Data from SMART-PLS3

3.4. Model Results Diagram

Figure 2. PLS-EM Results for the Measurement Model



Source: Data from SMART-PLS3

3.5. Bootstrapping Testing

The analysis of the influence of independent factors on dependent factors is a critical aspect of empirical research, particularly in structural equation modeling (SEM). According to Chin *et al.* (1996) this analysis requires not only examining the authenticity of the relationships between variables but also assessing the extent to which these relationships impact resource allocation. In other words, verifying the significance of causal relationships alone is insufficient; researchers must also evaluate their practical implications in decision-making processes, particularly in contexts such as business resource management and policy development.

Table 8. Bootstrapping results table of structural model

	Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation	T Statistics	P Values	Result
INT -> PV	H1a	0.294	0.298	0.052	5.604	0.000	Accept
ENT-> PV	H2a	0.481	0.474	0.059	8.088	0.000	Accept
INF -> ADV	H3B	0.352	0.351	0.04	8.813	0.000	Accept
CRE -> ADV	H4B	0.307	0.308	0.044	6.997	0.000	Accept
USE -> ADV	H5B	0.254	0.252	0.041	6.260	0.000	Accept
ADV -> PI	H7	0.176	0.175	0.037	4.740	0.000	Accept
CRE -> PI	H4a	0.149	0.149	0.032	4.691	0.000	Accept
ENT -> PI	H2B	0.131	0.132	0.034	3.887	0.008	Accept
PV -> PI	H6	0.19	0.191	0.04	4.744	0.000	Accept
INF -> PI	H3a	0.128	0.126	0.035	3.646	0.000	Accept
INT -> PI	H1b	0.092	0.095	0.035	2.645	0.000	Accept
USE -> PI	H5a	0.172	0.172	0.037	4.680	0.000	Accept
PI -> PB	H8	0.582	0.578	0.056	10.444	0.000	Accept

Source: Data from SMART-PLS3

Moreover, to ensure the robustness and reliability of the proposed model, researchers must conduct additional validation tests. One widely accepted method is the Bootstrap resampling technique, which helps assess the stability and consistency of the estimated parameters. Hair *et al.* (2017) recommend using the Bootstrap method with 5,000 pattern iterations, as this approach enhances the accuracy of standard errors and confidence intervals, ultimately strengthening the validity of the model. By performing multiple resampling iterations, researchers can mitigate potential biases arising from sample-specific variations and enhance the generalizability of their findings.

So, to assess the impact between variables in the model, the study looked at the P-value, T-statistic, and impact coefficient (Original Sample - O). Hypotheses with a P-value < 0.05 are considered statistically significant, while T > 1.96 shows a statistically significant relationship between variables. Based on the impact coefficient, we can determine which variable has the strongest impact and how much impact each variable has on other potential variables. All hypotheses (Table 8) have a P-value < 0.05, proving that the relationships in the model are statistically significant (satisfactory). At the same time, all T values > 1.96, confirming that the relationships are statistically significant. In addition, to assess the level of impact between variables, it is necessary to measure indicators (Original Sample - O). The most impactful variables were Purchase Intent (PI) → Purchase Behavior (PB) (0.582), indicating that use intent plays the most important role in purchase decisions. The second largest impact is the entertainment (ENT) → perceived value of short video content (PV) (0.481), proving that the entertainment factor has a significant influence on the perceived value of users. The results of the analysis show that the relationships in the model are statistically significant, with different levels of impact, clarifying the influence of each factor on the dependent variable.

4. Discussion, Managerial Implications, Limitations, Future Research Directions

4.1. Discussion

The strong development of modern technology has promoted the trend of online shopping, especially on TikTok Shop – an increasingly popular platform in Ho Chi Minh City. In this context, this study focuses on identifying factors in short video content that influence consumers' purchasing decisions. Here is a detailed breakdown of each factor and their impact.

Interaction positively affects purchase intent (INT -> PI) with (O = 0.092 > 0). These results support research by Garg & Bakshi (2024) which asserts that interaction in the social media environment affects consumers' perceived value and shopping intent. This factor shows that when the level of engagement is high, consumers tend to trust the content more, thereby increasing the likelihood of making a purchase decision.

Leisure positively impacts purchase intent (ENT -> PI) with (O = 0.131 > 0. This result supports research by Wu and Zhang (2024), which indicates that highly entertaining short videos can boost consumer purchase intent. This factor emphasizes the role of compelling content in capturing attention and motivating purchases.

The informative count is positively related to the consumer's purchase intention (INF -> PI) with (O = 0.128 > 0). This result supports research by Madhushanka & Nishadi (2024), which emphasizes that information-rich content in advertising can impact the attitudes of young consumers, which in turn influences their shopping decisions. This factor shows that clear and useful information enhances consumer confidence and increases the likelihood that they will make a purchase decision. This factor shows that clear and useful information will help improve consumer confidence and increase the likelihood that they will make a purchase decision.

Reliability has a positive impact on purchase intent (CRE -> PI) with (O = 0.149 > 0). These results support the research of Dachyar & Banjarnahor (2017), which asserts that reliability is a core factor shaping consumers' shopping intentions. This factor emphasizes that trust in a brand, product, or shopping platform helps consumers feel more secure, thereby increasing the likelihood of making a purchase decision.

Usefulness positively impacts purchase intent (USE -> PI) with (O = 0.172 > 0). These results support research Binh & Luan (2022), which emphasizes that the perception of the usefulness of online stores can positively influence consumers' shopping attitudes. This shows that if the product or shopping platform brings high practical value and utility, consumers will tend to choose and use more.

The perceived value of short video content has a positive impact on purchase intent (PV -> PI) with (O = 0.19 > 0). These results support research by Madhushanka & Nishadi (2024), which shows that the perceived value of social media advertising can impact shopping attitudes and intentions. This factor shows that when consumers perceive clear value from marketing content, they will tend to trust and be willing to make a purchase decision.

The ad value of short video content has a positive impact on purchase intent (ADV -> PI) with (O = 0.176 > 0). This result supports the research of Kim & Han (2014), which emphasizes that the value that consumers

receive from advertising plays an important role in shaping shopping intent, especially on mobile devices. This shows that the ad needs to not only attract but also provide specific benefits, helping to increase persuasion and stimulate purchase behavior.

Purchase intent has a strong impact on purchase decision making (PI -> PB) with (O = 0.582 > 0). This result supports the research of Wijekoon & Sabri (2021) who have also determined that purchase intent is an important factor in consumer decision-making. This suggests that once consumers have formed a purchase intent, the likelihood that they will actually buy the product will be very high.

4.2. Managerial Implications

4.2.1. For Businesses

To attract young consumers and provide promotional opportunities for small and medium-sized businesses, businesses need to focus on factors that have a positive impact on purchasing behavior through short video content on TikTok Shop: It is necessary to focus on the elements of interaction and action with the video to attract the curiosity of guests. When a video is highly interactive, it not only grabs the viewer's attention but also encourages them to take actions such as liking (dropping hearts), commenting, sharing, or following the business's account. Integrate entertainment elements and funny stories into videos because entertaining videos often stimulate positive emotions such as fun, surprise or curiosity, thereby indirectly promoting shopping behavior. The information provided in the video must be accurate that will help consumers better understand the product or service, from uses, features to usage, and increase brand credibility in the hearts of consumers. The credibility of the video will make users feel more secure and confident about the product being introduced. By partnering with reputable influencers or experts in the relevant field and ensuring product information to increase the credibility of the video. Businesses can create "tips" videos that show how to use the product, solve problems, or optimize the value of the product in everyday life. In order for consumers to see the usefulness of the video, create videos that are directly aimed at the specific needs and desires of the target audience, combining both informative and entertaining to ensure that they both meet the needs of learning and create a sense of enjoyment, will increase the perceived value of the video. The advertising value of short videos lies in their ability to convey messages quickly, creatively, and easily remember, focusing on those elements to enhance brand awareness and stimulate purchase intent.

4.2.2. For Consumers

Consumers need to be cautious and receive information selectively so that shopping is effective and avoid risks, careful consideration of factors will bring: Consumers should actively participate in activities such as commenting, sharing or participating in challenges to not only learn more about the product but also connect with the community of buyers and sellers. Users can approach the product in an interesting way thanks to highly entertaining videos, but it is necessary to evaluate objectively, avoid being attracted by content that is too funny or attractive and ignores the actual product quality that users need. Informativeness will help consumers gain an in-depth understanding of the product, evaluate important details, or learn how to apply the product in practice. Users need to choose videos that are highly reliable, transparent about the product or service, from origin, quality to usage to minimize risks. The usefulness of video content will help consumers prioritize videos that provide clear instructions or specific solutions to their product problems. Users will effectively receive offers, promotions, or product highlights through the promotional value of the video. High perceived value helps users see that their time is not only worthwhile, but also brings practical benefits, such as learning new knowledge, finding creative inspiration, or quality entertainment.

4.3. Limitations of the Study

Firstly, this study uses a convenient non-probability sample selection method that can reduce the representativeness of the study, making the results not fully reflect the characteristics of all consumers on TikTokShop. In addition, survey data can be influenced by subjective factors from participants, reducing the accuracy of the results.

Secondly, the scope of the study is only focused on Ho Chi Minh City, leading to the conclusions obtained mainly reflecting the characteristics of consumer shopping behavior in this area. Therefore, the widespread applicability of the study to other localities may be limited.

Third, the study has not been able to cover all the factors related to short video content that affect purchase behavior on TikTokShop. Some important aspects have not been analyzed in depth, leading to the inability to fully assess the impact of each factor in the actual context.

Fourth, the e-commerce market and social media marketing trends are always changing rapidly, causing consumer behavior to constantly change. Today's customers are highly adaptable to new technologies and trends, which makes research results easy to become outdated. Therefore, both businesses and researchers need to constantly update to ensure consistency with reality.

Fifth, the solutions in the study are relevant to the current e-commerce market, but as online shopping trends change, they may need to be adjusted to maintain effectiveness.

4.3. Future Research Directions

With the rapid development of the TikTok platform and short video marketing strategies, expanding and deepening current studies will provide a more comprehensive view of the impact of this type of promotion on consumer shopping behavior. The following research directions can help provide important insights that can improve the quality and applicability of research in the field of digital marketing:

Conducting research across different geographic areas will help assess the differences in purchasing behavior between regions. Comparing data from many localities will help increase the generality and wider application of research results.

Instead of using the convenient non-probability sample selection method, the following studies can apply the probability sample selection method to improve the objectivity and representativeness of the collected data.

Future studies may compare the effects of short video marketing across various platforms to get a more comprehensive view of the effect of this type of promotion on shopping behavior.

Further studies may look at the level of engagement and reputation of content creators, as well as other factors related to user experience, in order to more comprehensively assess the impact of short videos.

To ensure practicality, future research needs to track the evolution of e-commerce, combined with gathering expert opinions in the field of digital marketing to provide more insight.

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Credit Authorship Contribution Statement

Nguyen Thi Phuong Giang: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft.
Thai Dong Tan: Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Nguyen Binh Phuong Duy: Project administration, Software, Formal analysis, Writing – original draft, Supervision.
Tran Vu Quynh Nhu: Data curation, Validation, Writing – review and editing, Visualization.
Truong Thanh Ngan: Data curation, Validation, Writing – review and editing, Visualization.
Nguyen Thi Lien: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis.
Nguyen Ngoc Thao Phuong: Data curation, Validation, Writing – review and editing, Visualization, Software.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they did not use generative AI and AI-assisted technologies during the preparation of this work.

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Transparency, Information, Sustainability Interaction with Citizens, vs the Fight against Corruption, and Their Role in the Public Sector Auditing. Evidence from Albania

Almida Kafia HOXHA
Department of Accounting, Faculty of Economy
University of Tirana, Albania
ORCID: 0009-0000-1707-4856
almida.hoxha@unitir.edu.al

Mirela MITI
Department of Accounting, Faculty of Economy
University of Tirana, Albania
ORCID: 0000-0001-7896-8001
mirela.miti@unitr.edu.al

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Abstract: Through this study we have attempted to explore the role of transparency and accountability in the functioning of Albania's Supreme Audit Institution (ALSAI/KLSH) and its impact on public trust and the fight against corruption. Drawing on a ten-year analysis of public complaints, audit findings, and transparency initiatives, the research examines the correlation between citizen engagement, audit outcomes, and the level of perceived corruption in Albania. The study utilizes various methodological approaches, including Spearman's correlation coefficient, to evaluate the effectiveness of KLSH's transparency practices in fostering public confidence. Results indicate a positive relationship between sustained public interaction with KLSH and a reduction in corruption perceptions, highlighting the importance of institutional transparency and public participation. The study concludes that strengthening the relationship between audit institutions and the public is crucial for ensuring good governance, the rule of law, and preventing corruption. It advocates for further research to enhance the role of Supreme Audit Institutions in promoting accountability and strengthening the rule of law in Albania.

Keywords: transparency; sustainability interaction; citizen; auditing; corruption; public sector.

JEL Classification: M48; M42; K19; R11.

Introduction

Access to information and the involvement of civil society - particularly that of individual citizens - are not only democratic principles, but also important tools for preventing corruption and improving the quality of auditing in the public sector. The more informed and actively engaged citizens are in monitoring the activities of public institutions, the more positive pressure is created to increase accountability and responsibility.

Albania, on its path toward European integration, faces a major challenge in successfully fulfilling every EU requirement, especially the challenge of combating corruption. The reforms undertaken to meet these requirements focus on three main pillars: good governance, the rule of law, and the fight against corruption[1]. Currently, Albania has a comprehensive and inclusive framework for the fight against corruption and has adopted the cross-sectoral anti-corruption strategy for the period 2024 - 2030[2], with the aim of preventing corruption, punishing corrupt practices, and raising awareness and educating against corruption. The cross-sectoral anti-corruption strategy originated in 2015 and aimed to ensure "Transparent Albanian institutions with high integrity,

[1] https://masl.al/rreth-nesh/historia-dhe-mandati/
[2] https://mapa.gov.al/wp-content/uploads/2025/02/Strategjia-Ndersektoriale-Kunder-Korrupsionit-2024-2030.pdf

which enjoy citizens' trust and guarantee quality and incorruptible services." In the framework of the action plans, institutions and public authorities have drafted - and are currently implementing - transparency programs and ensured public access to information through information right coordinators, as well as by publishing the register of requests and complaints online[3].

At a time when the demand for good governance and accountability is increasing, information transparency and active citizen interaction have become essential elements for strengthening institutional integrity. Public institutions, and especially the Supreme State Audit (KLSH), play a fundamental role in ensuring the proper and effective management of public funds.

This was the reason for conducting this study aiming to explore the interaction between transparency, active citizen participation, and the fight against corruption, and how these elements contribute to a more inclusive, efficient, and effective auditing process. A country transitioning from a centralized to a decentralized economy, especially one burdened by corruption, faces significant institutional challenges, where the lack of transparency and accountability creates fertile ground for the misuse of public funds. Therefore, strengthening audit mechanisms and ensuring the involvement of civil society and citizens is essential.

1. Literature Review and Theoretical Framework

It is now widely recognized that public sector organizations are responsible for implementing policies and delivering services aimed at improving the quality of life for their citizens. According to the literature, financial management is a process used by governments to provide citizens with accurate information about their financial activities. Two core principles frequently discussed are the principles of transparency and accountability, both of which are essential requirements for implementation in Albania as well.

Accountability is a process that requires a public institution or entity to demonstrate that it has operated in accordance with legal standards and frameworks, and to report accurately on its performance - whether that be a central government institution, a local authority, or a public body.

Transparency is a process that ensures clear and timely provision of information regarding the activities carried out by an institution, central/local government body, or public entity during a specific period.

Transparency and accountability are fundamental components of democratic governance. They help both the public and private sectors stay focused on outcomes and develop effective strategies. However, the lack of accountability in the public sector does not prevent the public from asking questions such as, *"What happened to the money collected from taxpayers?"*

A study conducted by Ula-Lisa in 2005 identified that transparency and accountability can improve public understanding of decision-making processes and provide the information necessary for informed decision-making.

According to UNECA, accountability should focus on both responsibility and answerability, noting that a reliable budget is also crucial to ensure the public has the necessary information to engage in the decision-making process. Accountability can be achieved through regular financial reporting and the implementation of sound management procedures. In 2005, UNECA also emphasized that the quality of data collected and disseminated by governments must be maintained through independent oversight.

FRCN (2011) and IFAC (2012) highlight that adopting and implementing accrual-based accounting in the public sector would enhance both accountability and transparency and thereby improve good governance. IFAC (2012) further emphasizes that governments must take necessary measures to increase the transparency and accountability of public financial management. The implementation of IPSAS (International Public Sector Accounting Standards) is currently a core part of these efforts in Albania as well.

As observed, accountability and transparency are two essential elements of public financial management. This is also the main reason why the implementation of audit standards by Supreme Audit Institutions (SAIs) is seen as an added value in reinforcing the principles of transparency and accountability, thus further strengthening public trust.

SAIs operate within a broader legal and constitutional system in their respective countries and are accountable to various stakeholders, including legislative bodies and the public. They are also responsible for planning and carrying out their work and for applying the appropriate methodologies and standards to ensure that they promote accountability and transparency regarding public activities. By doing so, they fulfil their legal mandate and carry out their responsibilities in a complete and objective manner.

[3] https://mapa.gov.al/wp-content/uploads/2025/02/Strategjia-Ndersektoriale-Kunder-Korrupsionit-2024-2030.pdf pg 16

A major challenge faced by all SAIs is promoting a better understanding of their roles and responsibilities in society, both among the public and the administration. In accordance with their mandates and governing legal frameworks, information about SAIs should be easily accessible and linked to relevant public concerns. Their working processes, activities, and outputs must be transparent. SAIs should also communicate openly with the media and other stakeholders, ensuring that information is visible and present in the public domain.

According to INTOSAI P-12, Supreme Audit Institutions (SAIs) are expected, first and foremost, to conduct independent, objective, and high-quality audits. The results of these audits are published transparently, thereby increasing public awareness and encouraging institutions to improve governance and the management of public funds. This leads to greater accountability, transparency, and efficiency in public institutions. As a result, the quality of public services improves, and citizens' trust in government is strengthened, ultimately contributing to better daily life outcomes.

Figure 1. The Impact of Supreme Audit Institutions on Citizens' Lives

Source: INTOSAI P-12 – "The Value and Benefits of Supreme Audit Institutions: Making a Difference to the Lives of Citizens" (https://www.intosai.org/fileadmin/downloads/documents/open_access/INT_P_11_to_P_99/INTOSAI_P_12/INTOSAI_P_12_en_2019.pdf.)

This figure reinforces the idea that the work of SAIs is not merely technical but plays a fundamental role in strengthening democracy and sustainable development by improving citizens' lives.

David M. Walker (2004), in his study, highlights that SAI transparency can be strengthened and promoted through three essential elements: a regular audit process, the exposure of financial issues, and free press.

The DESA Working Paper No. 157 (2019) emphasizes that audits provide objective and independent evaluations, which help reinforce transparency and accountability in the implementation of Sustainable Development Goals (SDGs). This, in turn, increases the legitimacy and credibility of SAIs at both national and global levels.

Yemisi J. and E.O. Onyeanu (2023) found a strong relationship between financial and performance auditing on the one hand, and transparency and accountability on the other.

Cornejo, Guillan, and Lavin (2013) identify that the Transparency, Participation, and Accountability Initiative illustrates evolving partnerships between audit institutions and citizens. It highlights both the benefits and challenges of a collaborative approach in engaging public officials. The initiative has created a platform for cooperation between civil society organizations and SAIs in Latin America, becoming a valuable partner for audit institutions and helping to create regional consensus on the legitimacy of transparency and participatory mechanisms in auditing. However, increasing the impact of such collaboration requires working with additional stakeholders, adapting audit processes to be more citizen-friendly, and coordinating efforts with development partners.

Chen Ji Fang, Aidi Ahmi, and Zakiyah Sharif (2024), found that government audits primarily serve detection and prevention functions in the fight against corruption, while government transparency plays a significant moderating role in this relationship.

Tsetsura and Luoma-aho (2020) recognize transparency as a globally essential concept, especially during international crises involving information leaks. There are various mechanisms that affect non-transparent societies, one of the most prominent being corruption. Therefore, the continuum between trust and mistrust offers valuable insights into the challenges of improving transparency.

Ketners *et al.* in their study (2025) have analyzed the phenomenon of corruption, determining its risk for the development of the country and formulating specific areas of strategic state activity. They have identified 5 strategic directions; Reform and formation of anti-corruption state institutions; Judicial system; The creation of high-quality and effective legislation; Building an anti-corruption mechanism based on the principles of transparency and accountability: Cooperation with international organizations and Cooperation with the public.

The OECD at its March 2025 meeting, (member countries) discussed a series of events on the main issues of integrity today, focusing on the role that today's unprecedented innovations can play in transforming the global fight against corruption and inventing new ways to promote integrity and transparency.

Barco et al (2024) in their study emphasizes the role of education and promotion of ethical values in preventing corruption. Promoting a culture of integrity can help prevent corruption in the future. It is important that young people are taught the importance of honesty, responsibility and respect for the law. They also emphasize, among others, that the implementation of stricter laws and the promotion of transparency in public management are important steps in the fight against corruption. They have identified that the lack of transparency, citizens' perceptions of the integrity and effectiveness of government institutions and the quality of public services can be indicators of measuring the impact of corruption on government efficiency.

Stojanovic M (2025)[4] in her article identifies that although in Albania there is an improvement in the level of the corruption perception index, there is still room for improvement in increasing the level of public trust.

Even in Albania, transparency is not only a legal obligation but should be considered a concrete means through which institutions build and enhance their public profile, the impact of audit work, and, consequently, their credibility among stakeholders. *It should be emphasized that public information is regularly updated in accordance with Point 2, Article 5 of Law No. 119/2024 "On the Right to Information."* The rule of law and democracy are fundamental pillars for conducting independent and accountable public audits and serve as the foundation for the Lima Declaration[5].

Miti M. *et al.* (2023, 2024) identify in their study that, although Albania has undertaken multiple reforms over the years and has built a structured institutional architecture to combat corruption, the level of corruption remains high, and the role of professional accountants is particularly significant.

The legal and regulatory framework of the Albanian Supreme Audit Institution (SAI), known as the State Supreme Audit Institution (KLSH), guarantees the conduct of independent and transparent audits, in line with the Constitution of the Republic of Albania and Organic Law No. 154/2014 "On the Organization and Functioning of the SSAI."

To support transparency and accountability in public auditing, KLSH operates in compliance with the International Standards of Supreme Audit Institutions (ISSAI-s) developed by INTOSAI.

In particular, ISSAI 20 – Principles of Transparency and Accountability, outlines core guidelines for ensuring transparency in the work of SAI-s. This standard emphasizes that an SAI must act openly, clearly, and accessibly, by publishing audit reports, methodologies, and strategic plans in a timely manner, and ensuring that citizens have fair and equal access to public information.

The application of ISSAI 20 by KLSH ensures that the audit process is not only professional and independent but also comprehensible and beneficial to both citizens and institutions. In this way, transparency becomes a key element in strengthening public trust and improving governance.

Beyond ISSAI 20, which specifically addresses transparency and accountability, there are other relevant ISSAI-s that relate to transparency, accountability, and public communication in the work of SAI´s. Shortly, ISSAI 12: "The Value and Benefits of SAI´s", emphasizes the role of SAI´s in enhancing transparency, strengthening public accountability, and improving the lives of citizens. One of its three key principles includes: "Helping to increase transparency in public administration." ISSAI 10: "The Mexico Declaration on SAI Independence", considered the "Bible" of public auditors, underlines that SAI´s *have the right and obligation to report their audit findings, including those related to transparency and public fund usage, independently and publicly.* Also, ISSAI 100: "Fundamental Principles of Public-Sector Auditing", highlights the importance of transparent communication with the public and stakeholders to reinforce trust and legitimacy. It calls for audit results to be published in a clear and accessible manner.

Ulaya L.P. *et al.* (2023) also found in their study that the implementation of international accounting standards has significantly increased accountability in Tanzania's public sector organizations. The authors

[4] https://balkaninsight.com/2025/02/11/public-perceptions-of-corruption-in-balkans-continue-to-worsen-report/

[5] ISSAI 12, Vlerat dhe Dobitë e Institucioneve Supreme të Auditimit- sjellja e ndryshimeve në jetën e qytetarëve; www.isai.org / The Values and Benefits of Supreme Audit Institutions - Making a Difference in the Lives of Citizens;

recommend that public officials adopt effective measures to reduce corruption levels and improve the country's financial reporting systems.

In conclusion, transparency, information exchange, sustainability, and citizen engagement represent the fundamental pillars of an effective audit system in the public sector, especially in the fight against corruption.

The case of Albania demonstrates that increasing institutional transparency and actively involving the public in audit processes - supported by international standards such as the ISSAI-s - has significantly contributed to strengthening accountability and improving governance.

Sustainable interaction between citizens and audit institutions, such as the State Supreme Audit Institution, not only promotes public trust, but also creates a more resilient environment against corruption and the misuse of public funds. Thus, auditing becomes central to reforms for sustainable development and functional democracy.

3. Methodology

This study was designed in the study of the legal framework in the field of transparency and accountability of the Republic of Albania as well as in the data collection of the annual reports of the SAI, the only Supreme Audit Institution, for the period 2014-2023 (10 years). The study tests the correlation between the transmitted information and the audit of the issues surveyed.

This study was conducted based on three main components: (i) a review of the legal framework governing transparency and accountability in the Republic of Albania; (ii) a descriptive analysis of statistical data concerning the Corruption Perception Index (CPI) as perceived by the public; and (iii) the analysis and testing of data collected from the annual reports of the State Supreme Audit Institution (KLSH) - the only Supreme Audit Institution (SAI's) in Albania - covering the period from 2014 to 2023 (a ten-year timeframe).

A portion of the data obtained from KLSH could not be disclosed due to confidentiality constraints. However, to assess the extent to which transparency and the information disseminated by public institutions affect public trust, a correlation test was conducted between the issues raised by citizens through complaints and the findings of audit reports related to the same issues.

From this perspective, the central research question is: "Is there a correlation between the issues identified in citizen complaints and the findings of the auditor?"

Based on a review of the relevant literature concerning research methods used in this domain, Spearman's rank correlation coefficient was selected for data analysis. This coefficient is used to measure the strength and direction of the association between two ranked variables, particularly when data are not normally distributed or contain outliers.

The Spearman's rank correlation coefficient (*r*) (ranges from -1 to 1) is calculated using the following formula:

$$r = 1 - \frac{6 \sum d_i^2}{n(n^2-1)} \quad (1)$$

where:

r = Spearman's rank correlation coefficient, which ranges from -1 to +1.

d_i^2 = The difference between the ranks of the two variables for the same item *i*

$\sum d_i^2$ = The sum of the squares of the differences d_i

n = The number of data pairs (items being compared).

This method is widely recognized in academic literature for its robustness in cases of non-parametric data (Ulaya L.P. *et al.* 2023; Schmidt Huber *et al.* 2020; among others).

Vincent Tawiah (2022) emphasizes that the development and implementation of International Public Sector Accounting Standards (IPSAS) is significantly and positively associated with enhanced quality of public sector governance. The comparability, transparency, and detailed disclosure mandated by IPSAS contribute to high-quality governance and accountability in public sector financial management.

According to various institutional programs and guiding manuals (specifying the documentation used and processed by us for the purpose of operationalizing this study), such as: The Performance Audit Manual (November 2021), The Compliance Audit Manual (December 2022), The Financial Audit Manual (December 2022), The Public Procurement Audit Manual (2019), The Audit Manual for Public-Private Partnership (PPP) Projects (2020), The Performance Audit Guidelines (ISSAI 3000–3100), ISSAI 5220 – Guidelines on Best Practices for Auditing Public-Private Financing and Concessions, The Fiscal Transparency Code (IMF), as well

as the Transparency Program of the Supreme State Audit Institution (KLSH), prepared in accordance with Article 7 of Law no. 119/2014 "On the Right to Information", it is stated that transparency indicators may include:

- **Publication of audit reports:** Are the audit reports of the Supreme Audit Institution (SAI) published and available to the public?
- **Access to financial information:** Is financial and public expenditure data accessible to citizens?
- **Reporting on audit results:** How frequently and in what format is the content of SAI audits published, and what are the post-audit measures taken?
- **Citizen engagement in the audit process:** Are there opportunities for citizens to contribute to audit reports or to monitor audit processes?

Based on the above, in this study, the analysis of data collected from annual audit reports was subjected to correlation testing, to determine whether a relationship exists between citizen complaints and the audit findings, based specifically on the data from citizen-submitted complaints.

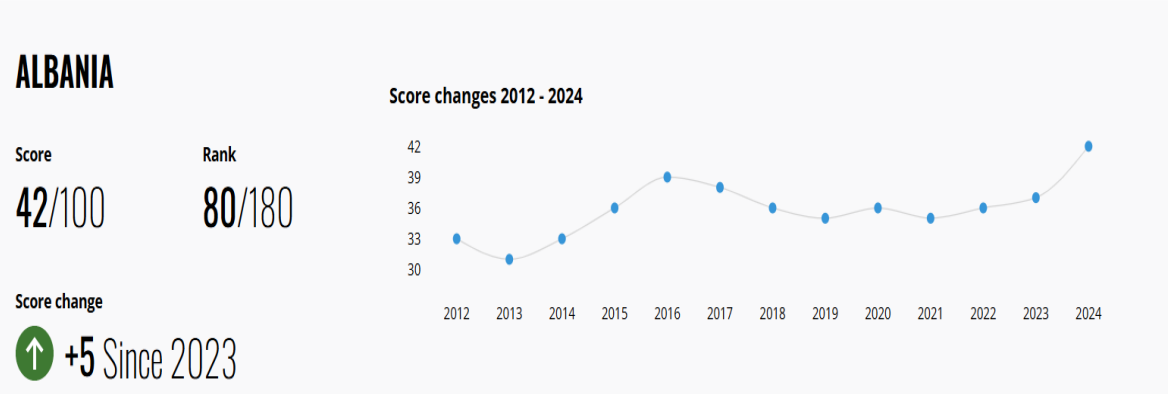
4. Research Results and Discussions

According to the Corruption Perceptions Index (CPI) Report 2024 published by Transparency International, Albania scored 42 out of 100 and ranked 80-th globally[6].

Although this represents (a + 5-point improvement compared to 2023), the score still reflects a relatively high level of perceived corruption in the country.

The analysis of CPI data from 2012 to 2024 reveals that the perception of corruption in Albania has remained consistently high, with only marginal changes over the years. The low degree of variation in the index across this period suggests structural and persistent challenges in anti-corruption efforts, transparency, and public trust in institutions.

Figure 2. Corruption Perceptions Index (CPI) - Albania (2012-2024)



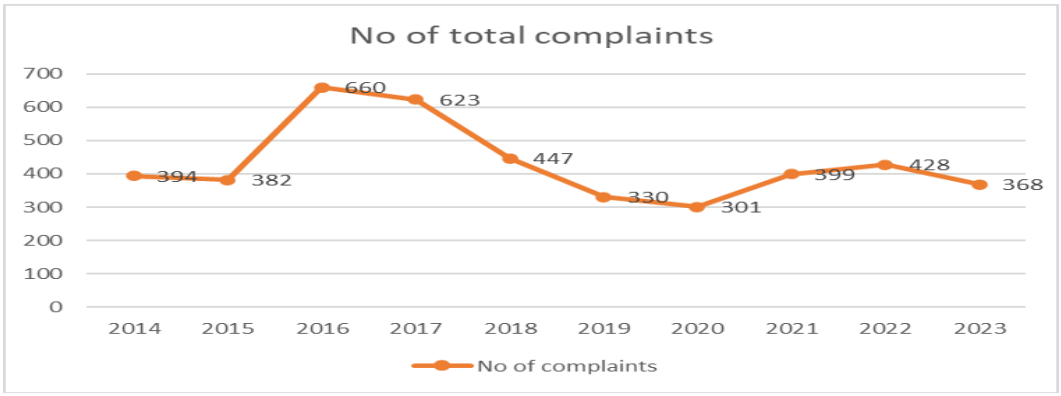
Sources: Transparency International (2024)

This assessment of the Corruption Perception Index is also due to a series of charges and convictions of high-profile former officials by the Special Structure Against Corruption and Organized Crime (SPAK), as well as its proactive role in promoting the fight against corruption and organized crime[7]. Thus, a very important aspect in the fight against corruption *is the involvement of citizens and civil society*. To successfully combat the deeply rooted culture of corruption as a social phenomenon, we highlight, among other factors, *the increase in public awareness*.

This also led to the creation of a more comprehensive legal framework for involving citizens in co-governance through the digital platform "With You for the Albania We Want." Through the legal act 107/2021 *on Co-Governance*, state structures responsible for co-governance with citizens were established, which include: a) the Agency for Dialogue and Co-Governance; b) institutions of the state administration. The main goal was to encourage the public to report cases of corruption. Focusing specifically on the complaints of citizens addressed to the Supreme State Audit (KLSH) as the only institution that audits and provides a reasoned opinion on the management of public funds, complaints for the period 2014 – 2023 are identified as follows.

[6] https://www.transparency.org/en/cpi/2024/index/alb
[7] https://spak.gov.al/wp-content/uploads/2025/04/Raporti-vjetor-SPAK-2024.pdf

Graph 1. Total complaints

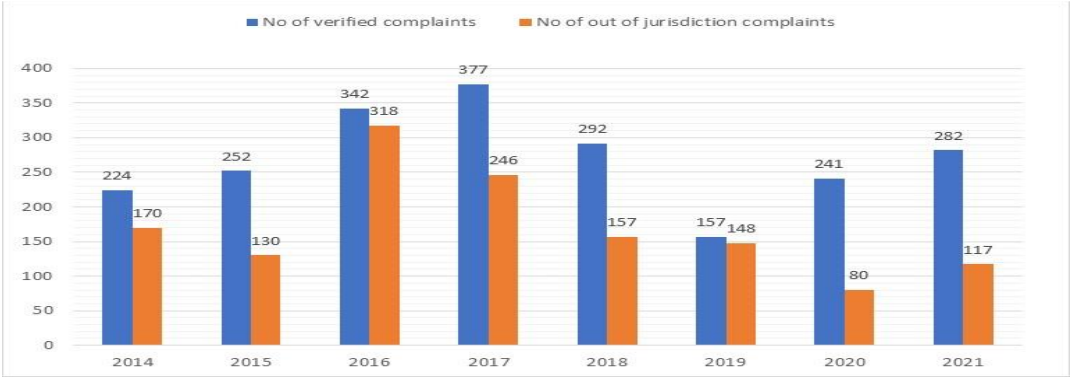


Source: Compiled by the authors based on the annual reports of the Supreme State Audit (KLSH)

It is observed that the number of public complaints remains within the same range, from 394 in 2014 to 368 in 2023. A significant increase of 67.4% is seen in 2016, which follows the increase in the previous two years. However, in 2019, a decrease in the number of complaints is noted, returning to the 300-400 complaints range per year.

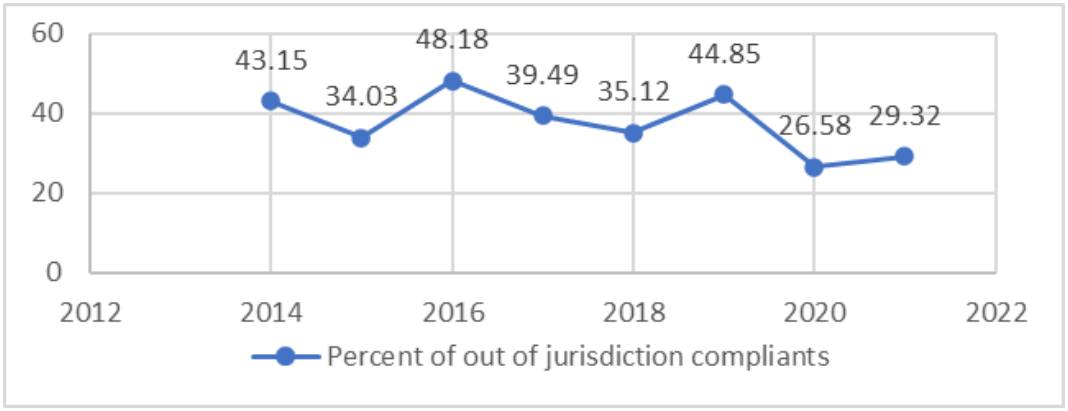
But from the analysis of the content of the complaints, it is found that a considerable number of them are outside the institution's jurisdiction (KLSH), especially in the period from 2014-2019, with a peak in 2016, during which 48.18% of the complaints were outside the jurisdiction (Graph no 2 and 3).

Graph 2. Verified Complaints and Complaints Outside the Jurisdiction



Source: Compiled by the authors based on the annual reports of the Supreme State Audit (KLSH)

Graph 3. Percentage of Complaints Outside the Jurisdiction



Source: Compiled by the authors based on the annual reports of the Supreme State Audit (KLSH)

The high level of complaints outside the jurisdiction raises the perception that many citizens are either unaware of the institution to which they should direct their complaints, or they view the Supreme State Audit (KLSH) as the only institution where they believe their complaints can find a solution.

The analysis of the data was further deepened concerning the complaints that fell within the jurisdiction and underwent the verification process. The question was whether there would be a connection between the data contained in the complaints and the findings established in the audit (classifying it as a valid complaint)? From the data analysis, a strong positive correlation was found between them (the descripted data see in the annex).

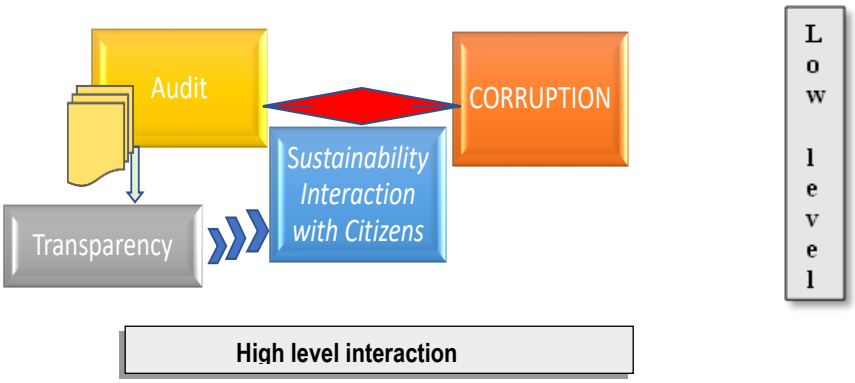
Table 1. Correlation between verified and fair complaints

	Total number	Verified Complaints	Fair Complaints
Total number	1	0.857**	0.881**
Verified Complaints		1	0.833*
Fair Complaints			1

*p-value<0.05 **p-value<0.01*
Source: Compiled by the authors

This confirms that the more Supreme Audit Institutions (SAI´s) implement transparency and accountability programs, the more the public will perceive the information. Sustainable institutional interaction with the public will also lead to the uncovering of fraudulent actions, thefts, and among them, corruption.

Figure 3. Relationship between Transparency, Sustainability Interaction with Citizens, vs the Fight Against Corruption in the auditing field



Source: Compiled by the authors based on the findings of the study

By studying a 10-year period of public interaction with the Supreme Audit Institution, it is concluded that the more sustainable and active this interaction is, the higher the role in reducing the level of corruption. This result aligns with the transparency index (Figure no 1).

Conclusions and Further Research

A major challenge faced by all Supreme Audit Institutions (SAIs) is promoting a better understanding of their roles and responsibilities in society, between the public and the administration. The information they provide should be easily accessible, understandable, and influence the increase of public trust. Their work processes, activities, and products must be transparent. They must also communicate openly with the media and other stakeholders, and the information should be visible in the public arena.

In Albania, there is a comprehensive legal and institutional framework for both transparency and the fight against corruption. The findings of the study highlighted that the public's perception of the level of corruption is high, but their role in identifying and preventing it is also significant. As a result, sustainable interaction with the Supreme Audit Institutions should be further strengthened to ensure good governance, rule of law, and prevention of corruption.

Through this paper, the authors emphasize the importance of public sector audit institutions in the fight against corruption, which through the correct implementation of the principles of transparency and sustainable communication and interaction with the public, will be the key to good governance and strengthening public trust. Further studies in these areas would increasingly contribute to strengthening the rule of law, where good governance and the rule of law are its companions.

Credit Authorship Contribution Statement

Almida Kafia Hoxha: Project administration, Investigation, Data curation, Writing – original draft, Writing – review and editing, Visualization.

Mirela Miti: Conceptualization, Methodology, Formal analysis, Supervision, Validation, Writing – review and editing.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they did not use generative AI and AI-assisted technologies during the preparation of this work.

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Appendix A

Appendix A.1

Correlations

			Total	Verified complains	Fair complains
Spearman's rho	Total	Correlation Coefficient	1.000	.857**	.881**
		Sig. (2-tailed)	.	.007	.004
		N	8	8	8
	Verified complains	Correlation Coefficient	.857**	1.000	.833*
		Sig. (2-tailed)	.007	.	.010
		N	8	8	8
	Fair complains	Correlation Coefficient	.881**	.833*	1.000
		Sig. (2-tailed)	.004	.010	.
		N	8	8	8

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

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

Appendix A.2

Descriptives

			Statistic
Complaints	Mean		433.2000
	95% Confidence Interval for Mean	Lower Bound	348.7644
		Upper Bound	517.6356
	5% Trimmed Mean		427.9444
	Median		396.5000
	Variance		13931.733
	Std. Deviation		118.03276
	Minimum		301.00
	Maximum		660.00
	Range		359.00
	Interquartile Range		132.50
	Skewness		1.232
	Kurtosis		.599

Descriptives

			Statistic
verified complants	Mean		270.8750
	95% Confidence Interval for Mean	Lower Bound	213.2087
		Upper Bound	328.5413
	5% Trimmed Mean		271.3056
	Median		267.0000
	Variance		4757.839
	Std. Deviation		68.97709
	Minimum		157.00
	Maximum		377.00
	Range		220.00
	Interquartile Range		101.25
	Skewness		-.027
	Kurtosis		.046

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The Impact of European Integration on the Stability of Ukrainian Financial Markets

Galyna KUCHER
Department of Finance
State University of Trade and Economics, Ukraine
ORCID: 0000-0002-1714-5623
garibliismayil@gmail.com

Oksana GALENKO
Department of International Accounting and Audit
Kyiv National Economic University named after Vadym Hetman, Ukraine
ORCID: 0000-0002-0518-2144
galenko.ox@gmail.com

Mykhaylo KAPYRULYA
Department of International Relations
Interregional Academy of Personnel Management, Ukraine
ORCID: 0009-0005-1527-9598
mkapyrulya@gmail.com

Viktoria KOSTIUK
Department of Banking and Insurance
National University of Life and Environmental Sciences of Ukraine, Ukraine
ORCID: 0000-0001-7671-3603
viktoriiak74@gmail.com

Ievgen VOLKOVSKYI
Department of Finance Named After Viktor Fedosov
Kyiv National Economic University named after Vadym Hetman, Ukraine
ORCID: 0000-0001-5904-919X
volkevgen@gmail.com

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Abstract: The aim of the study was to analyse the impact of the level of financial openness in the context of European integration on the stability of the financial markets of Ukraine. The research employed correlation, analysis of variance (ANOVA), and regression analysis. The regression model for the foreign exchange market obtained in the study showed that globalization has a significant and negative impact on the hryvnia exchange rate. The regression coefficient for the KOF Globalisation Index was 0.982115, which in the context of the analysis indicated a weakening of the hryvnia against the US dollar. At the same time, a mitigating effect on the exchange rate can be observed due to an increase in foreign trade turnover. The coefficient for this indicator reached -0.556658, which means a strengthening of the hryvnia due to an increase in foreign trade turnover. A statistically significant effect of the Debt-to-GDP ratio, the share of non-cash payments, and the number of commercial banks with foreign capital on consumer price indices was also found. This indicates that the increase in financial openness in the context of European integration can have a destabilizing effect on the money market, which requires decisive government action. The results obtained can be useful for politicians in the process of developing integration strategies, as it will allow considering the potential negative consequences of increasing financial openness and using the benefits.

Keywords: foreign exchange market; securities market; money market; sustainable development; financial openness; exchange rate.
JEL Classification: F55; G14; G28; C12.

Introduction

The stability of financial markets determines the economic stability of states, as it means strengthening the national currency exchange rate, increasing investment attractiveness and accessibility of capital, etc. In the context of globalization, financial integration and sustainable development, the stability of the financial sector largely depends on the level of financial openness (Solodovnik *et al.* 2021). Financial openness is the degree to which international participants can participate in the national economy (Gräbner *et al.* 2021). Ukraine, as a state that has chosen the path of European integration, can receive both significant benefits from increased financial openness and face new challenges. On the one hand, European integration provides financial support to Ukraine from international partners, improves access to financial resources, and stimulates infrastructure development in wartime. This occurs through grant mechanisms, loan programmes, and financing from the EU and international financial institutions (Alekseieva *et al.* 2023). In times of war, these mechanisms contributed to the stabilization of public finances, economic recovery, and support for the defence sector. On the other hand, it can increase the vulnerability of the national economy to external economic fluctuations. Therefore, identifying and analysing the impact of financial openness in the context of European integration on the stability of financial markets is a pressing task for researchers.

Many researchers have noted the positive impact of European integration on the stability of financial markets. At the same time, there is a lack of evidence of its impact on indicators that characterize such stability. Moreover, the systems of indicators that determine the stability of financial markets differ significantly, and indicators that characterize the impact of European integration processes are generally poorly studied. Therefore, the development of an approach that will assess the impact of European integration on key indicators of financial market stability may be a relevant area of research. Assessment of the impact of European integration should take into account such indicators as the volume of foreign capital in Ukrainian banks, foreign direct investment (FDI), the volume of external debt, the volume of international trade, etc. These indicators can reflect the level of financial openness, and analysis of their impact on stability will help to identify key risks and strengths. The novelty of the study lies in the comprehensive empirical analysis of the impact of financial openness on financial stability in the context of European integration using the example of Ukraine. The results of the work are important, as they can be used to minimize the risks of financial destabilization in the context of increasing financial openness. The aim of the study was to analyse the impact of the level of financial openness in the context of European integration on the stability of the financial markets of Ukraine. Research objectives:

- build a model of the impact of European integration and financial openness on the foreign exchange market;
- build a model of the impact of European integration and financial openness on the money market;
- build a model of the impact of European integration and financial openness on the securities market.

1. Literature Review

Many researchers seek to deepen their understanding of the impact of financial openness, globalization, and integration – processes that reflect a country's involvement in international economic processes – on the stability of financial markets. Financial openness is an integral element of Ukraine's European integration into the European financial space and is closely related to sustainable development, which is a key requirement of modern economic policy and international cooperation. Therefore, an analysis of the impact of financial openness will help to better understand the potential consequences of European integration for Ukraine and determine its role in achieving sustainable development goals. Giraldo *et al.* (2024) examined the impact of financial openness on the stability of the banking system. The researchers emphasized that theoretical studies note the positive impact of financial openness on growth and stability, while empirical studies show contradictory results. However, the research is reduced to studying the impact on the banking sector only, while the impact of financial openness on financial markets as a whole remains unexplored. A broader analysis is presented in Tongurai and Vithessonthi (2023), who studied the relationship between openness and the development of the stock market, banking sector, and bond market. However, the researchers have not studied the impact on the foreign exchange market, which is an important component of the financial market.

Uzoechina *et al.* (2023) examine the impact of financial openness on the domestic interest rate (using the case of Nigeria). They used the following indicators: Foreign Direct Investment (FDI) inflows, FDI outflows and portfolio investment, and capital account openness. Ashraf *et al.* (2021) examined the impact of trade and financial openness on the pricing of bank loans, but did not analyse how changes in pricing affect financial stability. However, the abovementioned studies use a limited set of indicators, which does not allow assessing the comprehensive impact of openness on financial development and sustainability.

A number of studies use a more comprehensive approach that reveals the impact of openness on sustainable development in general. Nam *et al.* (2025) and Nam *et al.* (2024) examined the impact of financial openness on financial development, taking into account the mediating effects of institutional quality and trade openness. However, the study does not provide sufficient explanations of how institutional quality affects the stability of financial markets. Ho and Iyke (2021) examined the impact of openness on financial development using the trade openness indicator for low- and middle-income countries. The study does not, however. specify the impact of openness on countries that are on the edge of the observed classification features. For example, Ukraine belongs to the lower-middle-income countries, which do not fall into the categories defined by the researchers. Damasceno and Guedes (2024) studied the impact of openness on capital accumulation and productivity growth in developing countries. However, the paper does not provide a clear explanation of how openness can affect countries' ability to withstand external shocks. Yu and Qayyum (2023) examined the relationship between financial openness and economic complexity. Their study does not, however, reveal the effect of financial openness on financial market volatility in the context of economic integration. Petry (2021) notes that globalization promotes international investment, but it can open up new challenges because of external economic fluctuations, as in the case of China. However, the paper does not reveal the impact of globalization and financial openness on the financial markets of countries with open economies. Paskaleva and Stoykova (2021) noted both positive and negative consequences of financial globalization. The researchers attributed an increase in the openness of markets for investors to the positive ones. The negative consequences are associated with the availability of global market information, which increased the volatility of stock prices in the context of the global financial crisis. However, the paper does not describe how countries can adapt to counter threats to financial stability in such circumstances.

Some studies have examined the impact of financial integration specifically in the context of European Union (EU) integration. Esteve-González *et al.* (2021) analysed the impact of market perceptions of financial integration on support for EU integration. The study does not provide a comprehensive overview of the impact of EU integration on financial markets, being reduced to some indicators of financial stability. Burghof and Gehrung (2022) analysed the impact of the single European financial market on economic growth in EU member states. However, the study does not provide a detailed analysis of the impact on non-EU countries with European integration intentions. Kussainov *et al.* (2023) examine the relationship between anti-corruption mechanisms, financial sector security, and artificial intelligence technologies in the EU economy. The study notes that sound anti-corruption governance is a prerequisite for effective financial integration in the context of EU enlargement. Although the study does not focus directly on financial openness, it reveals how institutional and technological factors shape the outcomes of financial integration.

The review shows that the studies lack evidence on the impact of financial openness on financial stability, which is one of the key areas of impact of financial openness. Furthermore, a very limited number of studies directly address countries seeking EU integration. This study seeks to fill these gaps by analysing the impact of individual indicators of financial openness on key indicators of the foreign exchange, money, and securities market. The study takes into account the context of European integration and financial openness using the case of Ukraine.

2. Materials and Methods

2.1 Research Design

The study was conducted for 2003-2024, which covers the period of the country's active steps towards European integration. The research began with the collection and preparation of data for the analysis. The next stage of the study involved data analysis and the construction of regression models for the currency, money, and securities market. The final stage provided for drawing conclusions and providing recommendations based on the results of the study.

2.2 Sample

The selection of indicators for the study was based on the criteria of significance for the study. The significance was assessed through the ability of the indicators to reflect, on the one hand, the level of stability of financial markets, and the impact of financial openness in the context of European integration on the other hand. The indicators were also selected considering the availability and reliability of data and the ability to interact with each other.

The average annual exchange rate (hryvnia per dollar) was used as a dependent variable for the model of the impact of European integration and financial openness on the foreign exchange market. This indicator is

important as a characteristic of currency stability and assesses how European integration and financial openness affect resistance to external fluctuations. The KOF Globalisation Index, official international reserves of Ukraine, the volume of foreign trade turnover, FDI were the independent variables for the model. The KOF Globalisation Index shows the level of globalization of the country, reflecting integration into the global economy through finance, trade, etc., and has an indirect impact on sustainable development. The volume of international reserves mitigates the impact of external shocks and fluctuations on the foreign exchange market. This indicator is useful for assessing the ability of the state to stabilize the exchange rate through monetary policy. The volume of foreign trade turnover is related to foreign exchange flows and is an important indicator of the impact of financial openness and integration on the foreign exchange market through changes in international trade. FDI is an important indicator of financial openness and can affect the demand for currency, which, in turn, affects the exchange rate.

The model of the impact of European integration and financial openness on the money market used consumer price indices as the dependent variable, which have a significant impact on market stability. The independent variables were the ratio of public debt to GDP, Ukraine's short-term external debt, the share of non-cash payments, and the number of commercial banks with foreign capital. A high level of external debt can significantly affect consumer price indices, leading to an increase in interest rates and devaluation of the national currency. The share of non-cash payments is important for harmonizing the national economy with international standards, integrating with international payment systems, improving transparency, control, stimulating development and investment. The number of commercial banks with foreign capital can deepen the assessment of the impact of foreign participation on the stability of the national money market.

The model of the impact of European integration and financial openness on the securities market used the PFTS (First Stock Trading System) index as the dependent variable, which is one of the main indicators of the state of the financial market of Ukraine. The independent variables included the total trading volume, the yield of USD-denominated government bonds, the yield of EUR-denominated government bonds, and FDI. The total trading volume and FDI were used to assess investor activity and market liquidity, which may indicate increased financial openness. The yield of domestic government bonds in foreign currency characterizes the interest of foreign investors in government securities.

2.3 Methods

The research employed the method of variance analysis, in particular the F-test to check the overall significance of the built regression models. The correlation analysis with the calculation of Pearson coefficients was used to analyse the correlations between variables in each of these models. The correctness of the results was ensured by conducting a multicollinearity test. Regression analysis using the linear regression method was applied to assess the value and direction of the influence of each of the independent variables on the dependent indicators. The correctness of the obtained models was checked through the Breusch-Godfrey test for autocorrelation and a check for normality of the distribution of residuals. The models were also built that allow predicting the values of the dependent indicators using regression modelling.

3. Research Results

The model of the impact of European integration and financial openness on the foreign exchange market

The average annual exchange rate (hryvnia per dollar) was the dependent variable in the model of the impact of European integration and financial openness on the foreign exchange market. The KOF Globalisation Index, official international reserves of Ukraine, the volume of foreign trade turnover, and FDI were used as independent variables. The model was characterized by a strong correlation between the indicators (Multiple R = 0.871769) and high explanatory power according to the value of the coefficient of determination (Adjusted R Square = 0.691405). Table 1 presents the results of the analysis of variance for the model.

Table 1. The ANOVA results for the model of the impact of European integration and financial openness on the foreign exchange market

	df	SS	MS	F	Significance F
Regression	4	1275.199	318.7996	11.08221	0.00029
Residual	14	402.7351	28.76679		
Total	18	1677.934			

Source: calculated by the authors based on (Ministry of Finance of Ukraine 2025b; ETH Zurich 2024; Ministry of Finance of Ukraine 2025a; State Statistics Service of Ukraine 2025; Ministry of Finance of Ukraine 2025c)

The ANOVA results show that the model is statistically significant, and the variables used have a significant impact on the dependent variable. The relatively low values of the residuals (SS Residual and MS Residual) indicate that the model is able to explain the variation of the average annual exchange rate well. Table 2 contains the results of the regression analysis.

Table 2. Results of the regression analysis for the model of the impact of European integration and financial openness on the foreign exchange market

	Coefficient	Standard error	t(14)	p-value
Intercept	-0.250562	0.134487	-1.86310	0.083561
KOF Globalisation Index	0.982115	0.182817	5.37212	0.000098
Official international reserves of Ukraine	0.153683	0.201545	0.76253	0.458402
Foreign trade turnover	-0.556658	0.222281	-2.50430	0.025256
FDI in Ukraine	-0.100211	0.211882	-0.47296	0.643532

Source: calculated by the authors based on (Ministry of Finance of Ukraine 2025b; ETH Zurich 2024; Ministry of Finance of Ukraine 2025a; State Statistics Service of Ukraine 2025; Ministry of Finance of Ukraine 2025c)

The results of the regression analysis for the model of the impact of European integration and financial openness on the foreign exchange market show a statistically significant impact of two variables on the average annual exchange rate. These are the KOF Globalisation Index (direct impact) and the foreign trade turnover (inverse impact). The increase in the average annual exchange rate, expressed in hryvnias per dollar, indicates a weakening of the national currency. Accordingly, the positive impact of the KOF Globalisation Index indicates that the increase in financial and trade openness is accompanied by a weakening of the hryvnia. This can be explained by increased demand for foreign currency, as well as increased risks because of external economic fluctuations. However, the inverse impact of the foreign trade turnover, on the contrary, contributes to the strengthening of the hryvnia, which may be associated with increased demand for hryvnia due to increased exports. International reserves and FDI do not demonstrate a statistically significant impact on the average annual exchange rate. The regression model has the form:

*Exchange rate (hryvnia per dollar) = -0.250562 + 0.982115 * KOF Globalisation Index + 0.153683 * Official international reserves of Ukraine - 0.556658 * Foreign trade turnover - 0.100211 * Foreign direct investment in Ukraine*

The model of the impact of European integration and financial openness on the money market

The model of the impact of European integration and financial openness on the money market uses the Consumer Price Index (CPI) as a dependent variable. The independent variables were the Debt-to-GDP ratio, Ukraine's short-term external debt, the share of non-cash payments, and the number of commercial banks with foreign capital. The correlation between the indicators reached 0.916998, which is a very high value and indicates that the variables used are closely correlated with each other. Adjusted R Square was 0.761327 and indicated a high ability of the model to explain changes in the dependent indicator. Table 3 presents The ANOVA results for this model.

Table 3. The ANOVA results for the model of the impact of European integration and financial openness on the money market

	df	SS	MS	F	Significance F
Regression	4	1568.173	392.0433	10.56948	0.002797
Residual	8	296.736	37.092		
Total	12	1864.909			

Source: calculated by the authors based on (Ministry of Finance of Ukraine 2025e; Ministry of Finance of Ukraine 2025d; National Bank of Ukraine 2025b; Ministry of Finance of Ukraine 2025f)

The ANOVA showed the statistical significance of the model and the significant impact of the independent variables on the CPI. According to the SS Residual and MS Residual, it can be concluded that the model can well explain the variation of the dependent indicator. The results of the regression analysis are presented in Table 4.

The Debt-to-GDP ratio, the share of non-cash payments, and the number of commercial banks with foreign capital in Ukraine have a statistically significant impact on consumer price indices. The impact of all indicators is direct, respectively, the growth of these indicators is associated with an increase in the CPI.

Table 4. Results of the regression analysis for the model of the impact of European integration and financial openness on the money market

	Coefficient	Standard error	t(8)	p-value
Intercept	-0.595420	0.253563	-2.34821	0.046812
Debt-to-GDP ratio	0.655687	0.176378	3.71752	0.005892
Short-term external debt of Ukraine on a remaining maturity	-0.329803	0.212815	-1.54972	0.159805
Share of non-cash payments	1.953821	0.548576	3.56162	0.007383
Number of commercial banks with foreign capital in Ukraine	2.030252	0.539418	3.76378	0.005514

Source: calculated by the authors based on (Ministry of Finance of Ukraine 2025e; Ministry of Finance of Ukraine 2025d; National Bank of Ukraine 2025b; Ministry of Finance of Ukraine 2025f)

In other words, an increase in the Debt-to-GDP ratio, the share of non-cash payments in their total volume, and the inflow of foreign capital to banks increases inflationary pressure. The inflow of foreign capital to banks can increase the availability of credit resources, which stimulates demand. An increase in the share of non-cash payments, in turn, can be a consequence of increased demand, which, ultimately, can become a stimulus for price growth. The regression model has the form:

*CPI = -0.595420 + 0.655687 *** Debt-to-GDP ratio *- 0.329803 * Short-term external debt of Ukraine on a remaining maturity + 1.953821 * Share of non-cash payments + 2.030252 * Number of commercial banks with foreign capital in Ukraine*

The model of the impact of European integration and financial openness on the securities market

The model of the impact of European integration and financial openness on the securities market uses the PFTS index as the dependent variable. Independent variables: total trading volume for the period, yield on USD-denominated government bonds on the primary market, yield on EUR-denominated government bonds on the primary market, FDI. The model is characterized by a fairly high correlation between the variables according to the Multiple R indicator = 0.792058. The explanatory power of the model can be described as moderate, as the Adjusted R Square is 0.441033. Table 5 presents the ANOVA results.

Table 5. The ANOVA results for the model of the impact of European integration and financial openness on the securities market

	df	SS	MS	F	Significance F
Regression	4	99741.44	24935.36	3.367042	0.067673
Residual	8	59245.74	7405.717		
Total	12	158987.2			

Source: calculated by the authors based on (National Bank of Ukraine 2025a; Ministry of Finance of Ukraine 2025c)

The ANOVA results show that the model does not pass the 95% confidence level test, but is very close to it, as the Significance F is 0.067673. The residual values indicate that a significant part of the variation in the PFTS index (over 37%) remains unaccounted. The results of the regression analysis are presented in Table 6.

Table 6. Results of the regression analysis for the model of the impact of European integration and financial openness on the securities market

	Coefficient	Standard error	t(8)	p-value
Intercept	653.5334	122.5610	5.33231	0.000701
Total trading volume for the period	0.090810	0.255097	0.35598	0.731059
Yield of USD-denominated government bonds in the primary market	-0.759653	0.251148	-3.02473	0.016441
Yield of EUR-denominated government bonds in the primary market	-0.041598	0.223432	-0.18618	0.856938
FDI in Ukraine	0.237504	0.248386	0.95619	0.366975

Source: calculated by the authors based on (National Bank of Ukraine 2025a; Ministry of Finance of Ukraine 2025c)

The results of the regression analysis for this model determine that only the yield of USD-denominated government bonds on the primary market has a statistically significant impact on the PFTS index. The regression coefficient indicates that an increase in the yield of USD-denominated government bonds is accompanied by a

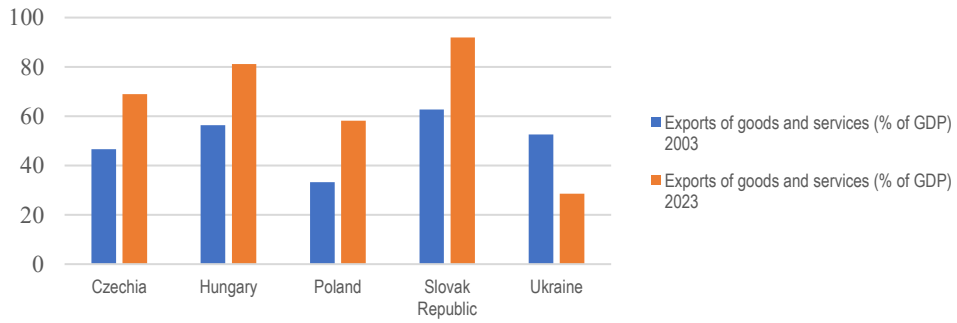
decrease in the PFTS index. This may indicate that high yields on government bonds may discourage investors from buying stocks in favour of buying bonds with high yields. The high and statistically significant value of the Intercept confirms that there are other factors that affect the PFTS index. In a stable environment, such factors as FDI and trading volume usually have a significant impact on the functioning of the stock market. The statistically insignificant impact of these indicators on the PFTS index may be associated with the underdevelopment of the Ukrainian stock market, a high level of risks, in particular, war-related, and investor distrust. The regression model has the form:

*PFTS Index = 653.5334 + 0.090810 * Total trading volume for the period - 0.759653 * Yield USD-denominated government bonds in the primary market - 0.041598 * Yield on EUR-denominated government bonds in the primary market + 0.237504 * FDI in Ukraine*

3.1 Global Comparison

Comparison of Ukraine's path to the EU with other countries that have recently joined the EU reveals both common features and differences. The KOF Globalization Index, which showed a significant negative impact on the foreign exchange market of Ukraine, is significantly higher in the Czech Republic, Hungary, Poland, and Slovakia in 2024. For comparison, the index for Ukraine reached 71.87243, the Czech Republic – 79.59854, Hungary – 81.28555, Poland – 75.04407, Slovakia – 76.88394. However, it can be assumed that the foreign trade turnover for these countries also has a mitigating effect on the foreign exchange market. This is confirmed by the high value of exports in these countries as of 2023. At the same time, these countries had lower export volumes on the eve of accession in 2003, and Ukrainian exports in 2003 were slightly inferior, and exceeded their results in the case of the Czech Republic and Poland (Figure 1).

Figure 1. Comparison of export volumes for selected countries and Ukraine in 2003 and 2023.



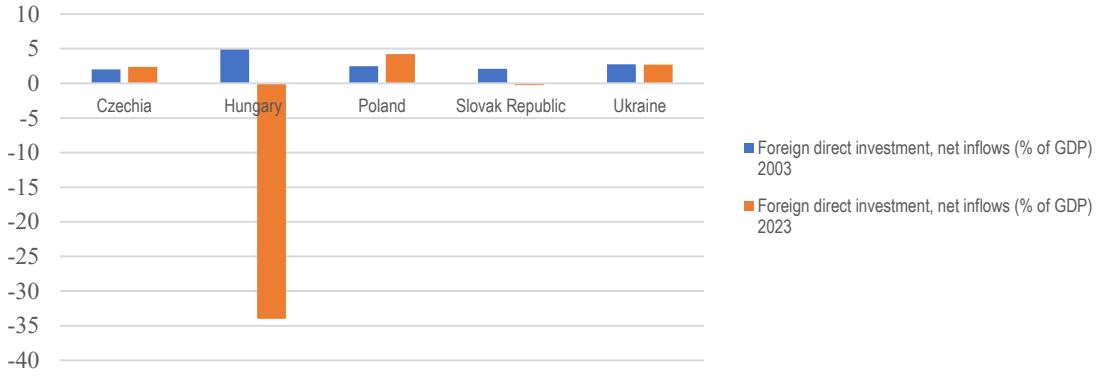
Source: calculated by the authors based on (World Bank 2025)

However, as the figure shows, Ukrainian exports have experienced a significant decrease as of 2023, which is undoubtedly associated with military operations on the territory of the country. Accordingly, the negative effects of globalization may be more pronounced for Ukraine than for other European countries.

Regarding the share of Debt-to-GDP ratio, it can be noted that this indicator for countries mostly increased after joining the EU. The increase for Hungary was almost 16%, for Slovakia — over 18%. This confirms the author's assumption about the direct impact of European integration on CPI, because the increase in the debt burden is usually accompanied by an increase in these indices. Along with this, all countries that joined the EU demonstrated a significant increase in the share of non-cash payments, which can also be associated with an increase in consumer price indices due to increased demand. However, unlike Ukraine, countries that are already members of the EU were able to apply more effective institutional and regulatory mechanisms and policies of the European Central Bank. This gave them the opportunity to mitigate the negative impact of the increase in consumer price indices and balance the benefits of European integration with potential risks. Although European integration contributes to the development of financial markets, this process is complicated by the lack of effective stabilization mechanisms in the case of Ukraine and may lead to increased inflationary processes.

FDI is considered one of the key factors of rapid growth and increase in GDP per capita for the countries that have joined the EU. At the same time, the analysis of the share of FDI in GDP shows that among the studied countries, Ukraine ranked second in this indicator both in 2003 and in 2023 (Figure 2). The significant outflow of FDI for Hungary is associated with political and regulatory uncertainty, business-unfriendly economic decisions and geopolitical risks. This experience may become important for Ukraine, as it emphasizes the need to maintain stability and transparency of economic policies.

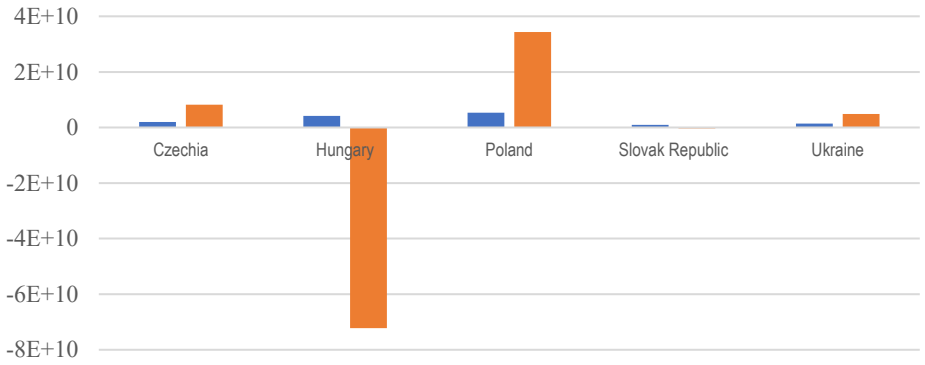
Figure 2. Comparison of the share of FDI in GDP of selected countries and Ukraine in 2003 and 2023



Source: calculated by the authors based on (World Bank 2025)

A somewhat different situation is observed in the process of analysing the absolute values of FDI for the countries. This indicator has increased significantly for Poland and the Czech Republic, while it has taken on a negative value for Slovakia and Hungary. FDI shows growth in Ukraine even in wartime (Figure 3).

Figure 3. Comparison of absolute values of FDI of selected countries and Ukraine in 2003 and 2023



Source: calculated by the authors based on (World Bank 2025)

The above gives grounds to draw several key conclusions. On the eve of joining the EU, the countries under study did not have a significantly higher development potential than Ukraine. However, integration allowed them to more widely reveal this potential through the use of effective stabilization mechanisms that contributed to the modernization of the economy, increased exports, and attracted FDI. The situation for Ukraine is complicated, first of all, by the war, as well as the imperfection of institutional mechanisms, which requires special attention to the regulation of risks and the benefits of financial openness.

4. Discussions

The analysis conducted in this study identified the strength and direction of the influence of indicators of the level of financial openness in the context of European integration on indicators of financial market stability. It was found that financial openness can have both positive and negative effects on the financial markets of Ukraine and therefore may have a contradictory impact on sustainability. However, it is appropriate to compare the obtained conclusions with the results of other researchers in order to deepen their understanding by considering different contexts.

The conclusions of Biliak (2024) and Derhachova *et al.* (2021) support the author's assumptions about the potentially negative impact of globalization on the foreign exchange market. The hryvnia exchange rate was affected by increasing dependence on trading partners, falling world prices for major export goods, and other external factors. The researchers noted that financial globalization can lead to a decrease in state control over monetary relations. However, the researchers' conclusions were not supported by appropriate calculations. The author's calculations and observed international experience prove that the negative impact of globalization can be mitigated by increasing foreign trade turnover.

Giraldo *et al.* (2024) found that financial openness, in general, increases the financial stability of the banking system by reducing the ratio of problem loans, increasing liquidity and capital adequacy. At the same time, susceptibility to foreign capital inflows can affect the increase in financial vulnerability. These findings are partially confirmed in our study, where the inflow of foreign capital through the banking sector is found to be accompanied by growing inflation, which increases financial vulnerability. However, the author did not find a statistically significant effect of FDI in general on the studied indicators of financial market stability. These results are supported by the results obtained by Damasceno and Guedes (2024), who found no evidence that financial openness stimulates capital growth or productivity in developing countries. The researchers noted that such findings differ significantly from the views prevalent in literature on the positive impact of openness on financial development. In particular, Sulehri *et al.* (2024) share such views, noting that financial integration contributes to economic growth and stability through cross-border capital flows and reduced financial market fragmentation. Izadi *et al.* (2022) found a negative relationship between FDI inflows and inflation and a positive relationship between FDI, market capitalization and exchange rate. Radmehr *et al.* (2022) found a positive relationship between FDI, trade openness, and economic growth in both low- and high-income countries. The differences in conclusions can be explained by the specifics of the regions taken for research, in particular, the author's study analysed the impact of foreign capital inflows using the case of Ukraine only. Kaya and de Haan (2022) studied the impact of European integration on capital flows to potential members of the association. The researchers found that a positive effect was observed before the global financial crisis, but European integration could not prevent a decrease in capital flow after the crisis. Moreover, the researchers found that the impact of European integration significantly depends on the level of institutional development. However, the study does not contain a detailed analysis of the effects of capital inflows, focusing mainly on the capital investment rate.

Tongurai and Vithessonthi (2023) found a positive relationship between openness, the development of the banking sector and the stock market. However, the study found a negative impact of financial openness on the development of the bond market. Such conclusions are not consistent with the author's results, where the negative impact of the increase in the yield of USD-denominated government bonds on the PFTS index was found. This may indicate that high bond yields distract investors from the stock market, in other words, the bond market benefits more from the increase in the involvement of international participants.

Nam *et al.* (2025) noted that financial openness can promote economic development, especially if institutions are strong. However, trade openness weakens this positive effect. The researchers concluded that excessive openness can harm the financial development of Eastern European countries. This thesis is confirmed in the author's study, where certain negative consequences of financial integration and globalization for Ukraine were identified. In particular, it was found that the joint impact of financial and trade openness, which are estimated in the study through the KOF Globalization Index, is negative, as it leads to a weakening of the hryvnia. The conclusions of Aremo and Arambada (2021) differ from the previous work and the author's work. The authors noted that trade openness in low-income countries has a positive impact on economic growth. At the same time, the joint impact of trade and financial openness is insignificant. In middle-income countries, the impact of trade openness and financial openness on economic growth was not observed. This contradicts the author's conclusions, as a significant negative impact of financial and trade openness on the hryvnia exchange rate was found. Slightly different conclusions regarding the impact of openness on the economies of countries with different income levels are presented in the study of Ho and Iyke (2021). The researchers proved the existence of the impact of openness on the financial development of low-income countries. At the same time, researchers have found that openness hinders the financial development of middle-income countries. Ukraine, as a country with an income below the average, is on the verge of the division of countries into low- and middle-income countries used by the researchers. So, it can be assumed that the consequences of openness can be both positive and negative for Ukraine. In general, the results of the author's study confirm this assumption by identifying both a direct and inverse impact of some indicators of openness on the stability of the country's financial markets.

Esteve-González *et al.* (2021) found that one of the important factors weakening support for EU integration is the tension over public debt financing. As the results of the author's study showed, the increased Debt-to-GDP ratio directly affects the increase in the CPI, which is consistent with the researchers' findings. The increase in the CPI as a result of the increase in public debt can worsen the economic situation and weaken support for EU integration. The practical implications of the study are to identify key areas and the strength of the impact of indicators characterizing financial openness in the context of European integration on the stability of Ukraine's financial markets. This will help policymakers to develop more effective integration strategies, preventing negative consequences and focusing efforts on the most effective areas.

The research limitations are related to the lack of data for certain indicators over a certain period. However, this did not become a significant obstacle, as the available data allowed us to form fairly complete and representative conclusions.

Recommendations

In the context of European integration and in order to strengthen the stability of financial markets, Ukraine should pay attention to regulating the impact of financial openness on the hryvnia exchange rate. In the context of limited foreign exchange reserves, this can be achieved through the development of exports, effective monetary policy, regulation of budget expenditures, etc.;

It is appropriate to increase the efficiency of public debt management, which is a difficult task in wartime. However, it is appropriate to consider various ways to mitigate the negative consequences, for example, debt restructuring or attracting private capital.

Attention should be focused on increasing the efficiency of using foreign bank capital, in particular, by ensuring better availability of credit resources for business.

Conclusions and Further Research

In wartime, ensuring the stability of financial markets and sustainable growth is critical to maintaining economic resilience. Therefore, the task of balancing the risks and benefits of increasing financial openness in the context of European integration is particularly relevant for Ukraine. The study found that increasing financial openness in the context of European integration can have both advantages and disadvantages. According to the regression coefficient for the KOF globalization index, it can be concluded that globalization has the most significant and negative impact on the hryvnia exchange rate. This can be explained by the decreased state control over monetary relations, which is determined by increased dependence on trading partners and foreign economic fluctuations. At the same time, the growth of foreign trade turnover can have a mitigating effect, strengthening the hryvnia due to increased exports of national goods and services.

Consumer price indices are significantly influenced by the Debt-to-GDP ratio, the share of non-cash payments, and the number of commercial banks with foreign capital in Ukraine. The impact of the indicators is direct, and therefore their growth is accompanied by an increase in consumer price's indices. This gives grounds to conclude that the money market is mainly negatively affected by increased financial openness in the context of globalization. This requires increased attention to this component of the financial market and the implementation of effective steps to stabilize prices. The model for the securities market had moderate explanatory power and therefore requires further analysis and expansion. The Ukrainian securities market has a low level of development, in particular, because of military risks, a low level of institutional trust, and a lack of transparency of financial transactions. At the same time, this element of the financial market may have the potential to attract investment, which will positively affect economic growth and stability. Therefore, it is appropriate to analyse the factors that determine demand and supply in the securities market in more detail. The analysis may include an in-depth assessment of the level of liquidity, institutional stability, transparency of financial transactions, and availability of financing for enterprises. The obtained results have practical significance in view of the identified advantages and disadvantages of financial openness in the context of European integration. They can be applied by politicians in the process of developing integration strategies, taking into account the potential negative consequences of increasing financial openness and the identified advantages. A promising direction for further research is the expansion of the regression model for the securities market.

Credit Authorship Contribution Statement

Galyna Kucher: Conceptualization, Validation, Project administration.
Oksana Galenko: Investigation, Writing – review and editing, Methodology.
Mykhaylo Kapyrulya: Writing – original draft, Software.
Viktoria Kostiuk: Formal analysis, Data curation.
Ievgen Volkovskyi: Supervision, Visualization.

Declaration of Competing Interest

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

Declaration of the Use of Generative AI and AI-Assisted Technologie

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Exploring Crime Rate through the Lens of Poverty and Education in Indonesia: Evidence from Panel Data Approach

Fitriyani FITRIYANI
Department of Economics, Faculty of Economics and Business
Universitas Syiah Kuala, Indonesia
ORCID: 0000-0003-0835-1625; Researcher ID: HNR-1463-2023
fitriyani@usk.ac.id

Teuku ZULHAM
Department of Economics, Faculty of Economics and Business
Universitas Syiah Kuala, Indonesia
ORCID: 0000-0002-5503-1176; Researcher ID: ABK-8542-2022
teukuzulham@usk.ac.id

Suriani SURIANI
Department of Economics, Faculty of Economics and Business
Universitas Syiah Kuala, Indonesia
ORCID: 0000-0002-4937-9141; Researcher ID: F-4002-2017
suriani@usk.ac.id

Jumadil SAPUTRA
Department of Economics, Faculty of Business, Economics and Social Development
Universiti Malaysia Terengganu, Malaysia
ORCID: 0000-0003-2919-5756; Researcher ID: R-4708-2018
Corresponding author e-mail: jumadil.saputra@umt.edu.my

Mhd Yavishan NOVINDA
Department of Economics, Faculty of Economics and Business
Universitas Syiah Kuala, Indonesia
ORCID: 0009-0009-4125-9936; Researcher ID: NJS-9544-2025
yavishan.n@mhs.usk.ac.id

Indra ISMAWAN
Department of Economics, Faculty of Economics and Business
Universitas Syiah Kuala, Indonesia
ORCID: 0009-0009-4639-9735; Researcher ID: NJT-0443-2025
indraismawan016@gmail.com

Fillah Ramadhan ALTHAF
Department of Economics, Faculty of Economics and Business
Universitas Syiah Kuala, Indonesia
ORCID: 0009-0009-2661-3191; Researcher ID: NJS-9813-2025
fillahraalthaf@gmail.com

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Abstract: This study investigates the determinants of crime rates across 34 Indonesian provinces from 2007 to 2023, with a particular focus on the impact of poverty and education. Employing a panel data approach with an Autoregressive Distributed Lag (ARDL) model, the research reveals significant long-term and short-term relationships between these factors and crime

rates. The findings indicate that poverty rates have a significant positive long-term effect on crime rates, whereas the influence of average years of schooling is not statistically significant in the long run. In the short term, both the change in crime rates from the previous period and the change in average years of schooling from the two prior periods significantly affect current crime rate fluctuations. The presence of significant error adjustment coefficients suggests a cointegration relationship or long-term equilibrium among the model variables. Based on these results, this study recommends that policymakers and stakeholders develop strategies aimed at poverty reduction and improved access to quality education as a potential means to mitigate crime rates in Indonesia. Furthermore, the research emphasizes the need for additional investigation of other potential contributing factors, such as family structure, peer group influence, and availability of legal and illegal opportunities, to enhance the effectiveness and sustainability of crime prevention and reduction efforts.

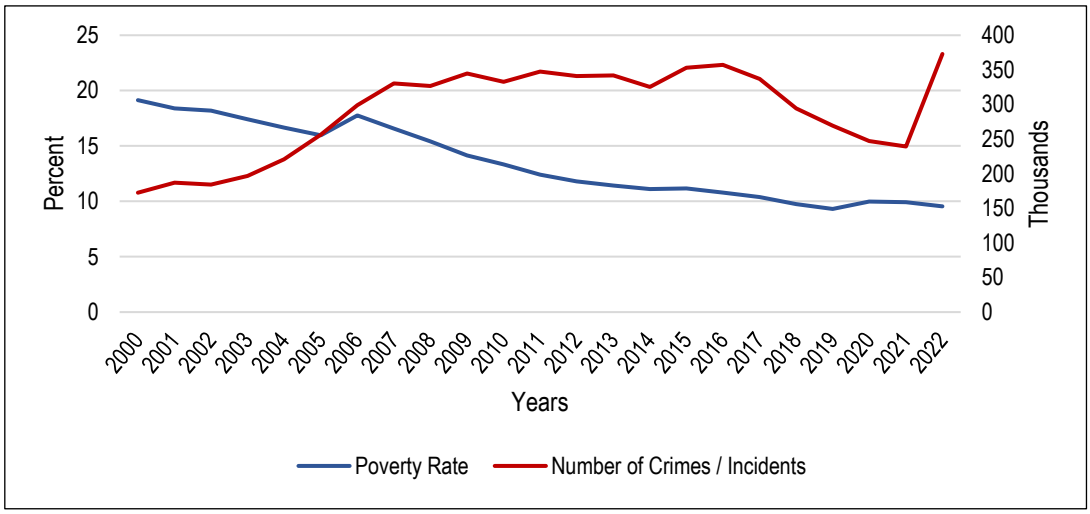
Keywords: crime rate; education; poverty; ARDL panel.

JEL Classification: I24; I32; K42; C33.

Introduction

Poverty has emerged as a significant challenge affecting numerous countries, particularly developing nations, such as Indonesia. Only a fraction of Indonesia's population experiences prosperity or full benefits from the country's development, while the majority remains impoverished and unable to reap the complete rewards of progress (Anjawarti & Rosmiati, 2022). A nation's development is typically assessed using indicators such as economic growth, poverty levels, and educational attainment. While countries strive to optimize these three indicators through various strategic initiatives, they do not entirely comprehensively encapsulate societal welfare. Among these factors, a high incidence of poverty is believed to exert a complex influence on social literacy within communities. According to a recent report by the Asian Development Bank (2023), Indonesia's population living below the poverty line, based on purchasing power parity, is 2.7%. This statistic positions Indonesia as the sixth country with the highest poverty rate in Southeast Asia at 9.5%. In comparison, Timor Leste leads the region with a poverty rate of 42%, followed closely by Myanmar at 40% (Aditiya 2023). These figures underscore the persistent nature of poverty in the region and highlight the need for continued efforts to address this pressing issue.

Figure 1. Poverty Rate in Indonesia for 2000 to 2022



Source: Central Bureau of Statistics (2023)

The poverty rate in Indonesia has shown a consistent downward trend (Figure 1). In 2000, the poverty rate reached 19.14%, with 38.70 million people living below the poverty line (Central Bureau of Statistics, 2023). A significant decline occurred between 2000 and 2005, with the poverty rate reaching its lowest level of 15.97% in 2005. This reduction can be attributed to several factors, including positive economic growth, increased investment, and effective government poverty alleviation programs (Crews 2012). Following the 2005 low, the poverty rate experienced considerable fluctuations. In 2006, it rose sharply to 17.75%, primarily due to increases in fuel oil (BBM) and food prices, which negatively affected the purchasing power of low-income individuals (Kompas.com 2022). However, the largest year-on-year (y-o-y) downward trend was observed in 2009, with an 8.24% decrease. From 2015 to 2022, the poverty rate in Indonesia demonstrated a relatively consistent downward trend, albeit with minor fluctuations. By 2022, the poverty rate decreased to 9.55%. This continued decline can be attributed to various factors, including stable economic growth, more targeted government

programs, and improved access to education and health services for low-income populations (Central Bureau of Statistics, 2023).

During the 22 years from 2000 to 2022, the cumulative reduction in Indonesia's poverty rate was 50.07%. This statistic indicates that more than half of those previously classified as poor rose above the poverty line during this timeframe. The government's efforts to address poverty are driven by the recognition of its wide-ranging social and economic impacts. Poverty can lead to various negative externalities, including criminal activities such as theft, embezzlement, fraud, and assault. These criminal behaviors are often rooted in economic factors that affect an individual's ability to meet basic needs, such as food, housing, and education (Dong, Egger, and Guo 2020; Spada, Fiore, and Galati 2023). The relationship between socio-economic disparities and criminal behavior is well established, highlighting the inextricable link between poverty and crime as interconnected social problems (Rusnani, 2015). Figure 1 illustrates that 2000 witnessed the lowest number of crimes in the subsequent 22-year period, with 172,000 incidents occurring at intervals of 182 seconds. Crime rates continued to escalate until 2007, reaching a 91.49% increase. From 2008 to 2016, Indonesia experienced fluctuating crime rates.

Subsequently, a downward trend was observed from 2017 to 2021, with a 28.86% decrease (BPS 2023). The COVID-19 pandemic in 2020 slightly altered this trend, with poverty rates rising to 9.98%, while crime rates paradoxically decreased to 247,218 cases. This reduction may be attributed to pandemic-related restrictions on community activities, which potentially curtailed criminal behavior. Over the past two decades, Indonesia has experienced an overall upward trend in crime rates, peaking by 2022. However, the past decade has shown a general decline, except 2022. Despite this, Indonesia's crime rate remains comparatively high among Southeast Asian nations, such as Singapore and Malaysia. Studies conducted by organizations such as Transparency International and the Asia-Pacific Economic and Social Organization (APEC) suggest that more robust anti-corruption measures and improved law enforcement are necessary to reduce crime in Indonesia. The literature often highlights the correlation between poverty and crime. A World Bank (2022) report indicated that poverty and significant economic disparities can foster an environment conducive to crime and violence. Braithwaite (2018) found that most offenders come from economically disadvantaged backgrounds with limited access to resources. The government is expected to implement appropriate policies to address these issues. A fundamental approach currently emphasized is improving mobility and access to education, providing various societal elements with opportunities for quality education. Enhancing individual quality through education is anticipated to positively impact quality of life and economic mobility, thereby comprehensively addressing various socioeconomic problems (Marin 2020).

The improvement in educational access is reflected in the increase in the average number of years of schooling (RLS) in Indonesia over the past 22 years. RLS indicates the duration of an individual's participation in formal and informal educational activities. It is postulated that longer engagement in educational pursuits increases the potential for developing knowledge related to various life aspects, including awareness of crime and criminality. Data from the Central Bureau of Statistics (2023) reveal a consistent, albeit modest, annual increase in RLS. The average RLS growth rate was only 1.27% per year. However, when considering the cumulative growth from 2000 (6.6 years) to 2022 (8.7 years), Indonesia's RLS experienced a substantial increase of 31.67%, equivalent to an annual growth of 2.09%. Education can potentially address social issues, such as poverty and crime. Research indicates a strong correlation between education and economic growth, with increased education levels associated with higher income and reduced poverty rates (Spada *et al.* 2023). Humble & Dixon (2017) suggested that global poverty rates could be halved if all adults in low-income countries have completed secondary education. Education equips individuals with the skills and knowledge necessary for better opportunities, breaking the cycle of poverty and crime (Majumder & Biswas, 2017). Character education, legal awareness, and social skills development through education can help individuals understand the consequences of criminal behavior and reduce the likelihood of engaging in such acts (Abdali and Suherman 2018). The role of parents and teachers in guiding children is crucial in preventing criminal behavior. Education fosters a better understanding of societal values, norms, and laws, thereby reducing the tendency toward criminal behavior (Faizal & Aisah, 2019).

Poverty, education, and crime were interconnected. Individuals living in poverty may struggle to meet their basic needs and access education, potentially leading to criminal activity as a means of survival. There is a research gap in analyzing the long-term effects of poverty and education levels on crime in Indonesia, with most previous studies focusing on short-term relationships or using national-level data. This study addresses this gap by examining the impact of poverty and education on crime rates across 34 Indonesian provinces from 2007 to 2023. By utilizing provincial-level data and a longer timeframe, this study seeks to provide a more comprehensive

understanding of the relationships between these variables. This study aims to assess the effectiveness of educational instruments in creating a stable society and explore how higher poverty levels may potentially drive individuals or groups towards criminal behavior. This study employs a more comprehensive analytical approach that considers inter-regional variations and long-term dynamics. The findings are expected to offer new insights and policy recommendations for addressing criminality by targeting root causes, such as poverty and low education levels, ultimately contributing to the development of a safer environment for all.

1. Literature Review

1.1. Poverty and Crime Rates

The relationship between poverty and crime rates is complex and multifaceted. Poverty has been identified as a potential contributing factor to criminal behavior, affecting individuals economically, socially, and psychologically. Numerous studies have demonstrated a correlation between poverty and increased crime rates. For instance, a study conducted across 34 provinces in Indonesia revealed that poverty, particularly in isolated areas, can lead to crimes such as theft, mugging, and stabbing (Fachrurrozi *et al.* 2021). The impact of poverty extends beyond immediate economic hardship, influencing educational levels, access to employment, and economic opportunities, all of which can contribute to criminal activity. Riskinanti & Ardianto (2020) examined this correlation in Indonesia by analyzing data from the Indonesian National Socio-Economic Survey and crime statistics. Their findings indicate a significant positive relationship between poverty levels and property crime rates, especially in urban areas. This finding supports the notion that economic deprivation can increase motivation to commit property-related crimes as a means of survival or resource acquisition.

Similar findings have been reported in other regions. A study focusing on Latin American countries explored the role of poverty and social exclusion in driving crimes. Research examining data from various Latin American countries found a strong positive correlation between poverty levels and rates of property and violent crime (Santos *et al.* 2021). However, it is crucial to note that poverty does not directly cause criminal behavior. As emphasized by Sampson & Laub (2017), poverty interacts with a range of individual, community, and societal factors. Effective crime prevention strategies must address the root causes of poverty, such as a lack of economic opportunities, inadequate education, and limited access to social services, while promoting social inclusion, community empowerment, and targeted interventions for at-risk populations. Several theories attempt to explain the relationship between poverty and crime rates. One such theory is the strain theory proposed by Robert K. Merton, which posits that the inability of individuals to achieve socially important goals can cause pressure (strain), potentially leading to criminal behavior.

In the context of poverty, individuals experiencing economic difficulties in achieving these goals may respond to criminal acts (Prayetno 2013). Dulkiah and Nurjanah (2018) argued that poverty can also affect education levels and access to resources crucial for reducing the likelihood of criminal involvement. Individuals living in poverty often have limited access to quality education and economic opportunities, which potentially increases their risk of engaging in criminal offenses. Factors such as difficulties in meeting basic needs for food, housing, and education can also trigger criminal behavior, including theft, fraud, and abuse. It is important to recognize that poverty is not the sole cause of increased crime rates. Crime rates are often influenced by a complex interplay of social, economic, and political factors. In the pursuit of improved social mobility, increased income, and enhanced quality of life, poverty and crime rates should be considered holistically. Therefore, efforts to expand employment opportunities, improve the quality of education, and assist individuals in overcoming poverty are crucial for creating a more just, sustainable, and developed society (Sugiarti 2014). Thus, poverty can contribute to crime through various mechanisms, including its influence on economic conditions, access to education, and economic opportunities. Efforts to address crime stemming from poverty require comprehensive and sustainable poverty reduction initiatives, as well as the strengthening of character education and legal awareness within communities.

1.2 Education and Crime Rate

The relationship between education and criminal behavior has been extensively studied, with numerous researchers suggesting an inverse correlation between the two. Higher levels of education have been found to reduce the likelihood of engaging in criminal activity, although the relationship is indirect (Crews 2012). Several studies have demonstrated a negative association between education and crime rates, indicating that individuals with higher educational attainment are less prone to criminal behavior. Bernard (2022) reported that a one-year increase in average years of schooling can lead to significant reductions in various types of crimes, including a 30% decrease in homicide and assault, a 20% reduction in motor vehicle theft, a 13% decrease in arson, and

approximately 6% reduction in burglary and theft. These findings align with previous research conducted by Becker (2020), who posited that education provides individuals with enhanced skills, knowledge, and life opportunities.

Stixrud & Urzua (2006) found that each additional year of formal education can reduce the probability of an individual's involvement in criminal offenses by up to 7%. The authors argue that education contributes to the development of improved cognitive abilities, social skills, and self-control, thereby diminishing the tendency to engage in criminal behavior.

Furthermore, education offers better employment prospects, increases income, and alleviates poverty, which are significant risk factors for criminal involvement (Stixrud & Urzua (2006). However, it is important to note that the relationship between education and crime is not always linear. The crime-reducing effect of education appears to be more pronounced at higher education levels such as secondary and tertiary education. This suggests that investing in quality and sustainable education is crucial for preventing future criminal involvement (Dong *et al.* 2020; Spada *et al.* 2023). Additionally, the impact of education on crime rates may vary depending on factors such as gender, race, and socioeconomic status (Rennison and Hart 2022). For instance, the crime-reducing effect of education tends to be stronger for men than women and for minorities and underprivileged groups. This highlights the need for a more comprehensive and integrated approach to improve access to and quality of education in communities. Contrary to these findings, some studies have found no significant relationship between education and crime rates after controlling for individual characteristics, such as wages.

Groot and van den Brink (2010) reported that researchers identified a significant negative relationship between wage levels and crime but found no association between education and crime after controlling for wages. Education can generally help individuals become more aware of their rights and responsibilities in society, thereby reducing their likelihood of engaging in criminal activity. Research has demonstrated that education can have a substantial impact on crime rates, and policies aimed at increasing educational attainment and improving the quality of schooling can effectively reduce crime and criminality rates (Hjalmarsson & Lochner, 2012). The impact of education on crime rates is a complex issue with multiple factors to consider. Lochner (2004) suggests that education can increase an individual's forbearance or risk aversion, which may influence their decision to engage in criminal activities. Education can also indirectly alter preferences, potentially affecting the decision to participate in a crime. However, most of these channels lead to a negative relationship between education and violent and property crimes.

2. Materials and Methods

This study employed a quantitative approach to examine the relationship between crime rates, poverty levels, and education in Indonesia. The research encompasses all 34 provinces of Indonesia over 17 years from 2007 to 2023. Secondary panel data, sourced from the Central Bureau of Statistics (BPS), form the basis of this analysis. The Autoregressive Distributed Lag (ARDL) regression model is utilized to analyze the panel data, resulting in a specific equation that captures the dynamic relationships between the variables of interest. This methodological approach allows for exploring the short- and long-term effects of poverty and education on crime rates across different provinces in Indonesia.

$$\Delta LCR_{it} = \beta o + \sum_{t=1}^{p} \beta_1 \Delta LCR_{it-1} + \sum_{it=1}^{p} \beta_2 \Delta LEDU_{it-1} + \sum_{it=1}^{p} \beta_3 \Delta POV_{it-1} + \varphi_1 LEDU_{it-1} + \varphi_2 POV_{it-1} + \mu_{it-1} \quad (1)$$

where LCR is the log crime rate, LEDU is the log average years of schooling, and POV is the poverty rate. β_1, β_2, and β_3 are short-run coefficients. φ_1 and φ_2 are long-run ARDL coefficients, μ is the disturbance error. The testing stages carried out in this modelling are data stationarity test, cointegration test, and optimum lag test.

3. Results

This section delineates multiple stages of testing and provides an overview of the applied test variables. Before proceeding with the estimation and analysis, the initial step involved examining the data characteristics through descriptive statistics. This preliminary analysis offers insights into the data distribution, central tendencies, and extreme values of the variables under consideration. Subsequently, several stages are undertaken, including stationarity tests, cointegration tests, optimum lag tests, and Autoregressive Distributed Lag (ARDL) estimation. Employing this model enables the researcher to estimate both long- and short-term relationships among the variables as well as identify crucial factors influencing the crime rate in Indonesia, such as poverty and education levels.

3.1. Descriptive Statistics

The results revealed significant variations in crime rates and educational attainment across the 34 Indonesian provinces from 2007 to 2023. Table 1 presents the descriptive statistics for the three primary variables examined in the panel data study. The number of crimes exhibited considerable variability, with a mean of 10,259.360 cases per province during the study period. However, the range of crime rates was substantial, ranging from a minimum of 499 to a maximum of 63,661 cases. This wide disparity is further evidenced by the large standard deviation of 10,622.87, indicating substantial differences in crime rates among Indonesian provinces. Community education, measured by average years of schooling, demonstrated a mean of 8.10 years. This suggests that, on average, residents in Indonesian provinces completed education equivalent to the primary and partial junior secondary levels. However, educational attainment also varied across provinces, ranging from a minimum of 5.23 years to a maximum of 11.44 years. This disparity highlights the differences in educational levels among the provinces studied. These descriptive statistics provide a foundational overview of the data characteristics, setting the stage for more in-depth analyses of crime rates and educational attainment across Indonesian provinces during the specified timeframe.

Table 1. Result of Descriptive Statistics Analysis

	Crime	Education	Poverty
Mean	10259.36	8.10	12.41
Maximum	63661.00	11.44	40.78
Minimum	499.00	5.23	3.44
Std. Dev.	10622.87	1.09	6.91
Skewness	2.31	0.32	1.20
Kurtosis	8.81	3.29	4.47
Jarque-Bera	1289.64	11.58	186.20
Prob. Jarque-Bera	0.711050	0.209288	0.000025*
Observations	561	561	561

Note: * implies 1% significant level.

The interregional poverty rate exhibited a mean value of 12.41% for the population living below the poverty line. However, the substantial disparity between the maximum (40.78%) and minimum (3.44%) values indicates considerable variation in poverty rates across Indonesian provinces. Descriptive statistics also provide insights into the skewness and kurtosis of each variable. The crime rate (2.31) and poverty rate (1.20) displayed positive skewness, suggesting right-skewed distributions, with some observations significantly exceeding the average values. Conversely, the education variable (0.32) demonstrated a slightly left-skewed distribution, implying the presence of observations notably below the mean value. All variables exhibited kurtosis values exceeding 3 (crime: 8.81, education: 3.29, and poverty: 4.47), indicating leptokurtic distributions with fatter tails compared to normal distributions. The Jarque-Bera test was conducted to assess normality. The poverty variable's Jarque-Bera probability value (0.000025) fell below 1%, indicating a non-normal distribution. In contrast, the crime (0.711050) and education (0.209288) variables showed Jarque-Bera probability values above 1%, suggesting a tendency toward normal distribution.

3.2. Unit Root Test

The stationarity tests, conducted using Augmented Dickey-Fuller (ADF) and Phillips–Perron (PP) methods, are presented in Table 2. These tests were employed to detect the presence of unit roots in the data, which would indicate non-stationary. The tests were performed at both the level (I(0)) and the first difference (I(1)) stages. The ADF test results revealed that the LCR and POV variables exhibited stationarity at the I(0) level, with test statistical values significant at the 1% confidence level. This finding suggests that crime and poverty data are free from unit roots, allowing for their direct utilization in the analysis without the need for differencing.

The results indicate varying levels of stationarity among the variables examined. The LEDU variable exhibited non-stationarity at the I(0) level but achieved stationarity after first-order differencing at the I(1) level. This is evidenced by the ADF test statistic, which was not significant at the I(0) level but became significant at the 1% confidence level after differencing at I(1). Consistent findings were observed using the Phillips - Perron (PP) method for stationarity testing. In contrast, the LCR and POV variables demonstrated stationarity at the I(0) level.

Table 2. Result of Unit Root Test

Variable(s)	Augmented Dickey-Fuller test stat (ADF)			Philip-Perron (PP)		
	I (0)	I(1)	Order	I (0)	I (1)	Order
LCR	121.785*	-	I (0)	109.572*	-	I (0)
POV	136.122*	-	I (0)	420.426*	-	I (0)
LEDU	18.9712	218.922*	I (1)	56.9948	364.744*	I (1)

Note: * implies 1% significant level.

The presence of variables that are stationary at different levels (I(0) and I(1)) fulfills a key prerequisite for employing the Autoregressive Distributed Lag (ARDL) model in panel data analysis. The ARDL model is particularly suitable for handling situations in which variables in the model exhibit different orders of integration, with some being stationary at the level and others becoming stationary after differencing. Given these stationarity test results, the application of the ARDL panel model appears to be an appropriate approach for analyzing the relationships among the variables of crime rate (LCR), poverty (POV), and education (LEDU).

3.3. Cointegration Test

After conducting the stationarity test and ensuring that the data used fulfils the requirements to use the panel Autoregressive Distributed Lag (ARDL) model, the next step is to conduct the cointegration test. Table 3 displays the results of the cointegration test conducted using two methods, namely ADF panel and PP panel. Both methods are used to detect the existence of a cointegration relationship or long-run equilibrium between the variables in the model.

Table 3. Result of Cointegration Test

Panel ADF-Statistic		Panel PP-Statistic	
Statistic	Prob.	Statistic	Prob.
-4.269503	0.0000*	-5.079718	0.0000*

Note: * implies 1% significant level.

Table 3 presents the results of the ADF panel cointegration test. The analysis yielded a statistical value of -4.269503 with a probability of 0.0000. This probability value is less than the 1% significance level, allowing for rejecting the null hypothesis, which posits the absence of cointegration. Consequently, this finding suggests the presence of a cointegration relationship or long-run equilibrium among the model variables. Comparable outcomes were observed in the cointegration test employing the PP panel method. Similarly, a statistical value of -5.079718, accompanied by a probability of 0.0000, indicates a cointegration relationship or long-term equilibrium among the model variables at the 1% significance level. Given the evidence of cointegration from both the panel ADF and panel PP tests, the application of panel ARDL models is deemed appropriate for analyzing the relationships among the variables in this study: crime rate (LCR), poverty (POV), and education (LEDU). The established cointegration relationship implies that while the variables may exhibit short-term imbalances, they tend to converge toward equilibrium in the long run. Consequently, the panel ARDL model can estimate the long- and short-run relationships among these variables. This approach allows for a comprehensive examination of the dynamic interactions between crime rate, poverty, and education within the studied context.

3.4. Optimum Lag-Length Selection Criteria

Selecting an appropriate lag length is crucial, as it significantly impacts the estimation results and interpretation of variable relationships within the model. An insufficient lag length may result in omitting vital information, whereas an excessive lag length can lead to reduced degrees of freedom and diminished estimation efficiency. To determine the optimal lag length, the Akaike Information Criterion (AIC) was employed to evaluate the performance of models with varying lag lengths. A lower AIC value indicates a superior and more favorable model. As illustrated in Figure 1, the model with a lag length of 3 for the LCR, LEDU, and POV variables yielded the lowest AIC value. This finding is further corroborated by Table 4, which demonstrates that the ARDL (3, 3, 3) specification exhibited the lowest AIC value of -0.250810 compared to alternative models.

Figure 1. Optimum Lag with Akaike Information Criterion (AIC)

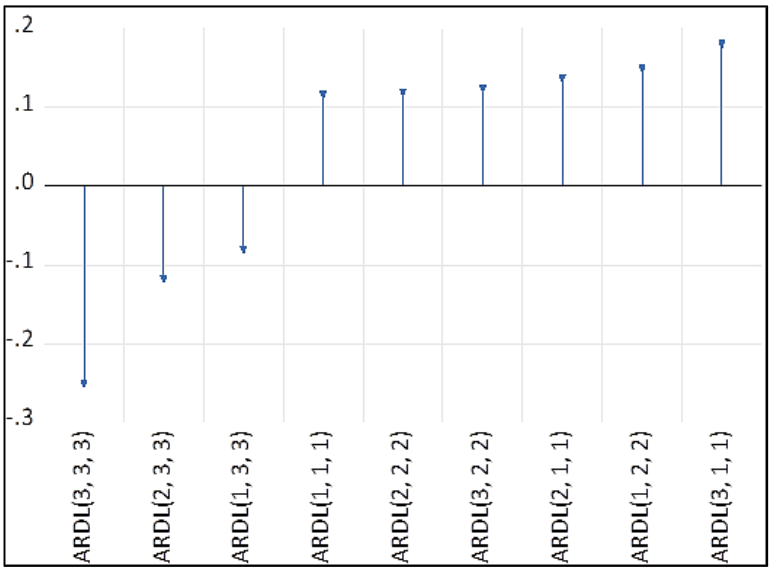


Table 4. Result of Lag-Length Selection

Lag Selected	HQ	BIC	AIC	LogL	Model
ARDL(3, 3, 3)	0.919241	2.721067	-0.250810	389.937223	9
ARDL(2, 3, 3)	0.936478	2.559207	-0.117274	326.090200	6
ARDL(1, 3, 3)	0.857253	2.300885	-0.080198	284.525666	3
ARDL(1, 1, 1)	0.589114	1.316357	0.116864	107.004457	1
ARDL(2, 2, 2)	0.941362	2.205897	0.120211	205.231163	5
ARDL(3, 2, 2)	1.062327	2.505959	0.124876	237.153555	8
ARDL(2, 1, 1)	0.726005	1.632345	0.137455	135.247867	4
ARDL(1, 2, 2)	0.854780	1.940218	0.149930	165.366222	2
ARDL(3, 1, 1)	0.886191	1.971628	0.181341	158.110311	7

Table 4 indicates that the optimal lag length selection can be informed by various information criteria, including the Bayesian Information Criterion (BIC) and Hannan-Quinn Criterion (HQ), in addition to the Akaike Information Criterion (AIC). Table 4 reveals that the ARDL (1, 1, 1) specification yields the lowest BIC value of 1.316357, whereas the ARDL (2, 3, 3) specification produces the lowest HQ value of 0.936478. Despite minor discrepancies in the optimal lag length selection across different information criteria, the ARDL (3, 3, 3) specification emerges as the most appropriate model for this study. This selection is primarily based on the achievement of the lowest AIC value and the consideration that AIC serves as a key indicator criterion among the information criteria. Consequently, the panel ARDL equation incorporating lag coefficients can be formulated as follows:

$$\Delta LCR_{it} = \beta_o + \beta_1\Delta LCR_{it-1} + \beta_2\Delta LCR_{it-2} + \beta_3\Delta LEDU_{it} + \beta_4\Delta LEDU_{it-1} + \beta_5\Delta LEDU_{it-2} + \beta_6\Delta POV_{it} + \beta_7\Delta POV_{it-1} + \beta_8\Delta POV_{it-2} + \varphi_1 LEDU_{it-1} + \varphi_2 POV_{it-1} + \mu_{it-1} \quad (2)$$

In the ARDL model equation after lag adjustment for each variable, the short-term coefficient is β_1 - β_8 and φ_1 - φ_2 is the long-term coefficient. The test variables are also stated to have a cointegration relationship, so the determination of the model equation in this study is as follows:

$$\Delta LCR_{it} = \beta_o + \lambda ECT_{t-1} + \beta_1\Delta LCR_{it-1} + \beta_2\Delta LCR_{it-2} + \beta_3\Delta LEDU_{it} + \beta_4\Delta LEDU_{it-1} + \beta_5\Delta LEDU_{it-2} + \beta_6\Delta POV_{it} + \beta_7\Delta POV_{it-1} + \beta_8\Delta POV_{it-2} + \varphi_1 LEDU_{it-1} + \varphi_2 POV_{it-1} + \mu_{it-1} \quad (3)$$

where λ is the cointegration adjustment coefficient (speed of adjustment) of the ECT (error correction term). This study considers the effect of three lag periods and their ability to reach long-run equilibrium after a short-run shock. The selection of an appropriate lag length allows the model to capture the dynamics and lagged effects of changes in the independent variable on the dependent variable.

3.5. Result of ARDL Estimation

The panel ARDL model estimation results, presented in Table 5, provide insights into the long- and short-run effects of education (LEDU) and poverty level (POV) on crime rate (LCR). The long-run coefficients reveal that an increase of one year in the average years of schooling is associated with a 0.0756% decrease in the crime rate. However, this relationship was not statistically significant at the 95% confidence level ($p = 0.6155$). Conversely, the poverty rate demonstrates a significant long-term effect on crime rates. A 1% increase in poverty was associated with a 0.8921% increase in crime rate, with this relationship being statistically significant at the 99% confidence level ($p < 0.01$).

Table 5. Result of ARDL Estimation

Variable(s)	Coefficient	t-Statistic	P-value
LEDU	-0.0756	-0.5029	0.6155
POV	0.8921	4.4559	0.0000*
ECT(-1)	-1.1669	-8.6069	0.0000*
D(LCR(-1))	0.3652	3.9863	0.0001*
D(LCR(-2))	0.2986	4.2756	0.0000*
D(LEDU)	-0.4782	-0.1545	0.8774
D(LEDU(-1))	-3.7951	-1.3043	0.1934
D(LEDU(-2))	-7.1723	-2.6935	0.0076*
D(POV)	-3.3345	-1.4573	0.1464
D(POV(-1))	-0.4795	-0.3428	0.7321
D(POV(-2))	-1.0829	-0.5903	0.5555
C	9.7088	8.5570	0.0000*

Note: * implies 1% significant level.

Table 5 presents the coefficients and significance levels of the variables in the short-run context. The error correction term (ECT), which measures the speed of adjustment towards long-run equilibrium, exhibits a coefficient of -1.1669 and is significant at the 99% confidence level. This indicates that approximately 116.69% of the short-run imbalance will be adjusted within one time period towards the long-run equilibrium. The short-run coefficients for the lagged dependent variables D(LCR(-1)) and D(LCR(-2)) are significant at the 99% confidence level, suggesting that changes in crime rates from previous periods significantly influence current crime rate changes. The unlagged LEDU variable D(LEDU) and its one-period lag D(LEDU(-1)) do not show statistical significance, as evidenced by the probability values exceeding 0.05. However, the two-period lagged variable D(LEDU(-2)) is significant at the 99% confidence level, with a coefficient of -7.1723. This implies that an increase in the average number of years of schooling from two prior periods leads to a reduction in the current period's crime rate.

Regarding the POV variable, neither the unlagged D(POV) nor the one-period lagged D(POV(-1)) coefficients demonstrate statistical significance. Similarly, the two-period lagged variable D(POV(-2)) failed to achieve significance at the 95% confidence level. In addition, the table reveals that the constant coefficient (C) is significant at the 99% confidence level, with a value of 9.7088. This constant represents the influence of other factors not included in the model on the crime rate. The empirical findings offer valuable insights into both the long- and short-term impacts of various factors on crime rates. In the long run, poverty levels demonstrate a significantly positive correlation with criminal activity, whereas educational attainment, measured by average number of years of schooling, does not exhibit a statistically significant effect. Conversely, short-term dynamics reveal that fluctuations in crime rates are significantly influenced by changes in criminal activity from the preceding period, as well as variations in educational attainment observed over the past two periods.

4. Discussions

The estimation results reveal a significant positive long-term effect of poverty on crime rates. This finding aligns with Meloni (2014) and Hu *et al.* (2024), who concluded that poverty is a primary driver of crime. These studies demonstrate a strong correlation between poverty and crime rates, with areas experiencing higher poverty levels tending to exhibit higher crime rates. Conversely, the long-term effect of education on crime rates was not statistically significant. This result, although not entirely unexpected, is consistent with the mixed findings reported in previous studies examining the relationship between education and crime. Wang *et al.* (2022) noted that

although many studies have identified an association between higher education levels and lower crime rates, the evidence remains inconclusive, and the relationship is not consistently strong. In the short-term context, changes in crime rates from the previous period were found to significantly influence current crime rates. This observation aligns with findings suggesting that past crime rates can impact current rates, indicating a cyclical pattern of criminal activity (Moffitt, 2013; Weijer *et al.* 2017).

Furthermore, the estimation results demonstrate that increased education levels from the previous two periods significantly negatively affect crime rates. This finding corroborates that of Groot & van den Brink (2010), who conclude that schooling significantly reduces the likelihood of detention and arrest. Their research indicated that each additional year of average schooling significantly decreased participation in criminal activities (Groot & van den Brink, 2010; Rusnani, 2015; Spada *et al.* 2023). However, the short-term effect of changes in poverty levels on crime rates was not statistically significant in this study. This result contradicts the findings of Nichols & Rothstein (2016), who reported that short-term fluctuations in economic conditions, such as unemployment and poverty rates, significantly influence crime rates. The discrepancy in these results may be attributed to differences in the research context and methodology.

Conclusions and Further Research

This study concludes that both the poverty rate and average years of schooling significantly influence crime rates in Indonesia, demonstrating both long-term and short-term effects. Specifically, an increase in the poverty rate contributes to a rise in the crime rate over the long term, while an increase in average years of schooling can reduce crime rates in both the long and short term. These results align with those of previous empirical studies investigating the factors contributing to crime and strategies for its reduction. The panel ARDL model estimation results reveal a cointegration relationship or long-run equilibrium between the variables in the model. This indicates that, despite short-term imbalances, there is a tendency to return to equilibrium in the long run. This finding strengthens the argument for formulating effective policies and strategies to address crime in Indonesia by considering crucial factors such as poverty and education. On the basis of the findings, several recommendations for the government and other stakeholders can be proposed. First, prioritize efforts to reduce poverty levels through comprehensive and sustainable poverty alleviation programs. Second, enhance access to and quality of education, particularly in areas with high crime rates, by allocating adequate resources and facilitating community participation in the education process. Finally, develop an integrated crime prevention strategy involving various stakeholders, including educational institutions, civil society organizations, and law enforcement agencies. This strategy should also consider other potential contributors to crime rates, such as family structure, peer group influence, and legal and illegal factors.

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Credit Authorship Contribution Statement

Fitriyani: Conceptualization, Investigation, Methodology, Project administration, Writing – original draft, Writing – review and editing.
T. Zulham: Conceptualization, Investigation, Methodology, Project administration, Writing – original draft, Supervision, Writing – review and editing, Visualization, Funding acquisition).
Suriani: Conceptualization, Investigation, Methodology, Project administration, Formal analysis, Writing – original draft, Supervision, Writing – review and editing.
Jumadil Saputra: Conceptualization, Investigation, Methodology, Software, Formal analysis, Data curation, Validation, Writing – review and editing, Visualization.
Mhd. Yavishan Novinda: Investigation, Methodology, Writing – review and editing.
Indra Ismawan: Investigation, Methodology, Writing – review and editing.
Fillah Ramadhan Althaf: Investigation, Methodology, Writing – review and editing.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Reforming the Tax System of Ukraine in the Context of Globalization Challenges

Oleksii MALIARCHUK
Department of Finance, Accounting and Taxation
Chernivtsi Institute of Trade and Economics
State University of Trade and Economics, Ukraine
ORCID: 0009-0004-6947-2820
alexmaliar@gmail.com

Serhii RYLIEIEV
Department of Finance, Accounting and Taxation
Chernivtsi Institute of Trade and Economics
State University of Trade and Economics, Ukraine
ORCID: 0000-0002-2058-1004
serhii.vdo@gmail.com

Mykola SKRYPNYK
Department of Finance, Accounting and Taxation
Chernivtsi Institute of Trade and Economics
State University of Trade and Economics, Ukraine
ORCID: 0000-0003-3597-6188; Researcher ID: LDG-8132-2024
mykolaskryp@gmail.com

Oleksii MATSAK
Interregional Academy of Personnel Management, Ukraine
ORCID: 0009-0002-5813-7141
omatsak14445@gmail.com

Pavlo KOLOMIIETS
Department of Entrepreneurship and Law
Poltava State Agrarian University, Ukraine
ORCID: 0000-0002-3155-0393; Researcher ID: F-6380-2016
pavlokol123@gmail.com

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Abstract: The relevance of the study is due to the intensification of global challenges that exert multidimensional pressure on national tax systems. The purpose of the study is to elucidate the strategic pathways of reforming Ukraine's tax system in light of the challenges posed by globalization. The study used a set of methods, in particular structural and logical analysis, comparative assessment of European countries' tax parameters, and correlation analysis to identify relationships between tax, macroeconomic and digital indicators. It was found that an increase in the corporate income tax rate is accompanied by a decrease in the efficiency of taxation (r = -0.4439) alongside the increase in GDP losses (r = 0.4641), which indicates the stimulation of tax evasion. A strong relationship between the level of corruption and the gross domestic product per capita (r = 0.7307) was revealed, as well as an inverse relationship between the perception of corruption and the burden of taxation (r = -0.3816), which confirmed the corruption's impact on fiscal discipline. The positive correlation of the income tax rate with digital development (r = 0.6090) and cybersecurity (r = 0.5873) indicates that countries with higher corporate taxes are investing more actively in digital transformation. The study revealed that Ukraine's tax system is characterized by excessive administrative complexity, weak resilience to global challenges, a high share of the shadow economy and an insufficient level of digital integration. The conclusions substantiate the need for a comprehensive approach to tax reform, which combines deregulation, digitalization, the fight against corruption and bringing national legislation in line with the requirements of the

EU and global tax initiatives. The scientific novelty of the study lies in a comprehensive approach to the examination of Ukraine's tax system through the lens of global trends, while meticulously considering digital and macroeconomic parameters. This methodology facilitated the identification of profound interconnections between essential fiscal and socio-economic indicators, employing contemporary correlation analytics as its foundation. Prospects for further research involve the development of a model for an adaptive tax policy in Ukraine, which will facilitate a nimble response to external challenges.

Keywords: digitalization; cybersecurity; corporate tax; corruption; fiscal policy; multinational business.

JEL Classification: H20; H21; H23; G31.

Introduction

Global processes of economic integration, the growth of transnational business and digital transformation pose new challenges for national tax systems. The average corporate income tax rate in the world has decreased significantly over the past decades – from almost 50% in 1980 to about 24% in 2020 (World Economic Forum, 2021), reflecting increased tax competition between countries. At the same time, the large-scale transfer of profits by multinational corporations to jurisdictions with low taxes leads to significant revenue losses: according to OECD estimates, countries around the world annually lose from $100 to $240 billion due to the tax base erosion (4-10% of global income tax revenues) (UK Parliament, 2025). In response to these global trends, the international community-initiated tax reforms. Since 2016, the BEPS action plan has been implemented, and as of October 2021, 136 countries joined the OECD multilateral agreement on two components of addressing the tax challenges of the digital economy (World Economic Forum, 2021). This agreement delineates, in particular, the establishment of a global minimum income tax (Pillar 2) at a rate of 15% for substantial multinational corporations. Ukraine is also involved in these processes: the introduction of BEPS mechanisms and a global minimum tax is identified as one of the priorities of the National Revenue Strategy of Ukraine for 2024-2030 (State Tax Service of Ukraine, 2024). For Ukraine, the problem of reforming the tax system is of particular relevance given the simultaneous impact of military, economic and integration challenges. The full-scale invasion instigated by Russia in 2022 precipitated an unparalleled economic downturn – Ukraine's GDP shrank by approximately 30% (Centre of Economic Strategy, 2025), which sharply narrowed the tax base and exacerbated the fiscal deficit. Despite partial economic recovery in 2023 (~5% growth) (Centre of Economic Strategy, 2025), the state budget remains profoundly reliant on external aid. As of 2024, nearly 73% of supplementary budgetary requirements were financed through international support (Centre of Economic Strategy, 2025).

All of the above global and domestic challenges – digitalization, the proliferation of transnational enterprises, tax competition, war, and European integration – underscore the imperative modernization of Ukraine's tax system.

The purpose of the study is to substantiate the directions of reforming Ukraine's tax system in the light of globalization challenges, taking into account international experience. The study set the objectives as follows: evaluating the macroeconomic determinants and global indicators that underpin the stability of the taxation systems in European nations; and scrutinizing the tax framework of Ukraine within the context of prevailing global challenges.

1. Literature Review

Modern research on taxation issues covers a wide range of problems. Thus, in the study of the authors Adelakun *et al.* (2024). It is emphasized that the imperfection of tax legislation and their inconsistency with modern financial technologies leads to an increase in tax risks.

The effectiveness of tax policy directly affects public spending and economic stability, which was noted by Afonso *et al.* (2021). The scholars conducted an international comparison of the level of tax systems efficiency, which showed that countries with a rational tax structure and a transparent mechanism for distributing public funds showed higher macroeconomic indicators. The conclusions drawn from the aforementioned studies align harmoniously with the findings of Alshubiri (2024), who scrutinized the impact of foreign direct investment inflows on tax revenues. The scholar's analysis revealed that the efficacy of tax policy plays a pivotal role in determining the extent of external capital attraction.

The study by Synchak (2025) offers a comparative analysis of the Ukrainian and the U.S. tax systems, focusing on their development and reforms. The researcher examines the evolution of tax legislation in both nations, highlighting the shift from disparate regulations to comprehensive codified documents. At the same time, in the article by Prokopenko *et al.* (2021), a retrospective analysis of Ukraine's tax system was undertaken,

tracing its development from the Soviet era through the period of independence. The authors identified five main stages of the tax system transformation, namely: 1991, 1995, 1999, 2011, and 2015.

The digitalization of tax systems has emerged not just as a tool of fiscal administration, but as a dynamic force capable of transforming the very nature of relations between the state and taxpayers. In this context, Mpofu (2022) explored how Industry 4.0 technologies are changing the process of mobilizing tax revenues and concluded that digital solutions not only expanded financial inclusion but also required a radical rethinking of tax strategies. The introduction of new payment mechanisms opened up opportunities for more flexible taxation, but at the same time created challenges for state structures, which often did not have time to adapt the regulatory framework to technological changes. Mpofu's findings were seamlessly integrated with the research conducted by Hasan *et al.* (2024), who underscored that even the most avant-garde tax initiatives may falter in the absence of a well-defined digital transformation strategy.

An integral aspect of reforming tax policy within the framework of the digital economy lies in the efficacy of tax reforms in fostering sustainable growth of fiscal revenues. The research conducted by Kamara and Kamara (2023) delved into the analysis of the specific digital reforms instituted by Sierra Leone's National Revenue Authority (NRA) and their impact on tax administration efficiency. Particular emphasis was placed on the ramifications of the electronic cash register, which made it possible to improve control over cash settlements in the field of trade and services, as well as ASYCUDA World (the global Automated System for Customs Data.

Yet another study conducted by Kamasa *et al.* (2022) aimed to assess the quantitative impact of tax reforms on the mobilization of tax revenues in Ghana. Using an autoregressive model incorporating distributed lags and analyzing data spanning from 1980 to 2018, the authors discerned that the implementation of reforms in tax administration significantly contributed to the proportion of tax revenues relative to GDP. Further, the study by Martynuk and Shevchuk (2019) sets forth a model of programmatic income taxation within the context of integration processes, articulating the principal aims and objectives of such a framework.

Despite a considerable body of research, the intricacies involved in reforming tax systems necessitate further advancements. The current perspective is particularly pertinent for Ukraine, where the tax system is under pressure from international standards and domestic challenges. This underscores the need to reform the tax system and develop recommendations for modernizing tax policy.

2. Materials and Methods

2.1 Research Procedure

For the analysis, statistical data for the period 2023–2025 were collected, using official reports from the World Bank Group (2023, 2021), Tax Foundation Europe (2024, 2025), Heritage (2025), Tax Justice Network (2024), Transparency International (2024), NCSI (2023). The collected data covered a number of macroeconomic and tax indicators, which made it possible to carry out a comprehensive assessment of Ukraine's tax system as compared with other countries. Corporate income tax (CIT) and value added tax (VAT) rates were included in the analysis as key indicators of tax policy that directly affect the country's investment attractiveness and the business activity level. Gross domestic product per capita (GDPpc) reflected the overall level of economic development and citizens' well-being, foreign direct investment (FDI) assessed a country's ability to attract external capital, the ratio of public debt to GDP. (DB/GDP) made it possible to determine the level of state's financial stability and its ability to finance tax incentives, the percentage of GDP losses due to tax abuse of companies (GDP Loss) served as a significant benchmark for assessing the efficacy of tax administration, since high losses signal the presence of large-scale tax evasion schemes. The Corruption Perceptions Index (CPI) took into account the regulatory system's quality and the level of trust in tax authorities. The tax burden (TL) characterized the general level of fiscal pressure imposed upon businesses and individuals. The Income Inequality Index (Gini) evaluates the social equity of tax policy, as pronounced disparities in income can signify a deficient system for redistributing tax revenues. The Cybersecurity Index (CSI) and the Digital Readiness Index (DRI) were incorporated as variables to reflect the extent of technological preparedness of the tax system for digital transformation.

2.2 Methods

In the study, the Pearson correlation coefficient was employed to analyze the interrelationships among pivotal tax and macroeconomic indicators, thereby facilitating the assessment of both the magnitude and direction of the linear association between the two variables. Correlation analysis was carried out to assess the impact of tax rates (CIT, VAT) on economic indicators, in particular GDP per capita, FDI, DB/GDP and GDP Loss, as well as to identify the relationship between the corruption perception index (CPI) and the efficiency of the tax system (TL,

Gini). The obtained values of the correlation coefficient r were interpreted according to the standard scale: weak relationship (0.1–0.3), moderate (0.3–0.5) and strong (0.5–1.0), while statistical significance at the level of p was estimated < 0.05. The study also employed the method of structural and logical analysis to construct a coherent analytical framework for reform, alongside the method of comparative evaluation of the tax parameters across European nations.

2.3 Sample

The sample of the study encompasses 39 European countries, which provides a broad analytical context for comparing Ukraine's tax system with the systems of states with different economic models, levels of development and tax approaches. The choice of the European region is due to the high degree of economic integration of Ukraine with European countries, as well as common challenges in the field of tax policy, including the fight against tax evasion, attracting investments and optimizing public finances. As European countries have different levels of tax burden, revenue structure, and public spending, this sample allows assessing the effectiveness of different tax approaches and identify the most relevant strategies for improving Ukraine's tax system.

2.4 Tools

Microsoft Excel was used to process and analyze the data in the study, in particular its built-in CORREL function, which enables us to calculate the Pearson correlation coefficient between two sets of numerical values. This tool was used to assess the statistical relationships between the main tax variables (CIT, VAT, TL) and macroeconomic indicators (GDP per capita, FDI, DB/GDP, GDP Loss, CPI, Gini, CSI, DRI), which made it possible to determine how tax parameters affect the economic development of the country. The calculations were performed by entering the corresponding variables into the table; thereafter the CORREL function made it possible to obtain the value of the correlation coefficient r, which was used to interpret the relationship between the indicators.

3. Research Results

The fiscal policy of the state assumes a pivotal role in guaranteeing macroeconomic equilibrium, the cultivation of a conducive investment environment, as well as other related dimensions. A comprehensive analysis of tax rates, the level of public debt, macroeconomic indicators and global indices makes it possible to identify patterns that determine the tax system effectiveness in the face of globalization challenges. Table 1 accumulates quantitative indicators and coefficients that characterize the structural features of the tax system.

Table 1. The macroeconomic determinants and global indicators of tax system sustainability in European countries

№	Country	CIT	VAT	GDPpc	FDI	DB/GDP	GDP Loss	CPI	TL	Gini	CSI	DRI
1	Austria	23	20	46338,96	0,6	77,8	0,3	67	46,3	30,7	85	78,35
2	Albania	15	21	5419,64	6,9	58,9	0	42	88,8	29,4	70,83	62,34
3	Belgium	25	21	44731,04	-0,4	103	0,9	22	50,6	26,6	92,5	73,55
4	Bulgaria	10	20	9819,57	4	23,7	0,2	43	94,2	39	-	-
5	Bosnia and Herzegovina	10	19	6507,02	3,8	17,1	0,1	33	93,6	33	33,3	52,35
6	United Kingdom	25	20	47322,67	-2,6	95,3	0,5	71	60	32,4	75	84,67
7	Greece	22	24	21139,19	1,9	162	0,3	49	45	32,9	-	-
8	Denmark	22	25	61295,98	1,1	29,3	0,1	90	80,8	28,3	-	-
9	Estonia	20	22	20123,42	13	20,2	0,2	76	77,6	31,8	88,33	82,56
10	Ireland	12,5	23	91647,77	-25,4	43,7	0	77	72,6	30,1	77,5	78,79
11	Iceland	21	24	59096,44	2,2	64,8	0,1	77	57,7	26,1	-	-
12	Spain	25	21	28569,84	2,7	108	0,6	56	57,4	33,9	-	-
13	Italy	27,8	22	34088,09	1,8	135	0,4	54	79,9	34,8	88,33	73,58
14	Cyprus	12,5	19	32341,3	-26,4	73,6	0,1	56	76,2	31,3	76,67	71,44
15	Latvia	20	21	16703,9	4	45	0,3	59	76,9	34,3	79,17	73,1
16	Lithuania	15	21	18685,55	4,8	37,3	0,2	63	0	36,7	85	75,53
17	Luxembourg	24,94	17	106342,8	-27,6	25,7	0,2	81	62,7	0	-	-

№	Country	CIT	VAT	GDPpc	FDI	DB/GDP	GDP Loss	CPI	TL	Gini	CSI	DRI
18	Malta	35	18	33000,59	112,6	47,4	0,1	46	70	31,4	-	-
19	Moldova	12	20	3728,9	2,2	34,6	0,2	43	92,8	25,7	81,67	62,55
20	Netherlands	25,8	18	51305,63	0	46,8	1,1	78	54	25,7	81,67	84,66
21	Germany	29,93	19	44336,78	0,4	62,9	0,9	75	60,5	32,4	-	-
22	Norway	22	25	78912,33	2,2	44,3	0,1	81	62,4	27,7	-	-
23	North Macedonia	10	25	6393,79	4,1	50	0,3	40	94,8	33,5	56,67	58,31
24	Poland	19	23	17391,14	4,2	49,6	0,6	53	73,8	28,5	92,5	73,21
25	Portugal	31,5	23	22292,42	3,4	99,1	0,9	57	59,8	34,6	84,17	72,94
26	Romania	16	21	12399	2,5	48,8	0,5	46	93,7	33,9	-	-
27	Serbia	15	18	8210,55	6	52	0,4	35	87,3	33,1	72,5	70,05
28	Slovak Republic	21	23	19238,76	-0,2	56,1	0,4	59	76,7	24,1	80,83	67,55
29	Slovenia	22	22	25708,87	2,1	69,2	0,2	60	56,6	24,3	-	-
30	Turkey	20	20	14713,57	1	29,5	0	34	72,2	44,4	-	-
31	Hungary	9	27	16282,83	-34	73,4	0,3	41	85,3	29,2	-	-
32	Ukraine	18	20	2159,95	2,7	84,4	0,1	35	89,1	25,6	80,83	71,87
33	Finland	20	25,5	37970,13	0,1	75,8	0,2	88	68,2	27,7	-	-
34	France	25,83	20	39117,48	0,3	111	0,7	67	54,3	31,5	-	-
35	Croatia	18	25	17147,17	4	63,5	0,2	47	77,3	28,9	-	-
36	Czech Republic	21	21	20245,66	2,4	44	0,6	56	78,9	26,2	98,33	72,93
37	Montenegro	15	20	8403,34	7	60,3	0,4	46	88,7	34,3	60	60,85
38	Switzerland	19,61	8,1	89555,56	-5,9	37,9	0,4	81	70,9	33,7	-	-
39	Sweden	20,6	25	54449,8	3,9	31,5	0,7	81	51,6	29,8	-	-

Source: World Bank Group, 2023; Tax Foundation Europe, 2025; Tax Foundation Europe, 2024; Heritage, 2025; World Bank Group, 2021; Tax Justice Network, 2024; World Bank Group, 2023; Transparency International, 2024; NCSI, 2023; Tax Foundation Europe, 2024.

The examination of macroeconomic determinants and global indicators influencing the stability of tax systems in European nations encompasses not only their systematic analysis, but also the identification of deep relationships between key economic variables. Table 2 presents a matrix of correlation dependencies between the tax, financial, and social parameters.

Table 2. The matrix of correlation dependencies between the tax, financial, and social parameters

	CIT	VAT	GDPpc	FDI	DB/GDP	GDP Loss	CPI	TL	Gini
CIT	1								
VAT	-0,13714	1							
GDPpc	0,353043	-0,21215	1						
FDI	0,437801	-0,11963	-0,22278	1					
DB/GDP	0,379797	0,186093	-0,0857	-0,06734	1				
GDP Loss	0,464128	-0,11466	0,04477	-0,05416	0,297592	1			
CPI	0,331925	0,016948	0,73066	-0,1674	-0,15376	0,069028	1		
TL	-0,44388	-0,00739	-0,35819	-0,00831	-0,27311	-0,27459	-0,38159	1	
Gini	-0,15425	0,004191	-0,46501	0,217302	0,105946	0,00605	-0,30663	0,043981	1

Source: author's own calculations

A significant negative relationship between corporate income tax rates and the tax burden (r = -0.4439) indicates that an increase in income tax rates is often accompanied by a decrease in real tax revenues. This may stem from the prevalent utilization of evasion strategies or the transfer of capital to jurisdictions with more lenient tax regimes. However, a substantial income tax rate is correlated with the proportion of GDP losses attributable to corporate tax evasion (r = 0.4641), which further confirms this hypothesis, i.e. high-income tax rates stimulate tax

evasion or create negative pressure on the business environment. At the same time, the relationship between the VAT rate and tax losses is weak and negative (r = -0.1147), which may indicate that the increase in VAT has less impact on tax evasion than direct taxation of profits.

The investment climate significantly influences the composition of the tax base. There exists a subtle inverse correlation between the level of GDP per capita and the influx of foreign direct investment (r = -0.2228) indicates that the level of economic development is not the sole factor determining investment attractiveness. Many countries with low GDP per capita attract investors with favorable tax conditions and lower labor costs. On the other hand, a positive relationship between the level of public debt and tax losses (r = 0.2976) indicates that the debt burden may be associated with the tax system's low efficiency and high levels of evasion. Positive correlation with foreign direct investment (0.44). - at first glance, this appears to be a paradoxical relationship, as elevated corporate tax rates are typically anticipated to reduce investment attractiveness. Nevertheless, in numerous nations characterized by high corporate tax rates, there exist efficacious mechanisms of tax incentives for investors that mitigate the primary tax burden.

The interplay between the degree of corruption and economic development warrants particular scrutiny. The pronounced correlation coefficient between the Corruption Perceptions Index and GDP per capita (r = 0.7307) substantiates that nations with higher economic development are characterized by diminished levels of corruption. However, the negative relationship between the Corruption Perceptions Index and the tax burden (r = -0.3816) suggests that in countries with higher levels of corruption, governments are forced to compensate for budget losses due to a formal increase in tax pressure.

Attention should also be paid to the positive correlation of foreign direct investment with the Gini coefficient (0.21), which is explained by the fact that countries with large volumes of foreign direct investment often have a high level of social inequality, since investments are concentrated in high-paid sectors, which exacerbates the property gap.

However, for a full understanding of the impacts structure, it is also imperative to take into account additional indicators that characterize the overall stability of the economic environment as well as institutional capacity (Table 3).

Table 3. The correlation matrix of the tax, digital development, and cybersecurity indices

	CIT	VAT	CSI	DRI
CIT	1			
VAT	-0,13714	1		
CSI	0,587331	0,167727	1	
DRI	0,608957	-0,079	0,688206	1

Source: author's own calculations

The examination of the correlation matrix presented in Table 3 facilitates the identification of both obvious and hidden relationships between tax policy, digital development and cybersecurity. The most pronounced are positive correlations between the corporate tax rate, the level of digital development (0.61) and the cybersecurity index (0.59). This suggests that countries with a high corporate tax burden tend to have a developed digital economy and are actively investing in cybersecurity measures. Given that digital companies are the main taxpayers in such countries, governments direct the funds received to support digital initiatives and protect critical infrastructure. Nevertheless, value added tax has a weaker impact; although its correlation with cybersecurity is positive (0.17), it is rather a consequence of the general advancement of financial and digital systems, which necessitate enhanced security measures.

Hidden relationships may indicate a possible contradiction between digital development and the value added tax rate, since a weak negative correlation (-0.08) was recorded between these variables. This may suggest that a high value-added tax increases the final value of digital goods and services, potentially slowing down the digital transformation process. At the same time, the evident correlation between the level of digital development and cybersecurity (0.69) confirms that countries that are actively developing digital technologies are compelled to simultaneously strengthen the protection of information systems. This necessity arises particularly from the escalation of cyber threats and the imperative to safeguard personal data.

The tax system, when assessed through various macroeconomic indicators, unveils considerable imbalances and structural deficiencies that hinder its efficacy and competitiveness within the international environment. The corporate income tax rate in Ukraine stands at 18%, a figure that can be considered average in comparison to its European counterparts. It is higher than in Bulgaria, North Macedonia or Hungary, where the

income tax is 9 -10%, but lower than in France (25.83%) or Germany (29.93%). This indicates a certain balance between the aspiration to attract investors and the imperative to meet the budgetary requirements. However, Ukraine's dilemma extends beyond the mere rate; it lies in the intricacies of tax administration, which diminishes the efficacy of revenue collection and fosters an environment conducive to tax evasion. A value added tax of 20% is standard for many countries, but at the same time less competitive compared to Luxembourg (17%) or Switzerland (8.1%). A high VAT rate without an effective administration mechanism often leads to significant budget losses due to shadow transactions and VAT refund schemes.

The gross domestic product per capita in Ukraine is extremely low, standing at a 2,159.95 USD, which constitutes the lowest figure among the countries under examination. In contrast, Moldova reports a per capita GDP of 3728,9 USD, while Latvia boasts an impressive 16703,9 USD. The low level of incomes of the population indicates a weak tax base, a high share of the shadow economy, as well as a low level of tax discipline. At the same time, in countries with higher GDP per capita, such as Ireland (91647,77) or the Netherlands (51305,63), the tax system is more efficient owing to a larger tax base. Foreign direct investment in Ukraine constitutes 2.7% of its GDP, which is on par with the average observed among developing countries; however, it is markedly lower than that of countries with proactive investment strategies, such as Estonia (13%) or Malta (112.6%). This indicates Ukraine's weak attractiveness for international capital, which, in turn, is a consequence of complex tax administration, instability of legislation, and high levels of corruption. Moreover, it is also important to acknowledge that the prolonged war in Ukraine has precipitated a deterioration in all macroeconomic indicators.

That being said, the GDP losses in Ukraine are 0.1%, which is relatively low when juxtaposed with the Netherlands at 1.1% and France at 0.7%. However, this figure does not necessarily indicate economic stability, as a minimal level of GDP losses may stem from constrained economic activity – an occurrence often characteristic of nations with limited investment and low GDP per capita.

Therefore, the Ukrainian tax system demonstrates a significant imbalance between the level of tax rates and the economic conditions for their effective functioning. The prevailing CIT and VAT rates fail to adequately offset the low household incomes, the subdued levels of investment activity, and the substantial debt burdens. The main problems remain the complexity of tax administration, a significant share of the shadow economy, high corruption risks, as well as the instability of tax legislation.

4. Discussions

The study substantiates the inefficiency of Ukraine's tax system primarily due to its intricate administrative processes, which facilitate tax evasion. A comparable conclusion was made by Dahal (2020), who demonstrated, through the example of Nepal, that the low ratio of tax revenues to GDP is a direct consequence of ineffective governance and pervasive informality. The agreement of these conclusions can be seen in Challoumis's article (2023), which claims that even in EU countries, the risks to the tax system increase in case of insufficient institutional resilience and political volatility.

The study revealed that the complexity of the tax system in Ukraine serves as a significant impediment to the attraction of foreign capital. This is fully consistent with the conclusions of Esteller-Moré, Rizzo, and Secomandi (2021), which proved that tax complexity reduces FDI, especially in developing countries. Yet other researchers, namely Amberger, Gallemore, and Wilde (2024) highlighted the detrimental effects of a convoluted corporate tax system on companies' investment decisions. However, in the aforementioned study it was noted that multinational corporations sometimes use complexity to their advantage to optimize. This explains why large investors may choose jurisdictions with a high level of tax planning, while Ukraine, seeking to attract small and medium-sized capital, on the contrary, should minimize barriers.

The challenges associated with social justice and fiscal redistribution are prevalent both in the present study and within the broader scientific literature. The researchers Gupta and Jalles (2022), through rigorous empirical analysis focused on developing countries, concluded that tax reforms can exert a profound impact on inequality. Their data show that direct tax progressiveness and the efficient use of income in the form of social transfers reduce the Gini coefficient. Similarly, Shettigar, Misra, Sanyal, & Kawinga (2023) emphasize the need to take into account human development when designing fiscal reforms. Thus, their findings also correlate with the current study.

The current study revealed a positive correlation between the level of digital development and tax efficiency, which coincides with the standpoint of Khmyz *et al.* (2023), who highlight the role of digital tools in the fight against the shadow economy. Similarly, Yamen, Coskun, and Mersni (2023), demonstrated that digitalization markedly diminishes the incidence of evasion, particularly in contexts characterized by a low degree of corruption.

The current study focuses on the importance of cyber defense. Similarly, Mulyani, Suparno, and Sukmariningsih (2023) illuminated this issue within the fields of e-commerce and e-administration, while other scholars, including Aidonojie *et al.* (2024); Bierbrauer *et al.* (2021), and Juliannisa, Parianom, & Abrianto (2023), concentrated on the legal ramifications associated with data protection in automated taxation systems.

The conclusions of the current study regarding the detrimental impact of corruption within tax authorities are wholly congruent with existing scholarly literature. Notably, Kussainov *et al.* (2023) and Melnyk *et al.* (2022) demonstrated that corruption significantly reduces voluntary payment of taxes and stimulates evasion.

Moreover, digitalization without reforms in the field of anti-corruption policy cannot yield the expected results.

Thus, the study is not only seamlessly integrated into the contemporary scientific discourse but also fortifies the argument for the imperative need for a profound and comprehensive tax reform in Ukraine.

Conclusions and Further Research

The reform of Ukraine's tax system is a multidimensional endeavor. The challenges posed by globalization – such as capital mobility, the digitalization of the economy, and transnational competition – necessitate that Ukraine establishes a tax framework that harmonizes competitive rates with a robust institutional foundation. The experiences of prosperous nations illustrate that the structural efficacy of the tax system is attained through the establishment of a broad tax base, the implementation of transparent and straightforward regulations, a high degree of digital administrative capability, and the mitigation of corruption. Despite the prevailing nominal interest rates, Ukraine continues to grapple with a constricted tax base and inadequate enforcement of legislation – nearly half of the economy remains untaxed, while administrative inefficiencies and corruption result in substantial revenue losses. This undermines both fiscal stability and investment attractiveness. Hence, a comprehensive approach is needed for successful reform. On the one hand, a moderate tax burden on businesses should be maintained in order to stimulate growth and attract investment, which is especially critical in the post-war reconstruction period. On the other hand, the tax system ought to evolve toward greater equity and contribute to the alleviation of inequality, which necessitates a judiciously progressive approach and a vigorous campaign against tax evasion perpetrated by the affluent.

The comparative analysis suggests that Ukraine should focus on the best practices of European countries with similar challenges, in particular the experience of post-socialist economies that managed to radically reduce shadowing (Estonia, Slovakia), as well as the practices of Western European countries in ensuring tax justice and the quality of tax services (Scandinavian countries). It is imperative to understand that there is no universal model – the reform should be adapted to Ukraine's unique situation (post-conflict recovery, European integration, significant external support).

Thus, an effective tax system transcends mere rates and benefits; it embodies the trust that exists between the state and its citizens, the transparency of regulatory frameworks, as well as the state's capacity to fulfill its commitments to the citizens. Ukraine needs to build a new tax social agreement, under which entrepreneurs voluntarily come out of the shadows, assured that tax obligations are minimal yet paid by everyone equally, while the state, in turn, guarantees order and fosters development.

Credit Authorship Contribution Statement

Oleksii Maliarchuk: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Serhii Rylieiev: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Mykola Skrypnyk: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Oleksii Matsak: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Pavlo Kolomiiets: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have used/not used generative AI and AI-assisted technologies during the preparation of this work.

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The Role of Greed in Moderating Factors That Enhance Investment Decisions

Firda NOSITA
Faculty of Economic and Business
Brawijaya University, Indonesia
ORCID: 0009-0005-7556-311X
firdanosita9@gmail.com

Moeljadi MOELJADI
Faculty of Economic and Business
Brawijaya University, Indonesia
ORCID: 0009-0000-7731-9149
moeljadimo@gmail.co

Sumiati SUMIATI
Faculty of Economic and Business
Brawijaya University, Indonesia
ORCID: 0000-0001-6190-5290
sumiatisum8@gmail.co

Kusuma RATNAWATI
Faculty of Economic and Business
Brawijaya University, Indonesia
ORCID: 0009-0006-9179-9410
kusumaratnawatik@gmail.co

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Abstract: The study aims to empirically test the effects of risk tolerance, social networks and financial literacy on individual investment decisions in the Ponzi scheme in Indonesia. In this study, greed is used as a moderating variable. A questionnaire distributed online obtained a total sample of 402 individual investors who were or had invested in the Ponzi Scheme. Data was analyzed with structural equation modelling-partial least square (SEM-PLS). The results demonstrate that risk tolerance, social networks and financial literacy affect individual investment decision-making in the Ponzi scheme. Meanwhile, greed does not moderate the relationship between risk tolerance, social network and financial literacy in individual decision-making in a Ponzi scheme. The findings of this study confirm that risk tolerance drives individuals to invest in risky schemes such as Ponzi. Risk-tolerant individuals tend to take the opportunity to make money from the Ponzi scheme. Social networks are also shown to have a significant effect on individual investment decisions in Ponzi schemes. Information obtained by the individuals through interactions with their social environment, both face-to-face and social media, strengthens the intention to join Ponzi scheme investments. Meanwhile, good financial literacy makes individuals more optimistic and confident to invest in Ponzi. Greed does not moderate the effects of risk tolerance, social networks and financial literacy on individual investment decisions in a Ponzi scheme.

Keywords: investment strategy; Ponzi scheme; investment decision; risk tolerance; social media influence; financial literacy.

JEL Classification: G41; G11; D91; D14; L26.

Introduction

Humans try to get money to fulfill all their needs and desires, both now and in the future. Needs and desires often increase along with increasing income, while the real value of money continues to decrease over time due to inflation. To overcome this, one alternative that the community can use is to invest.

The issue of individual investment decisions continues to be an interesting topic for researchers, professionals and policymakers because it is related to the individual's goal of achieving financial well-being. The many investment alternatives available affect the individual's investment decision-making process. Many individuals make investment decision-making processes independently, but not all investment decisions result in profits, and investors do not always make the right investment decisions.

The money game or Ponzi scheme is one of the most frequently identified investment schemes in various illegal investment cases in Indonesia. A Ponzi scheme is a form of financial fraud that uses investor funds to pay returns to other investors; even in some cases, investor funds are used for the personal interests of the organizer. Throughout 2022, the OJK Investment Alert Task Force recorded that there were more than 610 illegal investment entities reported by the public (OJK 2023). Several examples of illegal investment cases with Ponzi schemes in Indonesia that have harmed the public up to trillions of rupiah, such as the Pandawa Group in 2016, which harmed up to IDR 3.8 trillion, Dream for Freedom and First Travel in 2017, which each harmed their customers up to IDR 3.5 trillion and IDR 0.8 trillion. These entities generally offer unrealistic returns to their investors without any clear and identifiable underlying business using investor funds to pay returns to other investors.

The decision to invest in fraudulent schemes such as Ponzi can be associated with irrational decision-making that places the expectation of high returns as the goal but does not consider the rationality of the scheme and the risks that may be faced. Simon (1952) introduced the concept of bounded rationality or limited rationality, where individuals (or companies) always act according to their goals but will act against their goals if they have complete and perfectly rational information. He identified the constraints faced in decision-making. First, there is only a little information that is sometimes unreliable about possible alternatives and their consequences. Second, the limited ability of human thinking to evaluate and process the available information, and third the limitation of time. In other words, the source of bounded rationality is the limited processing capacity of the human brain ('stupidity'), the lack of knowledge about alternatives in the choice set ('ignorance'), and the role of 'passion' Simon's concept of bounded rationality also distinguishes between intuition and thinking. Institutional economist Commons asserts that human behavior is goal-oriented but also heavily influenced by "stupidity, ignorance and passion" (Kaufman 1999).

The ease with which individuals join illegal investment schemes such as Ponzi is not only influenced by their level of tolerance for risk. Greenspan (2009b) explains that it is easy for investors to be fooled by Ponzi because investors see the fact that other people have made much money and become a story that can be persuasive evidence. This tendency is called irrational exuberance. The pressure of this irrational exuberance will be greater, especially when friends or relatives become rich after investing. This interpersonal influence can occur due to the social process or interaction between social members.

The theory of planned behavior (TPB) is also related to the Consumer Socialization Theory, which predicts that communication between consumers can influence cognitive, affective and behavioral attitudes (Ward 1974). Individual behavior or attitudes are the result of learning obtained through social interaction in their social activities. Schmidt & Spreng (1996) stated that decision-making on investment products could be described in the framework of consumer purchasing decision-making, namely a series of steps including problem recognition, information search, alternative evaluation, purchasing decisions and post-purchase behavior.

In TPB theory, intention is a necessary condition for voluntary action that is activated by perceived opportunities or because intentions can change as more information becomes available. Social interactions often create an exchange of information and knowledge in society. Information plays an important role in purchasing decisions, especially investment products (Lin and Lee 2002). Information search aims to obtain the highest benefit from each resource spent, reduce the risk of loss and increase satisfaction with the choice of products or decisions. Before making an investment decision, people often seek as much information as possible to be used as consideration in making decisions. Individuals will seek more information before making an investment decision than before buying other goods because investments involve more risk and tend to be based on trust or experience.

The inconsistency of findings regarding the role of financial literacy in producing optimal investment decisions aimed at minimizing this risk is a research gap that will be filled by this study, especially in the context of individual investment decisions in risky products or entities included in Ponzi schemes. This study also includes greed as a variable that moderates the influence of risk tolerance, social networks and financial literacy on individual investment decisions in Ponzi schemes because greed has been shown to be an important factor that drives someone to invest in Ponzi schemes (Onoh & Eze, 2018; Quisenberry, 2017; Rasool & Ullah, 2020). Badua (2020) states that the most common motive that causes people to invest in risky schemes is the desire to get money in a short time.

Fei *et al.* (2021) found that the high cost of living is one of the factors that play an important role in shaping motivation, decision-making and investment behavior. In addition, the existence of social pressure that their financial ability usually measures a person's success also plays a role in a person's materialistic nature. The strong desire to get something or wealth encourages individuals to be greedy, coupled with a hedonistic lifestyle that prioritizes pleasure or happiness, which can generally be fulfilled with money and possessions, thus triggering them to be more materialistic. Greed blinds investors so that risk is often forgotten when pursuing high returns.

Individual attitudes towards risk may change when faced with offers of very high returns. They may even be willing to risk their savings in order to make more money. They may forget about the risk factors of the investment because of the promise or convincing evidence that they can make much money or become rich from the investment. Investment decisions are one of the financial decisions that must be made by individuals in order to achieve financial well-being. The right investment decisions can improve financial well-being; conversely, unwise investment decisions may have a negative impact on individual finances. Financial literacy is the basic capital for individuals in considering various investment alternatives that are increasingly complex today.

The development of technology and the internet has changed a lot about how people seek information, communicate and interact to market financial products such as investments. Individuals must be able to filter the information they get to avoid investment risks that can harm their well-being. However, each individual has a different risk tolerance that can affect the investment decisions they make. The greed factor often makes someone ignore valid information and may tend to follow decisions made by others in order to get the benefits they want. Individuals with high levels of greed may be more easily influenced by promises of very high and fast investment returns, creating a high risk for their finances.

The study aims to determine the Role of Greed in Moderating Factors that Increase Investment Decisions. The study determines how greed plays a role in determining investment decisions in companies.

1. Literature Review

1.1 Relationship of Risk Tolerance with Individual Investment Decisions

Investment is an activity that contains uncertainty of outcome or risk. Individuals make investment decisions usually based on their perception, preference and knowledge of risk. Individuals have different risk preferences resulting in different decisions even though they are faced with similar choices. Individuals can be risk averse, risk takers or neutral to risk. This attitude towards risk will determine the decisions taken on various investment product alternatives available.

Emotions, as powerful psychological experiences, can involve changes in an individual's thoughts, behavior, and world perception. In investment decisions, emotions influence investors' thoughts and actions, ultimately affecting the results (Hinvest *et al.* 2021). Investors often experience intense emotional pressure when making investment decisions. There are things such as market volatility, potential losses, or high expectations. Emotions can influence investors to make irrational decisions, such as hastily selling their stocks or holding them in unfavorable market conditions. These conditions can affect long-term investment outcomes and cause investors to incur losses. However, emotions generate better investment results. Investors who can control their emotions and make decisions based on rational analysis are often more successful at generating profits from their investments (Lerner *et al.* 2015; Chambers, C. D., & Tzavella 2022; Sutejo *et al.* 2023)

Baruah and Parikh (2018) found that risk tolerance has a significant effect on investment decisions. That suggests that individuals who avoid risk may not easily decide to invest. Nguyen, Gallery, and Newton (2019) found that risk tolerance is closely related to the allocation of risky assets; risk-averse individuals tend to exaggerate negative outcomes so that they feel certain investments are riskier while risk-seeking individuals tend to exaggerate positive outcomes. Loke (2017) showed that risk tolerance can explain financial vulnerability in working individuals in Malaysia. Risk-taking individuals tend to be financially vulnerable; however, individuals who diversify their savings with stock and bond holdings tend to be more financially vulnerable than just saving.

H1: Risk Tolerance Affects Individual Investment Decisions.

1.2 The Relationship of Social Networks to Individual Investment Decisions

Individuals are social beings who have friendships and family relationships that can form opinions and influence decisions, including decisions related to finances. Someone might make decisions that are in line with their colleagues or family to avoid conflict. On the other hand, media is a means to share stories and attract someone's attention. Social interaction with other people and the availability of internet facilities that make it easy for media to reach all groups can trigger a wider word-of-mouth effect. Ostrovsky-Berman and Litwin (2019) explain the

relationship between social networks, defined as "people who are considered close" with investment tendencies. They concluded that social networks are a relevant predictor of the desire to invest in risky assets. Ouimet and Tate (2017) also found that individual investment decisions are influenced by friends, where the influence becomes greater when their friends have more information. These findings strengthen the evidence of the relationship between risky investments and the influence of a person's social environment.

Moreover, heightened financial literacy is linked to increased participation in retirement savings plans. Contrarily, Sobaih & Elshaer (2023) delved into the impact of financial literacy on investment behaviour, unveiling that individuals with enhanced financial knowledge possess greater confidence in their investment decisions and are adept at effectively managing investment risks. Their study further indicated a positive influence of financial literacy on retirement planning and asset allocation strategies. Oppong *et al.* (2023), Khababa & Ahmadjonov (2023) contributed to this discourse by establishing a connection between higher levels of financial knowledge and success in investment decisions, encompassing wealth maximization and increased profits

Anser *et al.* (2020) used the theory of planned behavior to examine the effect of social media usage on individual interest in buying Bitcoin. Using a sample of 443 respondents, they found that social media usage has a positive effect on interest in buying Bitcoin, and perceived risk moderates the relationship between interest and the actual behavior of individuals buying Bitcoin. Social media sites make it easier than ever to collect and analyze information and public opinion.

H2: Social Networks Influence Individual Investment Decisions

1.3 Greed Moderates Risk Tolerance towards Individual Investment Decisions

Risk tolerance is an individual's attitude towards the uncertainty that will be received in the promised results. In general, people who are tolerant of risk will consider the promise of very high profits as compensation for risk. Such people tend to ignore fraud signals because of the greedy urge to create wealth. Meanwhile, people who tend to avoid risk will consider placing funds in illegal investments because of the desire to generate wealth quickly and easily, even though they know there are risks. Greed strengthens the desire to bet on risky investments such as Ponzi, even though they know there are risks. Mussel *et al.* (2015) found that more greedy individuals take higher risks than less greedy individuals. That causes greedy individuals to tend to make risky decisions. They also mentioned that greedy individuals have difficulty learning from experience, especially mistakes, punishments or negative events.

H3: Greed Strengthens the Relationship between Risk Tolerance and Individual Investment Decisions

1.4 Greed Moderates Social Networks on Individual Investment Decisions

Flexing, or the activity of showing off possessions, achievements or luxury, activates a person's materialistic nature and encourages someone to be greedy so that they may not want to miss the opportunity to make money easily and quickly. Flexing done by someone, either conventionally or through social media, will motivate others to imitate or want the same thing. Greed will strengthen an individual's desire to make money quickly, especially when they face high social pressure, so they are more susceptible to being deceived by illegal investments. The existence of media and the internet makes it easy for them to access information on how to make money quickly and easily in order to fulfill personal satisfaction and to be accepted in certain social groups. Word-of-mouth can also occur because of an individual's social relationships with others, not only with family, relatives, friends, superiors, or even with other people they do not know well. Success stories obtained from investments with very high profits even change a person's lifestyle dramatically to become an attraction for this kind of investment. They are reinforced by the drive for greed in individuals so that they increase their desire to be able to make money like that person.

Financial decisions are essential and necessary in a family’s financial and personal wealth management (Sahi *et al.* 2013). The conventional finance theories focusing on utility maximization assume that markets are efficient and investors are rational in their decision-making. In efficient markets, information reaches the market quickly and equally. For rational decision-making, investors collect and process this information. Based on objective information and their attitude, investors make investment decisions. However, in traditional finance, there is a lack of consensus on the efficiency of the financial markets and rational decision-making of investors (Mahmood *et al.* 2024).

H4: Greed Strengthens the Relationship between Social Networks and Individual Investment Decisions

2. Method

This study uses a positivist or quantitative approach with an explanatory type. This study aims to explore the determinants of individual investment decisions who have invested in illegal Ponzi scheme investments throughout Indonesia. The sampling technique in this study is a non-probability sampling technique, namely the purposive sampling method, so the sample in this study was 385 people. The data collection technique in this study was by questionnaire. Inferential statistical analysis is used to test the hypothesis or to determine the causal relationship between variables that have been set in the model. The inferential analysis used in this study is the Partial Least Square Structural Equation Model (PLS-SEM).

3. Research Results

3.1 Measurement Model

The results of the convergent validity test show that with 402 respondents, it has a loading factor value of > 0.6 and an AVE value of > 0.5. Meanwhile, the results of the cross-loading estimation show that the loading value of each item in its construct is greater than the cross-loading value, so all latent variable constructs are valid discriminants. The Fornell-Larcker Criterion value is also greater than the correlation value between other latent variables, so the item meets discriminant validity. Construct reliability is tested by looking at the composite reliability value and Cronbach's Alpha value. Composite reliability shows a value of > 0.6 and a Cronbach's alpha value of > 0.7, so it can be said that the instrument has met reliability. The R2 analysis shows a value of 0.505 or 50.5%, so it has a coefficient of determination value that tends to be moderate.

3.2 Structural Model Testing

R2 analysis shows the level of determination of exogenous variables on endogenous variables. The greater the R2 value, the better the level of determination. The study's R2 value, 0.505, is the R Square value.

PLSpredict / Cross-Validated Predictive Ability Test (CVPAT). The blindfolding method does not provide an assessment of out-of-sample predictive power. Hence, Hair *et al.* (2022) suggest using CVPAT (cross-validated predictive ability test) because it provides the results needed for an assessment of out-of-sample predictive power. All indicators have a Q2 prediction value greater than zero, indicating that the PLS path model is better than its benchmark. Based on the comparison of PLS_SEM_RMSE and LM_RMSE values, it can be concluded that the model has high predictive power. Analysis using SmartPLS for each relationship was carried out using the bootstrapping method on the sample. The calculation of CVPAT can be seen in the following Table 1:

Table 1. Value CPVAT

	Q^2predict	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
$Y_{1.1.1}$	0,362	0,783	0,557	0,789	0,575
$Y_{1.2.1}$	0,363	0,764	0,554	0,777	0,572
$Y_{1.3.1}$	0,332	0,762	0,542	0,762	0,552
$Y_{1.3.2}$	0,369	0,740	0,528	0,751	0,543
$Y_{1.4.2}$	0,361	0,802	0,584	0,808	0,580
$Y_{1.5.1}$	0,325	0,815	0,578	0,819	0,610

Source: Data Processing, 2024

Analysis using SmartPLS for each relationship is done using the bootstrapping method on the sample. That is done to minimize the problem of data abnormality.

Table 2. Path coefficient and hypothesis test results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Description
X_1 -> Y	0,167	0,161	0,065	2,582	0,010	Significant
X_2 -> Y	0,308	0,306	0,057	5,374	0,000	Significant
M x X_1 -> Y	0,020	0,029	0,063	0,314	0,754	Not Significant
M x X_2 -> Y	0,011	0,003	0,054	0,204	0,838	Not Significant

3.3 Relationship of Risk Tolerance to Individual Investment Decisions

The results of the study stated that the risk tolerance variable had an effect on investment decisions with a p-value of 0.010. The test results prove that individual risk tolerance has a significant positive influence on investment decisions in Ponzi schemes. That shows that when individuals have a high-risk tolerance or are more tolerant, they tend to decide to invest in Ponzi schemes. Individuals who are tolerant of risk find it easier to open up or accept investment offers such as Ponzi schemes, they do not want to be late compared to other people or do not want to miss the opportunity to get high investment returns. That may be because they already understand how investment works, so they have to be the first or at the top of the pyramid to get high profits before the scheme collapses.

Several studies show that people who invest in risky entities tend to be risk seekers and optimists, especially those who have been victims more than once (Fei *et al.* 2021). Tennant (2011) states that people with a high-risk tolerance are more open to Ponzi scheme investment offers and tend to be encouraged to try this scheme for the first time. Loke (2017) also shows that the level of risk tolerance can explain a person's level of vulnerability to falling into illegal investments. Trimpop (1994) shows that risk-seeking individuals usually have good knowledge of risk. Cox (2014)found that some of them often consider the risk of losing money or losses in investment schemes of this kind to be normal because they believe that every business, whether legal or illegal, is inherently risky and may fail or suffer losses. So, they say that this uncertainty is not a barrier to investing, and to achieve success, investors must accept the risk of losing money.

3.4 The Relationship of Social Networks to Individual Investment Decisions

The results of the study stated that the social network variable had a significant influence on investment decisions with a p-value of 0.00. The test results show that social networks have a significant positive effect on individual investment decisions. So, social interactions carried out by individuals, either directly or through the internet and social media, influence individual investment decisions in Ponzi schemes. The environment and social ties in which individuals interact play a role in shaping a person's perceptions so that they are used in the decision-making process, including investment decisions.

Social networks play a fundamental role as a great tool for spreading information, ideas, tendencies, values, emotions and influence in society through word of mouth (Kempe *et al.* 2015; Magessi & Antunes, 2013). On the TPB concept, individual behavior or attitudes result from the learning they obtain through interactions between individuals or community agents. The majority of respondents in this research are the younger generation, who are also digitally literate and utilize technology and social media as sources of information and reference. Having suggestions from people who are considered important or famous strengthens the desire to invest. That proves that opinions and advice from other people in a person's social environment are very valuable in investment decisions and are strengthened by the existence of the internet and social media, which makes it easier for them to access how other people have successfully invested in Ponzi schemes.

Chimaobi and Perpetua (2020); Wilkins *et al.* (2012) found that investors were interested in investing in Ponzi schemes because they were informed by their family members, friends or acquaintances. Even though investors are often hesitant to invest, when they see friends, neighbors or acquaintances getting the promised returns, they become more motivated to invest. Lewis (2012) states that people tend to be reluctant to challenge or question people they trust. Offers from people closest to you, such as family or well-known friends, seem difficult to refuse because they tend to be believed to not lead to losses.

The internet is the easiest choice nowadays when someone needs information. However, individuals must be selective in filtering information obtained from the internet because the internet provides unlimited information from many sources that are not necessarily credible. Apart from that, social media is also an option for individuals today to search for the information they need. The internet and social media can change the way a person makes investment choices and decisions because they allow a person to have information overload making it difficult to differentiate between credible and manipulative information. The widespread use of the internet and social media means that investment ideas can spread like an epidemic among investors (Shiller 2014) and make fraudsters more sophisticated (Ma and McKinnon 2022).

People are exposed to content from public figures or influencers who offer investments on various social media, especially if they do not have the information or are lazy about looking for information about investment offers, it might be easier to decide to invest. Dupuis *et al.* (2023) stated that influencers on social media drive some people who do not have new information and technology and have high media visibility, creating an environment that supports the development of new fraud schemes. There are still many people who place funds

in Ponzi scheme investments; perhaps they are fooled by the illusion of increasingly diverse ways of investing, so it is more difficult for people to recognize these investments as Ponzi.

Cox (2014) said that concerns about social inequality could drive the Fast Money Investment Scheme. Increasing costs and lifestyle demands are often not balanced with increasing income, causing individuals to look for alternative income in various ways, one of which is by taking advantage of investment opportunities offered by family, friends and even people they do not know well personally.

Badua (2020) stated that people participated in Ponzi because they only received minimal income and had high family needs. In this study, the majority of respondents had incomes in the range of IDR 3,000,000 – IDR 8,000,000 per month (around $186-$500 per month); this could indicate that the majority of respondents invested in Ponzi schemes because they wanted to increase their welfare. Satisfying family needs becomes one of a person's achievements, which then encourages them to join fast investment schemes as a solution to earn money quickly and easily (Badua 2020).

Ponzi scheme organizers usually display "initial credibility" to investors by providing returns in a timely and appropriate manner. This ensures that investors consider this investment credible. Investors who are happy to get high returns tend to tell other people about the success of this investment. Even these successful investors often display a luxurious lifestyle, which will attract more investors and make this investment more popular (Mohammed 2021).

3.5 Greed Moderates Risk Tolerance towards Individual Investment Decisions

The results of the interaction test of greed and risk tolerance do not act as a moderator of the influence of risk tolerance on investment decisions, with a p-value of 0.754. The test results show that greed does not strengthen the relationship between risk tolerance and individual decisions to invest in Ponzi schemes. Greed in investment is often associated with the "speed" of making money (Nataraj-Hansen 2024). In the case of a Ponzi scheme, greed can dominate the feelings of investors or potential investors when deciding to join or increase the amount of investment. However, this greed may be controlled by investors because they know that this investment carries high risks, so they have to make decisions quickly and correctly if they want to make money from this scheme. Ponzi scheme investors may realize that these investments will not last long depending on the ability of the organizers and/or existing investors to find and recruit new investors to keep the scheme going and have a long life.

The majority of respondents in this study have professions whose income depends on a fixed base salary and allowances. That may be related to how individuals can control their greedy nature due to the constraints of limited income and professions that depend on class or rank. Individuals who have large wealth or income encourage them to take more risks and can accept losses better than individuals with smaller incomes (Hinz, McCarthy, and Turner 1997). Even though they are driven to earn much money quickly, respondents control this desire because they realize that their fixed income is not only used for investment but must also be able to meet increasingly complex living needs, so they must carefully calculate investment offers so as not to reduce their financial ability.

The majority of respondents in this study were Generation Y and Generation Z, where both generations were aware of and even started planning for retirement from an early age. Generation Z is already thinking about retirement and influencing them in income and career planning. The generation so that you can live your retirement with enough money.

The younger generation in Indonesia tends to use money not only to meet personal needs but also for their parents and to build friendships. They also think that money is one of the factors that causes anxiety in life (Hinduan, Anggraeni, and Agia 2020). Generation Z also understands the importance of unexpected financial situations and overcomes challenges such as debt pressure, decreased quality of life and decreased pension funds in the future (Bado *et al.* 2023). The term sandwich generation can also influence individual behavior, where they must be able to manage limited finances to meet the needs of the generation upper and lower generations. If they make mistakes in managing their money, the impact will be greater. This fact may influence the younger generation in controlling their greed and desire to invest in Ponzi schemes because they realize that if the investment fails to produce much money, it will cause personal anxiety and disrupt the fulfilment of their personal and social needs.

3.6 Greed Moderates Social Networks on Individual Investment Decisions

The test results of the interaction variables of greed and social networks do not act as moderators of the influence of social networks on investment decisions, with a p-value of 0.838. The test results show that greed does not

moderate the relationship between social networks and individual investment decisions. Cardella *et al.* (2019) conducted experiments on the effects of greed contagion in social interactions and found that there was no effect of greed contagion on a person's behavior. So, greed cannot always predict future behavior and is not always contagious; greed is just a norm of selfish behavior.

Generation Y and Generation Z are digitally literate generations who tend to use the internet and social media as their main sources of information. Individuals must be able to understand and interpret information logically and understand that information regarding investing in Ponzi schemes is mostly persuasive in order for them to join in. Even though greed often dominates the desire to make money quickly, individuals realize that nowadays, everyone can become a source of financial knowledge on various online media and social media, as if everyone is a financial expert. So, individuals must filter information well before making financial decisions.

The test results show that greed does not strengthen the influence of financial literacy on individual investment decisions. That may be because individuals with good financial literacy can carry out analysis when faced with certain investment offers. Individuals with good financial literacy will use their rationality to sort investment alternatives and will carry out due diligence before deciding to join. Greed is simply a desire to gain wealth that can be controlled by how someone can clearly use their knowledge and skills so that the decisions made can be maximized.

Khan *et al.* (2024) stated that the knowledge and skills that individuals gain while studying will last a lifetime and be useful in making sensible decisions. Good financial literacy does not necessarily make individuals blind and overconfident enough to accommodate their greedy nature, so it is not easy to accept Ponzi scheme investment offers. Individuals tend to be opportunists who take advantage of investment opportunities even though they know and understand that investing is a Ponzi scheme. They control their greed by understanding the right time to join and exit the investment.

Conclusions

The research proves that attitudes towards risk, as reflected in risk tolerance, are an important factor in considering investment decisions in Ponzi schemes. A risk-tolerant person is more likely to grab investment opportunities even though there is a lot of uncertainty or risk that must be faced. This study also showed that the diffusion of information from social networks also influences individual decisions to invest. Word-of-mouth carried out by social networks, whether shared face-to-face or via the internet and social media, has been proven to encourage people to participate in investing in Ponzi schemes that promise quick and easy wealth. Irrational exuberance or euphoria of investors who have succeeded in generating wealth will produce fantasies of wealth for other people. This successful investment experience activates other people's curiosity and leads to the decision-making process, namely seeking information about the story behind that success. In addition, communication can also encourage or provide approval for certain behaviors through verbal or indirect messages shared by other people. The abilities and skills possessed by individuals can increase self-confidence in decision-making. Greed does not strengthen the role of risk tolerance and social networks on individual investment decisions in Ponzi schemes. This finding explains that the direct influence of risk tolerance and social networks can increase individual investment decisions in Ponzi schemes. However, when interacting with greed, it is unable to increase individual investment decisions.

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Credit Authorship Contribution Statement

The authors equally contributed to the present research at all stages, from the problem formulation to the final findings and solutions.

Declaration of Competing Interest

The authors state that no competition for financial interests or personal relationships could influence the work reported in this paper.

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors hereby declare that no generative artificial intelligence (AI) or AI-assisted technologies (including but not limited to ChatGPT, Bard, or any other large language models) were used in the preparation, drafting, editing,

or submission of this manuscript. All content, including ideas, data interpretation, and language composition, is solely the result of the authors' original and independent work.

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Digital Accounting Dynamics: Unmasking Disruption and Gauging Its Impact on Financial Paradigms

Mohammad Ahmad ALNAIMAT
Department of Accounting
Alzaytoonah University of Jordan, Jordan
ORCID: 0000-0002-8589-110X
alnaimat@zuj.edu.jo

Natalya MALYUGA
Department of Accounting, Taxation and Audit
Polissia National University, Ukraine
ORCID: 0000-0001-7367-5381
bachynskan21@gmail.com

Volodymyr SHEVCHUK
Interregional Academy of Personnel Management, Ukraine
ORCID: 0009-0002-4456-7618
vshevchuk15@gmail.com

Alona KHMELIUK
Department of Finance and Accounting
Dnipro State Technical University, Ukraine
ORCID: 0000-0001-7367-4928
khmelyukalona@gmail.com

Oleksii NAIDENKO
Department of International Trade, Customs and Financial Technologies
Simon Kuznets Kharkiv National University of Economics, Ukraine
ORCID: 0000-0003-0638-3965
naidenkoolexiy@gmail.com

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Abstract: The study provides the empirical analysis of the impact of disruptions in accounting on the financial paradigms of 20 large Ukrainian companies for 2019-2023. The aim of the research is to analyse and explain how these disruptions affect financial performance indicators, such as Return on Assets (ROA), company stability, and market value. The research employed a panel data model, where the dependent variable is the financial performance of the companies and disruptions in accounting are the independent variables. The data were collected from publicly available financial statements, audit reports, and macroeconomic indicators. The study applied a fixed-effect and random-effect regression model to measure the relationship between disruptions in accounting and financial indicators. Company size, industry type, and other macroeconomic conditions (*e.g.*, Gross Domestic Product (GDP) growth) are control variables. Disruptions in accounting have a significant negative impact on financial performance, including restatements, reporting delays, and qualified audit opinions, which causes a decrease in ROA. GDP growth is a macroeconomic factor that positively affects financial performance, while company size mitigates the negative impact of accounting accuracy on performance. The results show that accurate and timely financial reporting is important for maintaining investor confidence and financial stability. This study is one of the first studies to examine how disruptions in accounting affect Ukrainian companies, provides an up-to-date conceptual understanding of the relationship between financial reporting practices and financial performance in a transformational economy.

Keywords: disruptions of accounting; Ukrainian companies; financial indicators; panel data; recalculations.

JEL Classification: D11; F65; M41; C01.

Introduction

Disruptions in accounting in the form of financial restatements, financial reporting delays, and adverse audit opinions are becoming a critical issue for companies worldwide (Schaltegger 2020). These disruptions negatively affect organizations, causing significant impacts on financial health, operational performance, and value (Sukanthasirikul 2021). The impact is most acute in emerging markets such as Ukraine, where corporate governance remains underdeveloped and financial transparency is far from standard practice. Therefore, understanding how accounting disruptions, such as investments in R&D and advertising, affect financial accounting metrics and ultimately companies' financial performance is important for both academics and practitioners responsible for strategic management of companies and building investor confidence.

Therefore, understanding how disruptions in accounting, such as investment in research and development and advertising, affect financial accounting indicators and, ultimately, the companies' financial performance, is important for both academics and practitioners responsible for the strategic management of companies and for building investor confidence.

This article empirically examined how disruptions in accounting affected the financial paradigms of 20 large Ukrainian companies for 2019–2023. By examining restatements, reporting delays, and audit opinions, the study determines the impact of these three variables on financial indicators such as profitability, financial stability, and market value. The impact of disruptions in accounting on investment is analysed using a panel data model that controls the company size, industry type, and macroeconomic conditions.

Recent studies have shown that disruptions in accounting negatively affect the companies' financial performance (Bila, 2024; Secinaro *et al.* 2021). However, their impact on the Ukrainian economy is poorly studied. The authors of this study fill this gap by explaining how disruptions in accounting affect the companies' financial performance in Ukraine, considering the unique constraints and opportunities in its markets. The aim of the article is to provide relevant information for further effective decisions of policymakers, investors and corporate managers, the importance of timely and accurate financial reporting for the viability of the company and market confidence.

The article also examines the relationship between disruptions in accounting and financial paradigms to demonstrate the role accounting plays in the economy as a whole in emerging markets. This is important in order to understand their dynamics, improve financial transparency, and enable sustainable business growth in Ukraine.

A novel contribution of this study is to empirically investigate the particular financial impacts of accounting disruptions of restatements, reporting delays and audit opinions on the financial performance of major Ukrainian firms during economic transformation (2019–2023). Despite the plethora of literature on digital transformation and financial transparency in developed markets, there is very little scholarly work looking into how disruption of these trends occurs in transitional economics such as the Ukraine. Through the use of panel data econometrics, this research addresses a large gap by applying frameworks to a diverse sample across critical industries and delivering actionable bottom-line takeaways for policymakers, investors and corporate executives. The findings highlight the financial reporting role in strategic decision making, targeted particularly at maintaining investors' confidence and stability of the macroeconomy in post crisis situation.

1. Literature Review

Accounting has undergone significant changes in the past few years, driven by technological advances and the increasing complexity of global economic and environmental challenges (Truong *et al.* 2021). The concept of sustainability in accounting has gained critical importance, especially in times of crisis. Tregidga and Laine (2022) argue that these disruptions require a revision of long-term environmental accounting to address the new risks that organizations face. This is consistent with broader discussions linking sustainability to global challenges such as pandemics, as suggested by Schaltegger (2020). Schaltegger advocates the integration of ecosystem accounting into a comprehensive framework for sustainable development. In addition, Industry 4.0 has caused enormous disruptions in work and supply chains, as Koh *et al.* (2019) noted. New technologies, such as cloud computing and big data, are transforming accounting, enabling real-time data-driven decision-making. Cloud accounting, being flexible and efficient, also poses new risks.

Yau-Yeung *et al.* (2020) discuss these risks and propose mitigation strategies, emphasizing the careful integration of technology into accounting practices. As Jayasuriya and Sims (2023) note, blockchain technology has revolutionized accounting and ledger management by eliminating intermediaries. Knudsen (2020) show how digitalization is blurring traditional boundaries and disrupting organizational power dynamics. These technological

advances highlight the transformative potential of digital tools in accounting. However, there are challenges to the implementation of digital tools.

Al-Okaily and Alsmadi (2024) and Hamundu *et al.* (2020) propose a model for implementing cloud accounting in Indonesian micro, small and medium-sized enterprises (MSMEs). David and Cernușca (2020) study how accountants see the future of their profession in the context of digital transformation. Chu and Yong (2021) note that big data analytics improves decision-making but requires a robust infrastructure to support its complexity.

Al-Okaily *et al.* (2024) and Al-Okaily and Alsmadi (2024) emphasize how digital tools and blockchain improve accuracy and trust in financial systems, directly addressing the disruptions highlighted in this study. Lulaj & Brajković (2025) and Alassuli *et al.* (2025) underline the role of governance and ESG integration in mitigating the negative effects of accounting irregularities. Amin *et al.* (2025) and Avdimetaj *et al.* (2025) stress the need for practical skills and updated education to support digital accounting adoption. De Silva *et al.* (2025) and Komelina *et al.* (2018) highlight how digital integration drives sustainable and resilient financial reporting. Together, these studies align with the findings on Ukrainian companies, affirming that digital accounting transformation is essential for improving financial paradigms amid disruption. The incorporation of non-financial elements into accounting practices is also increasing. Summarizing this literature review, it can be concluded that the synergy between technology, sustainability, and digital transformation in accounting is a very relevant issue.

2. Materials and Methods

2.1 Research Procedure

The study employed a quantitative approach using panel data. The data were collected over a 5-year period for 20 Ukrainian companies. The analysis focuses on financial indicators such as ROA and Altman Z-score as dependent variables. Independent variables will include disruptions in accounting: restatements, audit opinions, and reporting delays. Fixed effects (FE) and random effects (RE) models were used with diagnostics such as the Hausman test to select the appropriate model.

2.2 Sample

Twenty companies (Naftogaz of Ukraine, Ukrnafta, Metinvest, DTEK, Ukreximbank, PrivatBank, Kernel, MHP, Ferrexpo, Kyivstar, Nova Poshta, ArcelorMittal Kryvyi Rih, Zaporizhstal, Astarta-Kyiv, Interpipe, Epicentrk, Vodafone Ukraine, Ukrtelecom, Ukrhydroenergo, Obolon) were selected for the analysis, representing various sectors of the Ukrainian economy, including energy, banking, manufacturing, and telecommunications. This approach ensures a representative sample. The number of companies was limited to 20 to ensure a detailed analysis of each case, taking into account the availability of data and research resources, as well as to maintain a balance between breadth of coverage and depth of research

2.3 Methods and Instruments

The dependent variables include financial stability (Altman Z-score), profitability (ROA), and market valuation (*e.g.,* price-to-book ratio). The independent variables are accounting disruptions (restatements, audit opinions, reporting delays), while the control variables include company size, industry type, GDP growth, and Corporate Governance Index (CGI).

The econometric model used:

$$Yit = \beta 0 + \beta 1 Restatementsit + \beta 2 Delaysit + \beta 3 AuditOpinionsit + \beta 4 Zit + \epsilon it \quad (1)$$

where:

Yit - represents the ROA for company *i* in year *t*. It measures how efficiently the company uses its assets to generate profit.

β0 - represents the baseline level of financial performance when all independent variables are zero.

β1Restatementsit - reflects the impact of financial restatements on performance. A higher frequency of restatements indicates a higher number of accounting errors, which are hypothesized to negatively affect the ROA.

β2Delaysit - reflects the impact of delays in financial reporting on performance. Longer delays typically indicate inefficiencies or management problems that are expected to reduce ROA.

β3AuditOpinionsit - reflects the impact of audit opinions (*e.g.*, qualified or adverse) on financial performance. Adverse opinions indicate weaknesses in financial management that can harm ROA.

β4Zit - includes control variables such as firm size, GDP growth or industry effects, which take into account external factors and company-specific characteristics that can also affect financial performance.

ϵit - errors, which include unobserved factors or random variations that affect financial performance but are not explicitly included in the model.

Hypotheses:

H1: Disruptions in accounting negatively affect financial paradigms (β1 < 0).

H2: Large companies suffer less from disruptions in accounting due to reliable management (β4>0).

2.4 Data Collection

The data were obtained from company reports, auditing firms (Kearns-Manolatos *et al.* 2024; PwC 2023), as well as macroeconomic indicators of the Derzhstat (2024) and the World Bank (2023; 2024), IMF (2023; 2024).

2.5 Econometric Steps

1. The data cleaning (missing values were removed and variables were normalized).
2. Panel data estimation (FE models were used and RE models were considered based on diagnostics).
3. Diagnostics (Hausman test, Breusch-Pagan test for heteroscedasticity, and variance inflation factor (VIF) for multicollinearity were performed).
4. Software tools (Stata and Excel were used for analysis).

3. Research Results

In modern economies, the integrity of accounting practices is closely linked to financial paradigms. Disruptions in accounting include financial misstatements, audit discrepancies, and underreporting (Youssef & Mahama, 2021). These disruptions complicate decision-making by stakeholders and affect confidence in financial markets (Tsiligiris and Bowyer 2021).

The proposed econometric model addresses a pressing problem in accounting and financial management practices. This is consistent with the political and economic goals of Ukraine. Using a fixed effects approach, a panel data regression model was estimated, where the result of the Hausman test showed that fixed effects were more relevant compared to random effects ($p < 0.05$). This identifies the relationship between disruptions in accounting and financial paradigms for 20 Ukrainian companies in 2019–2023. The results of this econometric model are presented in Table 1.

Table 1. Results of the econometric model (ROA)

Item No.	Variables	Coefficient (β)	Standard error	t-Statistic	p-Value
1.	Restatements	-0.145	0.062	-2.34	0.019 **
2.	Delays	-0.008	0.003	-2.67	0.008 **
3.	Audit Opinions	-0.102	0.046	-2.22	0.027 **
4.	Company Size (Registered Assets)	0.076	0.021	3.62	0.000 ***
5.	GDP Growth Rate	0.153	0.038	4.03	0.000 ***
6.	Industry	0.062	0.024	2.58	0.011 **
7.	Constant	0.842	0.215	3.91	0.000 ***

Note:

1) *** (three asterisks) – the result is highly statistically significant, often corresponding to a p-value of less than 0.001. This means that the probability that the observed effect is accidental is less than 0.1%.

2) ** (two asterisks) – the result is statistically significant, often corresponding to a p-value of less than 0.01. This indicates that the probability that the effect is accidental is less than 1%.

Model diagnostics:

1) R2 (within): 0.62;

2) R2 (overall): 0.57;

3) F-statistic: 12.34 (p < 0,001);

4) Number of observations: 100 (20 companies over 5 years).

Source: developed by the authors.

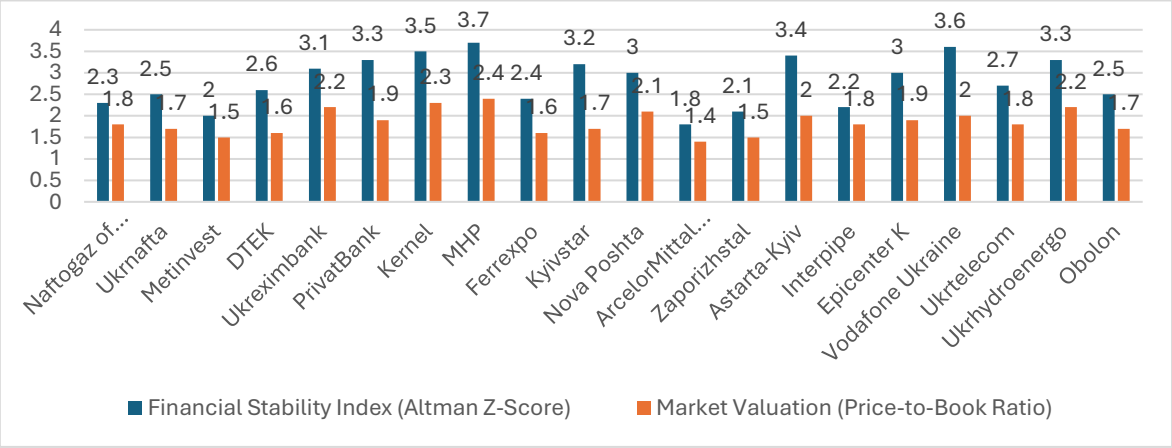
The data in Table 2 and Figure 1 show that disruptions in accounting characterized by restatements, delays, and audit opinions, significantly worsening financial performance. Macroeconomic growth and company size were found to mitigate these negative effects.

Table 2. The results for 20 Ukrainian companies

Item No.	Company	Restatements (%)	Reporting delays (days)	Audit opinions (%)	ROA (%)	GDP growth (%)	Company size	Industry
1.	Naftogaz of Ukraine	5.2	10	2.5	3.1	3.5	10.2	Energy
2.	Ukrnafta	4.1	12	3.1	4.2	3.5	9.7	Energy
3.	Metinvest	6.3	14	2.8	5.0	3.5	11.1	Manufacturing
4.	DTEK	3.9	8	4.0	2.7	3.5	10.8	Energy
5.	Ukreximbank	2.5	9	5.0	6.0	3.5	9.5	Banking
6.	PrivatBank	1.8	7	5.5	7.5	3.5	9.8	Banking
7.	Kernel	3.0	6	4.2	6.8	3.5	10.0	Agriculture
8.	MHP	2.4	5	3.8	8.0	3.5	9.9	Agriculture
9.	Ferrexpo	4.5	10	2.9	4.5	3.5	10.4	Mining
10	Kyivstar	3.2	4	3.5	5.2	3.5	10.3	Telecommunications
11	Nova Poshta	2.1	6	3.2	9.0	3.5	9.6	Logistics
12	ArcelorMittal Kryvyi Rih	7.0	13	4.0	3.5	3.5	11.3	Manufacturing
13	Zaporizhstal	5.8	15	3.5	4.0	3.5	10.5	Manufacturing
14	Astarta-Kyiv	2.0	3	2.3	6.2	3.5	9.4	Agriculture
15	Interpipe	4.2	11	3.7	3.8	3.5	10.1	Manufacturing
16	Epicentrk	3.3	5	3.1	7.0	3.5	9.7	Retail
17	Vodafone Ukraine	2.6	4	3.5	6.5	3.5	10.2	Telecommunications
18	Ukrtelecom	3.4	7	2.9	5.3	3.5	10.0	Telecommunications
19	Ukrhydroenergo	2.8	6	4.2	6.3	3.5	9.8	Energy
20	Obolon	4.7	12	3.0	3.9	3.5	9.9	Manufacturing

Source: developed by the authors.

Figure 1. Financial Stability Index (Altman Z-score) and market valuation (price-to-book ratio)



Source: developed by the authors.

One important finding is that for the energy and industrial sectors, financial restatements alone lead to a 14.5% decline in ROA for companies such as Naftogaz of Ukraine, Ukrnafta, and Metinvest. Most of them operate in capital-intensive industries and where investor confidence plays a significant role in raising capital and maintaining operational integrity. As a state-owned energy giant, Naftogaz could ultimately spread financial misstatements throughout the economy and at the political level as a whole. The same applies to all large companies such as Zaporizhstal and ArcelorMittal Kryvyi Rih, which, together with the other four largest steel producers in Ukraine, are vital to the country's steel production and are unlikely to be able to withstand disruptions in their financial reporting, as such disruptions could negatively impact their credit ratings and access to export markets.

The analysis shows a 0.8% decrease in ROA due to daily financial reporting delays. This finding is particularly important for companies such as PrivatBank, Ukreximbank, and Kernel, which operate in highly competitive and time-sensitive sectors. Delays in reporting financial results, such as those at PrivatBank and Ukreximbank, can hurt customer confidence and deter potential investors, as these banks are now under special scrutiny following the 2014 economic reforms. Similarly, Kernel and MHP, leaders in the agricultural sector, depend on timely reporting to secure important contracts in international markets and to keep the supply chain as efficient as possible.

Management and audit quality are critical, as evidenced by the adverse negative impact of qualified or negative auditor opinions on ROA (-10.2%). Audits with negative opinions regarding the involved companies can negatively impact their internal control deficiencies and can be interpreted as a weakness in internal control of telecommunications companies such as Kyivstar and Vodafone Ukraine, which, in turn, can have a negative impact on their reputation in the market and their ability to attract business partnerships. Retail and logistics companies such as Nova Poshta and Epicentrk need to have reliable audit practices to counter the risks that result from rapid growth and complex operational processes.

Finally, the positive relationship between company size and ROA supports the idea that the return to scale and governance structure found in large companies help DTEK, Metinvest, and ArcelorMittal Kryvyi Rih. With their established financial structure and diversified sources of revenues, these companies are better positioned to absorb shocks caused by accounting failures. Furthermore, the impact of GDP growth on ROA and its positive impact on profitability across sectors is confirmed. When the revenues of companies in the consumer goods and energy sectors, like the two mentioned above, are largely dependent on domestic and international demand, these sectors are more sensitive to economic fluctuations.

The econometric model assumes industry differences, according to which banking firms have relatively higher ROA than others. For example, Ukreximbank and PrivatBank have resorted to regulatory reforms despite accounting failures to improve financial performance. On the other hand, industrial giants such as Interpipe and Ferrexpo are particularly vulnerable to the adverse impact of money-related announcement issues because they are constrained by volatile commodity prices and geopolitical risks.

4. Discussions

Most current studies examine quite similar themes and challenges, as well as the function of technology in improving business analytics and sustainability in accounting. For example, Chu and Yong (2021) examine the growing use of big data analytics in accounting and auditing, analysing how it can improve business analytics. This is supported by our study, which also recognizes the role of technological tools from big data to cloud accounting in modernizing accounting practices. Their findings are consistent with research that suggests that the use of big data will improve decision-making and the efficiency of accounting systems. However, the current study goes beyond this and further examines both the operational benefits, sustainability challenges, and risks associated with integrating these technologies.

Tettamanzi *et al.* (2022) show that financial accounting is linked to the dynamics of Environmental, Social and Governance (ESG) Strategy. They examine sustainability, a key issue of this study, where accounting practices need to consider non-financial issues to be fit for purpose, especially in times of crisis such as the COVID-19 pandemic. The current study shares Tettamanzi *et al.* (2022) view that ESG factors are central to accounting and extends this view by exploring how integrating sustainability strategy into accounting through technological tools will provide transparency and accountability in ESG reporting.

According to Lodhia *et al.* (2021), the changing needs of sustainability accounting in the post-pandemic era are forcing accounting systems to measure and create value through the use of non-financial indicators. This is consistent with our research that is based on a sustainability perspective, considering the environmental, social, and economic aspects of business. The study consists of the idea that accounting practices need to change from a simple split approach to a more integrated approach where non-financial data will be most useful for decision-making.

Adedoyin *et al.* (2021) and Al-Okaily *et al.* (2024) analyse the environmental consequences of the EU economic complications, examining the impact of Brexit and other economic crises on tourism. Although this study deals more with the macroeconomic level, its findings complement the analysis of our study in the case where crises and resilience interact with each other. This study is consistent with the findings of Adedoyin *et al.* (2021) that the complexity of the current economy requires a kind of accounting that is agile and sensitive to external shocks.

The study of Cho *et al.* (2022) emphasize the growing relevance of environmental risk accounting, the issue that is closely related to the focus of this study on environmental accounting. Our study supports their arguments, suggesting that accounting practices need to evolve to more fully reflect the risk of environmental crisis, and thus expand integrated technical accounting systems.

In particular, Levytska *et al.* (2022) distinguish risk-based approaches to the functioning of internal audit in financial monitoring systems. This study fills a gap in current research, also emphasizing the importance of having adequate internal controls and risk management strategies in place in view of new technological disruptions. According to their findings, our study concludes that accounting systems that are currently facing technological advances and environmental challenges will require further adaptation and suggests that a risk-based approach to relatively new technologies will be crucial for effective integration.

The study of Sydorchuk *et al.* (2024) examined the effects of digitalization in public administration, as well as in the field of national security and economic stability. Although they work only on public sector administration, their findings are relevant to our study, which aims to examine the broader picture of digitalization in accounting. Sydorchuk *et al.* (2024) believe that digitalization can improve the efficiency and accountability of systems such as accounting, and our research agrees with the idea that digital tools need to be further integrated into accounting practices to increase sustainability.

In Prokopenko *et al.* (2024), the social impact of innovative green entrepreneurship models for the benefit of local development is discussed. Our study adopts a perspective that also shares the idea that accounting promotes sustainable business practices. This is consistent with the idea of Prokopenko *et al.* (2024) that green entrepreneurship is necessarily innovative, often involving advanced accounting systems that allow for more accurate tracking and measurement of environmental and social impacts.

The study by Mazur *et al.* (2023) deals with capital management related to the rational structuring of financial resources of construction companies. Although the perspective is more focused on the area of capital management, the importance is obvious for the current research on resource allocation and sustainability. The study confirms the idea of Mazur *et al.* (2023) on the importance of effective resource management for sustainable development, especially for environmentally regulated industries and disruptive markets.

In general, our research is consistent with the current literature on how sustainability can be integrated with technology and accounting. In terms of ESG factors, this is consistent with the aforementioned studies, particularly with regard to the growing relevance and desire for more transparent and integrated accounting. However, building on these concepts, our research examines how these technological developments can be applied to accelerate the transformation of accounting systems in light of the environmental, social, and economic crises that are rapidly approaching the accounting field.

Limitations

The limitations of this study concern the impact of disruptions in accounting on the financial performance of Ukrainian companies. As the authors cover only 20 companies, the distribution of companies may not fully reflect the Ukrainian corporate sector. The authors would have had a better sample with a larger sample that includes more companies, especially SMEs. Moreover, relying on publicly available data may miss hidden disruptions in accounting within the company that do not result in restatements or audit opinions. Information on more detailed internal audit data can be obtained through interviews with accountants or managers. Although the study focuses on restatements, delay, and audit opinion, it does not include other influential factors such as the quality of corporate governance or industry characteristics. These variables, in addition to extending the time frame of the analysis to a longer period, should be included in further studies.

Recommendations

Further research may focus on additional macroeconomic variables as Ukraine's economic environment is likely to be so volatile. Using qualitative methods, i.e. interviews with financial managers or auditors, could help to better understand the relationship between accounting practices and financial performance. Finance teams should receive regular training to improve the accuracy, timeliness, and accessibility of financial reporting, and companies should implement more stringent internal controls to avoid errors that lead to misstatements. Another way to improve audit quality, which significantly affects financial performance, is to expand auditors' collaboration with external auditors. To increase investor confidence, policymakers should strengthen the regulatory framework for financial reporting and auditing practices to further align with international standards and increase transparency. These implementations will contribute to Ukraine's financial transparency, its economic growth and stability in the market..

Conclusions and Further Research

Disruptions in accounting, such as restatements, reporting delays, and adverse audit opinions, negatively impact the financial performance of Ukrainian companies. These disruptions impact short-term profitability and reveal governance issues that undermine investor confidence and market stability. Effective corporate governance, including transparent reporting, timely financial disclosure, and reliable audit relationships, is critical to mitigating these impacts.

The positive relationship between GDP growth and financial performance emphasizes the interaction between the macroeconomic and corporate levels. Larger companies benefit from the effect of scale, which enable them to deal with disruptions in accounting more effectively. Further research may focus on the longer-term impact of disruptions in accounting on market valuation and investor behaviour. Expanding the sample to include SMEs would provide a clearer picture of the broader economic impact. Incorporating detailed data, such as interviews with financial managers and auditors, can uncover the root causes of these disruptions. Research can also examine how reforms, such as strengthening audit committees, reduce the negative impact of accounting problems.

Longer study periods and additional macroeconomic variables, such as inflation or exchange rates, could offer a deeper understanding of how external factors affect accounting practices. This study contributes to the expansion of research on transition economies such as Ukraine. The study recommends reliable financial reporting, clear rules, and effective governance to ensure financial stability and market confidence.

Credit Authorship Contribution Statement

Mohammad Ahmad Alnaimat: Conceptualization, Validation, Project administration.
Natalya Malyuga: Investigation, Writing – review and editing, Methodology.
Volodymyr Shevchuk: Writing – original draft, Software.
Alona Khmeliuk: Formal analysis, Data curation.
Oleksii Naidenko: Supervision, Visualization.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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The Impact of Brand Management Strategy on the Trading Companies' Competitiveness

Yaroslav BIRIUKOV
Department of Journalism and Advertising
State University of Trade and Economics, Ukraine
ORCID: 0009-0006-6198-1617
091019591nb@gmail.com

Tetiana DUBOVYK
Department of Journalism and Advertising
State University of Trade and Economics, Ukraine
ORCID: 0000-0001-9223-4629
78tatnia98@gmail.com

Olena MELNYKOVYCH
Department of Journalism and Advertising
State University of Trade and Economics, Ukraine
ORCID: 0000-0001-8531-8509
lena.melnik@gmail.com

Grigor NAZARYAN
Armenian State University of Economics, Armenia
ORCID: 0000-0001-6048-9790
Nazar214@gmail.com

Anatolii VYKHRYSTIUK
Department of Administrative, Financial and Banking Law
Interregional Academy of Personnel Management, Ukraine
ORCID: 0009-0008-5734-8004
vykhrystiuk.a@gmail.com

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Abstract: The study analyses the impact of brand management strategy on the retail companies' competitiveness in the current conditions of globalization and digital transformation. The relevance of the issue is determined by the need to create sustainable competitive advantages of companies in a highly competitive environment, where effective brand management contributes not only to enhancing consumer loyalty, but also to ensuring long-term financial stability. The aim of the study was to identify key brand management factors that affect the competitiveness of retail companies in an international context. The research used a comprehensive approach, including the methods of correlation analysis, benchmarking, and dynamic (trend) analysis. The results of the study showed that companies that invest more than 10% of total revenue in brand management demonstrate an average revenue growth of 11.4% over five years, and the customer retention rate among such companies increases by 8.2% compared to competitors. It was found that the use of digital communication platforms, social networks, and personalized marketing significantly increases the level of trust in the brand and strengthens its position in the market. The academic novelty of the study is the determined optimal combination of traditional and digital brand management tools to increase the retail companies' competitiveness. The practical significance of the obtained results is the possibility of their application for the development of strategic marketing programmes aimed at increasing brand recognition and its adaptation to digital markets. Further research may focus on at developing methods for assessing the effectiveness of

digital brand strategies in various retail segments, as well as studying the impact of new technologies, in particular artificial intelligence (AI) and blockchain.

Keywords: competitiveness; brand management; brand strategy; retail companies; marketing communications; branding.

JEL Classification: M31; L81; A12.

Introduction

Current globalization and digital transformation make trading companies to constantly strengthen their competitive positions. Growing competition and changes in consumer preferences emphasize the role of brand management in shaping long-term competitive advantages and financial stability of companies (Chernysh 2024).

The rapid development of trade and economic interaction of Ukraine with the countries of the European Union (EU) creates the prerequisites for expanding market opportunities for domestic trading companies, entailing an increased competition from leading European players. The volume of bilateral trade in goods between the EU and Ukraine in 2023 reached €61.9 milliard, which is more than twice the figures at the time of the entry into force of the Deep and Comprehensive Free Trade Area (DCFTA) in 2016. The EU's share in Ukraine's foreign trade was about 56% in 2023, which confirms the significant importance of the European vector for the sale of Ukrainian goods. At the same time, Ukraine ranked 16th among the EU's trading partners, accounting for 1.2% of the total EU trade. Exports from Ukraine to the EU in 2023 amounted to €22.8 milliard, and EU return exports to Ukraine amounted to €39.1 milliard, which indicates a relatively stable structure of mutual supplies despite the existing political and economic risks (European Commission 2024).

In the current retail sector, brand management is a multi-component process that includes the development and implementation of strategic decisions regarding brand identity, communication policy, and differentiation in the market (Marques *et al.* 2020; Teece 2025). A strong brand promotes consumer trust, reduces sensitivity to price changes, and strengthens the market position of companies.

Growing digital competition requires an active online presence of brands. Fayvishenko *et al.* (2023) emphasize that social networks are a key tool for attracting customers and maintaining their loyalty. At the same time, Gyenge *et al.* (2021) emphasize that branding should be integrated into the overall business strategy, taking into account the development of e-commerce and changes in consumer preferences. Despite a wide range of research, a unified approach to assessing the effectiveness of brand management in retail remains uncertain. There is a lack of empirical data on the impact of digital transformation on brand stability, while the adoption of blockchain and smart contract technologies is still limited.

The aim of this study is to determine the impact of brand management strategies on the retail companies' competitiveness in an international context, in particular by analysing the effectiveness of digital brand strategies and their adaptation to the global digital transformation. The aim of the study involved the fulfilment of the following research objectives:

1. Study theoretical approaches to brand management and the competitiveness of retail companies in an international context.

2. Analyse the impact of digital brand management tools on the market position of retail companies in different countries, as digital transformation significantly changes the competitive environment, and the effective use of digital technologies enables companies to adapt brand strategies to changes in consumer behaviour and improve their market sustainability.

3. Identify the correlation between the effectiveness of brand management strategies and the level of retail companies' competitiveness through an empirical analysis of key economic indicators in several countries and to offer recommendations for improving brand strategies in the digital economy.

1. Literature Review

Brand management is one of the key factors in shaping the retail companies' competitiveness. Academic studies examine different approaches to brand management that affect its positioning and market sustainability. According to Mullabayev and Ravshanbekov (2025), marketing strategies are the basis of brand management, as they cover market analysis, consumer segmentation and value proposition creation. As Huda *et al.* (2025) have shown, companies that systematically apply such strategies achieve better results in promoting and satisfying customer needs. On the other hand, Tambunan *et al.* (2025) emphasize that brand effectiveness depends on the alignment of brand strategy with operational processes.

Ali and Anwar (2021) states that strategic brand management contributes to the long-term competitive advantages, which is confirmed by the positive impact of brand identity on the level of consumer loyalty. Gupta *et al.* (2020) express a similar opinion, who prove that effective brand management can improve not only the

company recognition, but also its financial performance. Zhang (2025) notes that the use of data-driven management models allows for more accurate marketing decisions and increases brand effectiveness.

Academic literature demonstrates that branding plays a central role in shaping the company's value for both consumers and investors. Rahman *et al.* (2021) notes the concept of "brand love" as one of the key aspects of long-term competitiveness, as it establishes an emotional connection between the consumer and the company. They prove that optimizing product policy can significantly increase the company's market position and contribute to the development of sustainable competitive advantage. On the other hand, Chi *et al.* (2024) point to the growing role of customer experience management in retail brand management.

Current marketing concepts also emphasize the significant role of strategic brand management in retail. The research by Musayeva *et al.* (2022) demonstrates that marketing approaches focused on building brand loyalty are key to the long-term success of retail businesses. Dal Mas *et al.* (2022) add that corporate social responsibility is becoming an important element of brand management, which significantly affects consumer trust.

The digitalization of marketing processes is an important direction in modern brand management. The study by Al Kurdi *et al.* (2022) showed that blockchain and smart contract technologies can significantly improve the level of consumer trust in brands, reducing the risks of counterfeiting and increasing transparency in retail. However, the implementation of digital technologies does not always provide the desired results. Qi *et al.* (2020) note that although digital marketing tools can significantly increase a company's competitiveness, they need to be adapted to the specifics of local markets. Varadarajan (2020) describe similar results, indicating that excessive dependence on digital technologies can create risks of losing brand authenticity and differentiation.

The relationship between brand and consumer behaviour is a key aspect of research. Choedon and Lee (2020) found that an active brand presence on social media positively impacts customer engagement. Tran *et al.* (2020) emphasize the importance of brand authenticity, as consumers prefer companies that demonstrate transparency and alignment with their values. Zhou *et al.* (2022) demonstrated that personalized recommendation systems affect brand competitiveness, especially in online retail. Yu *et al.* (2021) emphasize that social platforms create new opportunities for personalized interaction with consumers.

Brand management determines the retail companies' competitiveness, but approaches to its implementation vary depending on market conditions. Dembitska and Kudyarko (2024) reveal insufficient analysis of the adaptation of brand strategies in retail, which indicates methodological gaps. Maiboroda and Marchuk (2021) emphasize the need to revise brand strategies during periods of economic instability. Mostaghel *et al.* (2022) note that digital brand management can both strengthen and weaken market positions depending on its integration with traditional methods, which is also confirmed by Rodinova *et al.* (2024), who focused on adaptation to digital transformation, especially in countries with transitive economies. Another important aspect is the correlation between brand management and financial stability of companies. Paydas Turan (2021) investigates the effectiveness of co-branding, arguing that it can strengthen the companies' competitive position. At the same time, Sumets *et al.* (2022) developed a methodology for assessing the sustainability of companies that can be applied to the analysis of brand strategies.

So, the literature review demonstrates that brand management is a critically important factor that determines the retail companies' competitiveness. But there are still some gaps in the academic literature related to insufficient coverage of the specifics of brand management in retail, contradictory results on the effectiveness of digital branding, and the lack of a unified methodology for assessing the effectiveness of brand strategies. Further research should focus on analysing the adaptation of brand management to the conditions of global digital transformation and the integration of its strategies into international trading systems.

2. Methods

The research methodology is aimed at empirical assessment of the impact of brand management strategies on the retail companies' competitiveness in an international context. The research was conducted in several stages (Figure 1), which included the collection, processing, and analysis of data on the impact of brand management strategies on the retail companies' competitiveness in an international context. All calculations were performed in Microsoft Office Excel (version 2016). The research sample included 30 retail companies (10 from the USA, 10 from the EU, 10 from Ukraine), which are leaders in their regions by market share.

Figure 1. Research design

Source: developed by the author.

The sample was formed based on the following criteria: financial stability (income level and growth dynamics over the past 5 years), intensity of brand management use (active communication strategy and application of digital technologies), and industry specifics (representation in the e-commerce, fashion, food retail segments). The general population for the study is companies in the trade sector of countries with a high level of economic development and a structured market environment. Brand management directly affects competitiveness, so the sample included those companies that demonstrate significant influence in their sectors, taking into account the following conditions: 30 companies (the optimal number to ensure representativeness and in-depth analysis), the USA, the EU, and Ukraine (for comparing brand strategies in mature and transformational economies), three industries (for assessing the impact of brand management in different consumer segments). The comparability of operating conditions is ensured by selecting companies with a similar level of international activity, competitive environment, and application of digital strategies, which eliminates the influence of external factors on the analysis results. The research employed the following methods:

- Correlation analysis was used to identify and assess the relationship between key brand management parameters and competitiveness indicators of retail companies (in particular, profitability, market share, and customer loyalty level). Correlation coefficients were calculated in Microsoft Excel (version 2016) based on panel data for 2020–2024, which made it possible to establish the strength and direction of the influence of brand management strategies on the companies' performance. The dependence of operating profitability on the share of investment in brand management, as well as the dynamics of brand awareness and customer retention rate for 2020–2024, were also studied in order to assess the long-term impact of brand strategies on the companies' competitiveness.

- Benchmarking was used to compare the brand management strategies of the studied companies with leading market practices. At the same time, brand awareness indicators, the target audience coverage, as well as general approaches to promotion and positioning were taken into account. The obtained benchmarking results gave grounds to identify effective brand management tools and elements of communication strategies that have the greatest impact on strengthening competitive advantages;

- Dynamic (trend) analysis was used to study changes in the main brand management indicators over time. The dynamics of brand awareness and the level of consumer loyalty were assessed based on the statistics for 2020–2024. This approach made it possible to trace positive trends in the development of retail companies and to support the results of correlation analysis with a quantitative assessment of the long-term impact of brand strategy on competitiveness.

The main analytical tools used were Microsoft Office Excel (version 2016) for processing statistical data, calculating correlations, and analysing trends, as well as official data sources Statista, Euro-stat, European Commission and Ministry of Economy of Ukraine and scientific research of the authors, which are indicated in the list of sources used. Particular attention was paid to developments on the formation of competitive advantages through brand management, as well as practical recommendations and cases on the implementation of brand strategies in trading companies. The proposed approach to assessing the effectiveness of brand management

strategies provides sound results that can be used to develop practical recommendations on increasing the trading companies' competitiveness.

3. Results

The results of the study revealed common features of brand management strategies based on emotional engagement and creating long-term competitive advantages. However, the mechanisms for their implementation differ significantly depending on the level of digitalization of markets. Personalized marketing and interactive communication technologies dominate in developed countries (USA, EU), while a traditional approach focused on strengthening customer relationships prevails in less digitalized markets. Ukrainian companies demonstrate a mixed strategy, which indicates a gradual adaptation to integrated digital solutions in brand management.

The impact of brand management strategies on the retail companies' competitiveness was analysed by studying 30 companies from different regions of the world, which have high market positions and actively use brand management tools. Table 1 presents the general characteristics of the research sample. The obtained indicators show that the studied US companies demonstrate a relatively higher level of market share and implementation of innovative branding tools, while the sample from Ukraine has lower indicators of the use of AI technologies in marketing, which potentially affects their competitiveness. At the same time, European companies are distinguished by a relatively high share of online sales and positive dynamics of revenue growth. The data show a potential connection between the active use of digital brand management strategies and competitiveness in the global market.

Table 1. Characteristics of the study sample

Region	Number of companies	Average market share (%)	Average revenue growth (2020-2024), %	Share of online sales (%)	Use of AI in marketing (%)
EU	10	12.3	8.5	45.2	67
USA	10	14.8	7.9	51.7	72
Ukraine	10	6.7	5.1	32.4	48
Average	**30**	**11.3**	**7.2**	**43.1**	**62.3**

Source: created on the basis of Statista (2024), Eurostat (2024), Ministry of Economy of Ukraine (2024).

The impact of digital brand management tools on market position was assessed by using input data on online sales, the level of activity in social media, and brand recognition in the online environment. The results of the analysis confirmed a significant improvement in market performance for companies that use digital promotion channels and personalized marketing tools. In particular, an increase in market share was found for companies that actively used the so-called "digital-first" strategies, compared to competitors that focus mainly on offline communications. The advantage of digital strategies is clearly recorded in consumer loyalty indicators, as companies that actively use elements of interactive services and consumer data analytics demonstrate an increase in repeat purchases and average check.

The relationship between the intensity of brand management and the main indicators of competitiveness was determined through correlation analysis. The companies' competitiveness was assessed using two groups of indicators: financial and market metrics (revenue growth rates - %, market share - %, and operating profitability - operating profit as a percentage of revenue); marketing indicators (customer loyalty - Customer Retention Rate, and average revenue per customer - Customer Lifetime Value, CLV). Each pair of variables (for example, Brand Awareness and Revenue Growth Rates) was considered separately for 30 companies for 2020–2024. As the data were panel (several years of observation for each company), the final coefficient values are weighted averages. The correlation matrix in Table 2 demonstrates the relationships between the main variables of the study.

Table 2. Correlation matrix between brand management and competitiveness indicators

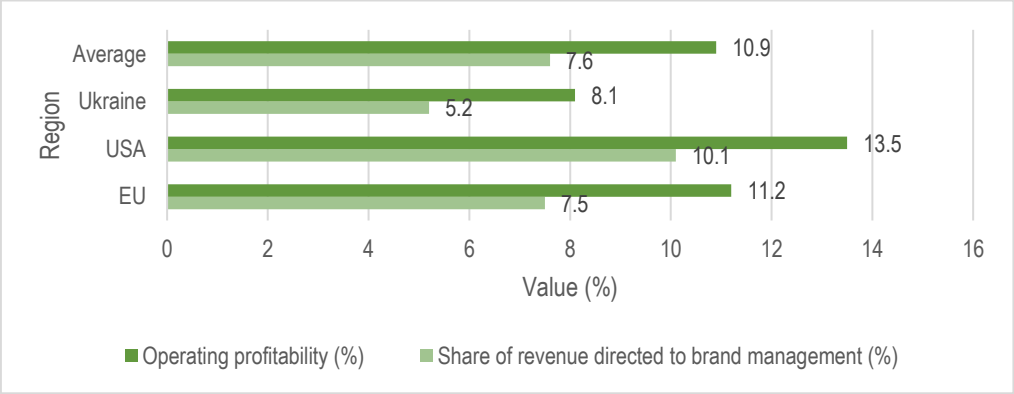
Parameter	Revenue Growth Rate	Market Share	Profitability	Customer Loyalty	CLV
Brand Awareness	0.74	0.79	0.71	0.83	0.78
Brand management costs	0.82	0.73	0.75	0.8	0.76
Digital channel usage intensity	0.77	0.69	0.7	0.79	0.82

Source: created on the basis of systematized data from Statista (2024), European Commission (2024), Eurostat (2024), Ministry of Economy of Ukraine (2024) with the values of the Pearson correlation coefficient displayed.

The analysis of relationships confirms a significant correlation between investment in brand management and financial and market indicators (r = 0.82 for revenue growth rates and r = 0.75 for profitability). High values of correlation coefficients between brand awareness and customer loyalty (r = 0.83) indicate that shaping of a clear and attractive brand directly affects the company's ability to retain consumers. Furthermore, a strong relationship was found between the digital channel usage intensity and CLV (r = 0.82), which reflects the importance of personalized and interactive communication with customers.

Analysis of the relationship between investment in brand management and operating profitability of companies assesses the effectiveness of strategic marketing decisions. Figure 2 shows that companies that allocate more than 7.5% of revenue to brand development demonstrate higher profitability, with the best indicators recorded in the USA (13.5%). This confirms that active investment in brand management has a positive impact on business profitability. Figure 2 illustrates that a higher level of investment in brand management (USA – 10.1%) correlates with higher profitability (13.5%), while lower investment (Ukraine – 5.2%) correspond to lower profitability (8.1%).

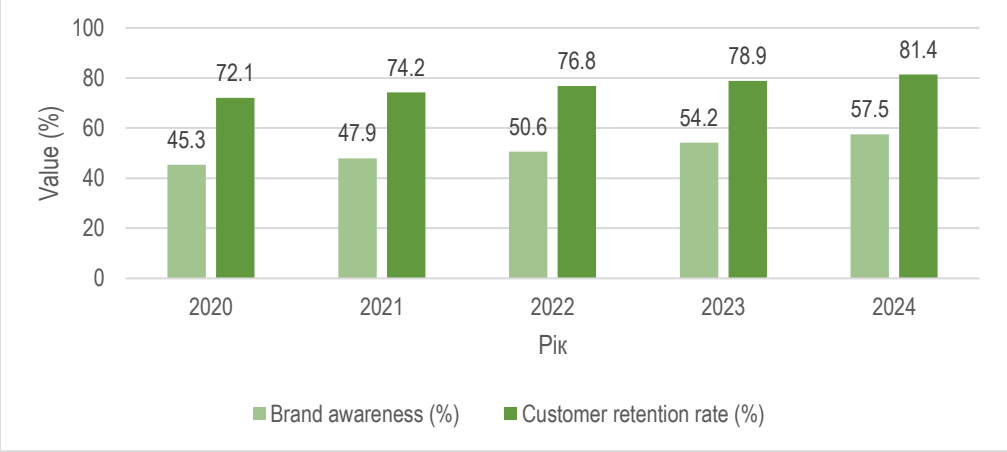
Figure 2. The impact of investment in brand management on the companies' profitability (2020–2024)



Source: created on the basis of Statista (2024), Eurostat (2024), European Commission (2024), Ministry of Economy of Ukraine (2024).

Studying the dynamics of brand awareness and customer retention makes it possible to assess the long-term effect of brand management on the company's sustainability in the market. Figure 3 shows that both indicators have grown steadily from 2020 to 2024, confirming the effectiveness of comprehensive marketing strategies. The most significant increase (+12.2% in brand awareness and +9.3% in customer retention) indicates the importance of personalized marketing and digital communications.

Figure 3. Dynamics of brand awareness and customer retention (2020–2024)

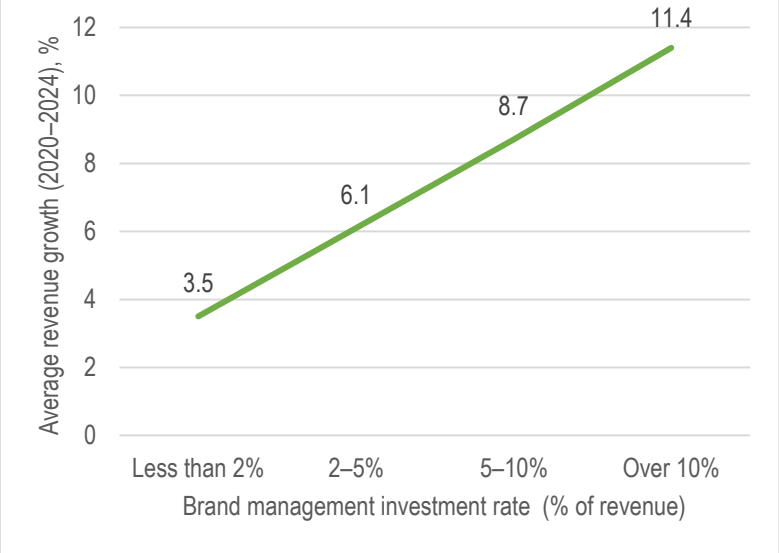


Source: created on the basis of Statista (2024), Eurostat (2024), European Commission (2024).

The effectiveness of brand management in the long run was assessed by analysing the dynamics of companies' revenues depending on the volume of their investment in brand strategy. The study took into account indicators from the annual reports of leading retail companies, as well as open statistics published in Statista (2024), Eurostat (2024), and the Ministry of Economy of Ukraine (2024). All quantitative values were combined

into a single database and processed in Microsoft Office Excel. Figure 4 shows the summarized results, reflecting the average revenue growth rates for 2020–2024 depending on the share of investment in brand management. The data indicate that the highest revenue growth rate (11.4% over 5 years) was recorded among companies that direct more than 10% of total revenue to brand strategy. So, high activity in the field of brand management correlates with better financial results and can be considered a significant factor in increasing competitiveness.

Figure 4. The relationship between the brand management investment rate and revenue growth



Source: created on the basis of Statista (2024), European Commission (2024), Eurostat (2024), Ministry of Economy of Ukraine (2024).

The obtained results give grounds to provide recommendations for increasing the retail companies' competitiveness by improving brand strategies. Optimization of digital communications costs is a key factor in modern brand management. A significant correlation between brand strategy costs and the growth of financial indicators confirms the feasibility of expanding investment in digital channels of interaction, especially for companies that focused mainly on traditional marketing.

Personalization of marketing communications contributes to increased customer engagement and long-term loyalty. The high level of correlation between the use of digital technologies and CLV indicates the need for detailed consumer segmentation. The use of big data analysis technologies and AI makes it possible to create personalized offers, which increases the effectiveness of communications and average revenue per customer.

Strengthening brand identity is important for growing competitive positions. The correlation between brand awareness, market share, and customer loyalty emphasizes the need to create a consistent visual and communication image of the brand. Integration of offline and online channels helps to build trust with the target audience.

Regular assessment of the effectiveness of the brand strategy enables adjusting marketing decisions in accordance with changes in consumer behaviour and the competitive environment. The development of a system of key performance indicators will contribute to more accurate monitoring of the impact of brand activities on financial indicators.

So, the results of the study confirm that the integration of digital technologies into brand management significantly increases the competitiveness of retail companies. Personalization of marketing activities and the use of modern information tools can significantly strengthen the market positions of companies and ensure their long-term profitability.

4. Discussion

The obtained results confirmed the research hypothesis that brand management strategy is a key factor in increasing the retail companies' competitiveness. Our study found that companies that invested more than 10% of their revenues in brand management demonstrated an average revenue growth of 11.4% over five years, which is consistent with the findings of Chen *et al.* (2021) and Fayvishenko *et al.* (2023).

Comparison with previous studies confirms the general trends in the relationship between brand management and competitiveness. Correlation analysis showed that the intensity of brand management is

directly related to profitability (r = 0.75) and customer loyalty (r = 0.83). Marques *et al.* (2020) and Gupta *et al.* (2020) also indicate a close relationship between brand strategies and market performance of companies.

However, there are also some differences in the impact of brand management on companies in different regions. For example, the study by Lelyk *et al.* (2022) shows that brand management has a smaller impact on competitiveness in countries with transition economies because of limited company resources. Our results partially confirm this: Ukrainian companies that had a lower level of AI use in branding (48%) showed slower revenue growth (5.1%) compared to European (8.5%) and American (7.9%) ones.

Another contradiction is found in comparison with the study by Mostaghel *et al.* (2022), where the authors note that digital brand management does not always guarantee the stability of the company's business model. In contrast, our study recorded a high correlation between digital strategies and CLV (r = 0.82), which indicates a positive impact of personalized marketing.

The practical significance of the results gives grounds to provide recommendations for retail businesses. First, an active digital presence on social media is critical for brand identity, as confirmed by the findings of Choedon and Lee (2020). Second, it is necessary to implement personalized marketing strategies, as Yu *et al.* (2021) proved that such measures increase customer trust. It is also appropriate to combine traditional brand management with digital tools for businesses to adapt to changes in consumer preferences.

However, our study has certain limitations. In particular, the analysis was conducted on the basis of a sample of 30 businesses, which limits the possibility of generalizing the findings. The study covered mainly large companies, which may not reflect the situation for small businesses. Further research can be aimed at expanding the sample and analysing the impact of brand management strategies in small and medium-sized businesses. So, the results confirm that effective brand management is a key factor in increasing the retail companies' competitiveness, especially in the context of digital market transformation.

Conclusions

The studied issue is relevant as the increased competition in the market of goods and services encourages retail companies to look for new approaches to shaping a positive image and increasing consumer loyalty. In this context, the brand management strategy is a determining factor in ensuring the recognition and attractiveness of a retail brand, which directly affects the competitiveness and sustainable growth of companies in a dynamic market environment.

The analysis showed that the purposeful development of a brand strategy has a positive effect on increasing market share and increasing sales. The use of an integrated approach to brand management contributes to the differentiation of the offer, the formation of a value proposition for consumers, and the strengthening of competitive advantages. The results also indicate that the use of integrated marketing tools (advertising campaigns, awareness-raising activities, digital communications) ensures the establishment of a stable emotional connection with consumers and long-term commitment to the brand.

The academic novelty lies in the identification of key elements of an effective brand strategy that directly affect the competitiveness of retail enterprises. The practical value of the study is the possibility of using the obtained results to develop comprehensive brand management programmes that will enable retail companies to adapt to the current market challenges and ensure sustainable development. It is appropriate to apply the developed recommendations in the field of marketing communications, strategic management, as well as in the corporate culture and customer service quality management.

Research prospects include further expanding of methodological approaches to the analysis and measurement of the impact of brand strategy on the financial performance of retail companies. The relationship between internal branding, staff motivation and the overall level of competitiveness also requires deeper empirical study.

Credit Authorship Contribution Statement

The authors contributed equally to this research.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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The Impact of Sovereign Wealth Fund Acquisitions on Corporate Performance and Value. A Comparative Study in the Madrid and Saudi Stock Exchanges

Basim Khaleel Saadon SAADON
Faculty of Economics and Business
Universidade da Coruña, Spain
Corresponding email: b.saadon@udc.es

Fernando de LLANO PAZ
Faculty of Economics and Business
Universidade da Coruña, Spain
fdellano@udc.es

Paulino MARTÍNEZ FERNÁNDEZ
Faculty of Economics and Business
Universidade da Coruña, Spain
paulino.martinez@udc.es

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Abstract: This study investigates the influence of sovereign wealth fund (SWF) investments on the financial performance of firms in Saudi Arabia and Spain. Findings indicate that SWF investments exert a notable influence on average share prices, accounting for a considerable portion of the variation in stock values across both countries. Conversely, no significant relationship was found between SWF investments and other financial indicators such as return on investment, liquidity ratio, financial leverage, and profitability ratio.

The analysis underscores the relevance of a firm's national context when assessing the implications of SWF activity, as such investments may alter ownership structures and strategic directions. Additionally, the study emphasizes that SWF decisions are closely linked to broader economic and political developments, necessitating continuous monitoring and contextual evaluation.

To explore these dynamics, the research utilized statistical tools such as regression models and coefficients of determination, enabling a clear measurement of the investments' effects on financial indicators.

The study concludes with several recommendations: further investigation into other variables influencing financial performance, stronger collaboration with SWFs as part of strategic investment planning, and improved transparency through consistent financial disclosure. Moreover, longitudinal and cross-sectoral comparative research is encouraged to deepen the understanding of SWF impacts globally.

Keywords: corporate performance; sovereign wealth fund acquisitions; corporate value Madrid Stock Exchange; comparative financial analysis Saudi Stock Exchange.

JEL Classification: G34; G15; L25; H54; P51; C10.

1. Background

This chapter offers an in-depth exploration of the relationship between sovereign wealth funds (SWFs) and firm value, drawing on established models and prior empirical research. It sheds light on how SWFs influence both firm valuation and financial performance, underlining the importance of understanding these dynamics in light of evolving global economic conditions.

The chapter seeks to contribute both theoretically and practically, encouraging further inquiry into this increasingly relevant domain.

Sovereign wealth funds are state-owned investment vehicles designed to generate long-term returns, support national economic goals, and foster diversification (Ang *et al.* 2009; IWG-SWF 2020; Morau and Aligishiev 2024). The link between SWFs and firm value is assessed through various lenses, including strategic

objectives, sectoral focus, and macroeconomic and political environments (Kotter and Lel 2011). Core goals of SWFs include maintaining sustainable financial yields, enhancing domestic economic development, and aligning with broader social and environmental standards (Cuervo-Cazurra *et al.* 2023; Bahoo *et al.* 2019). In this line, Habermann and Steindl (2025) confirm the power that have the sovereign funds in Europe to influence in the application of strategies of sustainability by part of the companies participated by the fund. Nevertheless, these funds must navigate substantial challenges, such as market volatility and global uncertainty, which demand advanced investment frameworks (Godsell, 2022). In a recent study, Megginson *et al.* (2025) argue that it would not be suitable create an American sovereign fund due to the markets of capitals are being efficient, ther is not a favourable political climate due to existent divisions and would be fiscally imprudent by the high debt that keeps the country together with the restrictions of budgetary character.

Economic and political contexts - both domestic and international - play a pivotal role in shaping SWF investment behavior (Bortolotti *et al.* 2010; Yu *et al.* 2021). Market dynamics, exchange rate fluctuations, and shifts in economic policy are among the primary drivers (Young, 2020). Political developments - ranging from new regulatory frameworks to geopolitical tensions - can amplify risk and necessitate strategic realignment (Gelb *et al.* 2014; Billio *et al.* 2021).

Likewise, macroeconomic indicators such as GDP growth, inflation levels, and employment trends significantly affect investment trajectories. SWFs tend to favor sectors demonstrating rapid growth in developing markets or long-term stability in more mature economies (Knill *et al.* 2012; Starks, 2023). Understanding these interrelated factors calls for ongoing assessment and nuanced analysis.

Sovereign wealth funds (SWFs) often prioritize investments in sectors such as energy, manufacturing, infrastructure, healthcare, and technology. Recently, they have also shown growing interest in emerging industries like biotechnology, renewable energy, and digital innovation (Megginson *et al.* 2015; Kartal, 2020). In fact, Moreau and Aligishiev (2024) analyse the sovereign fund of Saudi Arabia (Public Investment Fund, PFI) like a key instrument to attain the diversification of the investment further of the traditional energetic exports and going in in sectors like digital services and sport. These preferences are shaped by global economic growth projections, market demand, tech advancement, and regulatory directions (Kartal, 2020 and KPMG, 2020).

One of the main challenges SWFs faces is market instability, which tends to increase during periods of economic and political uncertainty (Wojcik, 2018; Hübel, 2022). Geopolitical issues - like rising tensions or armed conflicts - can trigger sudden drops in asset value and increased risk exposure. Also, regulatory frameworks - both domestic and international - complicate investment procedures and drive-up compliance costs (Hübel, 2022). Hasse *et al.* (2024) show empirically that the sovereign funds could reduce the apparition of monetary crises, by what conclude that the policymakers could develope the potential of the sovereign funds to manage foreign exchange risks.

Despite the risks, SWFs continue to identify valuable opportunities in high-tech sectors, clean energy, and infrastructure projects (Erkmen *et al.* 2020; Hsu *et al.* 2021). Innovations in robotics, additive manufacturing (like 3D printing), and gene therapies are viewed as promising avenues that not only deliver financial returns but also support broader developmental goals (Ward *et al.* 2022; Dimitropoulos *et al.* 2020).

Various researchers have assessed the implications of SWF involvement on corporate performance, mainly focusing on aspects like profitability, ROI, revenue expansion, and capital structure (Young, 2020). For instance, Bahoo (2020) highlighted significant connections between SWF funding and changes in stock price and market value. Similarly, Dewenter *et al.* (2010) found that firms tend to experience an uptick in value right after SWF investment announcements, suggesting a strong positive market signal associated with such investments.

Kartal (2020) explored how sovereign wealth fund (SWF) investments influence a firm's capital structure and dividend policies, reporting notable shifts in both ownership distribution and strategic direction following investment. In a related study Hübel (2022) focused on corporate ownership changes, concluding that SWF participation can impact the performance not only of recipient firms, but also of firms outside the investment scope. By comparing companies backed by SWFs to those without such support, Hübel (2022) and Sias *et al.* (2001) identified clear performance gaps - reinforcing the idea that SWF involvement plays a decisive role in shaping corporate outcomes.

Further, Erkmen *et al.* (2020) assessed how SWF investment affects stock price behavior and market volatility. Their findings suggest that such interventions often lead to increased fluctuations in both pricing and trading volume, potentially disturbing market equilibrium and altering investor sentiment. On another front, Cuervo-Cazurra *et al.* (2023) looked into the implications of SWF stakes on internal corporate policies and strategic outlooks. Their analysis revealed that SWFs can significantly shape firms' future directions - modifying

growth trajectories, investment preferences, and even ownership frameworks - which in turn influences competitiveness and overall firm performance.

Taken together, these studies offer valuable insight into how sovereign wealth funds act as powerful financial and strategic actors in global markets, reshaping not just the companies they invest in, but also the broader investment landscape.

This study contributes meaningfully by offering a cross-market evaluation of the effects of sovereign wealth fund (SWF) acquisitions on firm performance and value, focusing specifically on two contrasting financial ecosystems: the Madrid Stock Exchange and the Saudi Stock Exchange. Through this comparative lens, the research brings forward several contributions:

- Contextual Insight: It deepens the understanding of how SWF participation affects firm-level financial indicators and shareholder interests across distinct regulatory and economic environments.
- Strategic Value for Investors: The findings may assist institutional and private investors in assessing how SWF-backed firms perform in markets with different risk profiles and governance norms.
- Guidance for Policymakers: It provides practical takeaways for regulators and public sector actors seeking to evaluate or encourage SWF activity within their jurisdictions, while remaining mindful of potential structural and strategic trade-offs.
- Bridging a Research Gap: By comparing developed and emerging market responses to SWF involvement, the study addresses a notable gap in the literature that has largely treated these markets separately or in isolation.

Overall, this study adds both empirical depth and practical relevance to ongoing debates around sovereign wealth strategies and their broader implications for corporate governance and market performance.

2. Methodology

This study aims to explore the influence of sovereign wealth fund (SWF) acquisitions on firm value and financial performance across international markets. Particular emphasis is placed on understanding how the nationality and type of company mediate this relationship. The research also seeks to generate practical recommendations to strengthen the linkage between SWF investments and firm outcomes. Furthermore, it intends to add new perspectives to the ongoing discourse on the strategic role of SWFs in shaping corporate value and financial dynamics.

To address these goals, the study puts forward the following hypotheses:

1.There is a positive association between sovereign wealth fund (SWF) investments and corporate financial performance, as measured by return on assets (ROA), liquidity ratios, financial leverage, and profit margins.

2.There is a positive relationship between SWF investments and firm value, represented by stock price levels.

3.The company's nationality moderates the relationship between SWF investments and both financial performance and firm value.

Based on the study's objectives, the following research questions are posed:

- To what extent do sovereign wealth fund (SWF) investments influence a company's financial performance?
- Does the nationality of the company play a moderating role in the relationship between SWF investments and financial performance?
- How do SWF investments impact a company's market value?

2.1. Research Population and Sample

The research population encompasses firms listed on both the Madrid Stock Exchange and the Saudi Stock Exchange (Tadawul) that have received equity investments from global sovereign wealth funds (SWFs). The study focuses on evaluating the changes in financial performance indicators before and after these investments.

The Madrid Stock Exchange, founded in 1831 and headquartered in Spain's capital, is a major European financial center. It accommodates a broad mix of domestic and international companies and plays a central role in supporting Spain's capital markets and economic development.

The Saudi Stock Exchange (Tadawul), established in 2007, is the leading securities market in Saudi Arabia and the largest in the Middle East. It hosts a diverse portfolio of Saudi-listed firms and serves as a key channel for both domestic and foreign investments, reflecting the country's economic dynamism and reform-oriented agenda.

The research sample includes twenty companies, evenly split between the two stock exchanges. These firms represent various economic sectors and were selected based on their receipt of SWF investments ranging from 3% to 17% of equity shares during the period from 2008 to 2019. Further details, including company names and sectoral classifications, are provided in Appendix 1.

2.2 Method and Data Handling

To explore how sovereign wealth fund (SWF) acquisitions interact with corporate value, this study employs an integrated methodology that leans heavily on both numerical assessment and interpretive context. Rather than relying on a single analytical lens, the research draws from a combination of statistical techniques and cross-period comparisons to ensure that observed outcomes are both consistent and contextually meaningful.

Data collection centers on financial reports from selected firms, covering a time window before and after SWF engagement. Key indicators such as profitability margins, liquidity strength, debt reliance, and capital efficiency are extracted and analyzed.

The study utilizes:

- Descriptive statistics (mean values) to track overall shifts in performance,
- Standard deviation to capture variability across firms,
- Paired sample t-tests to test statistical significance in the pre- and post-investment phases, and
- Regression modeling to estimate the weight and direction of SWF influence on performance metrics.

Rather than isolating metrics in a vacuum, the study contextualizes them within broader strategic movements in both market environments, allowing for a more grounded interpretation of how and where SWF capital leaves a measurable footprint.

The financial records used in this analysis were obtained from verified public databases and company disclosures. These records included a range of financial indicators and average share prices for the selected firms listed on the Madrid Stock Exchange, covering a span of six years - three years prior to and three years following SWF acquisition.

To streamline the analysis, the data were filtered and structured to capture trends in performance over time. Appendix 2 provides a full breakdown of the core financial ratios for each company across this six-year period. As part of the preliminary phase, average values were computed for the indicators both before and after the acquisition events. These averages formed the basis for evaluating whether meaningful changes occurred.

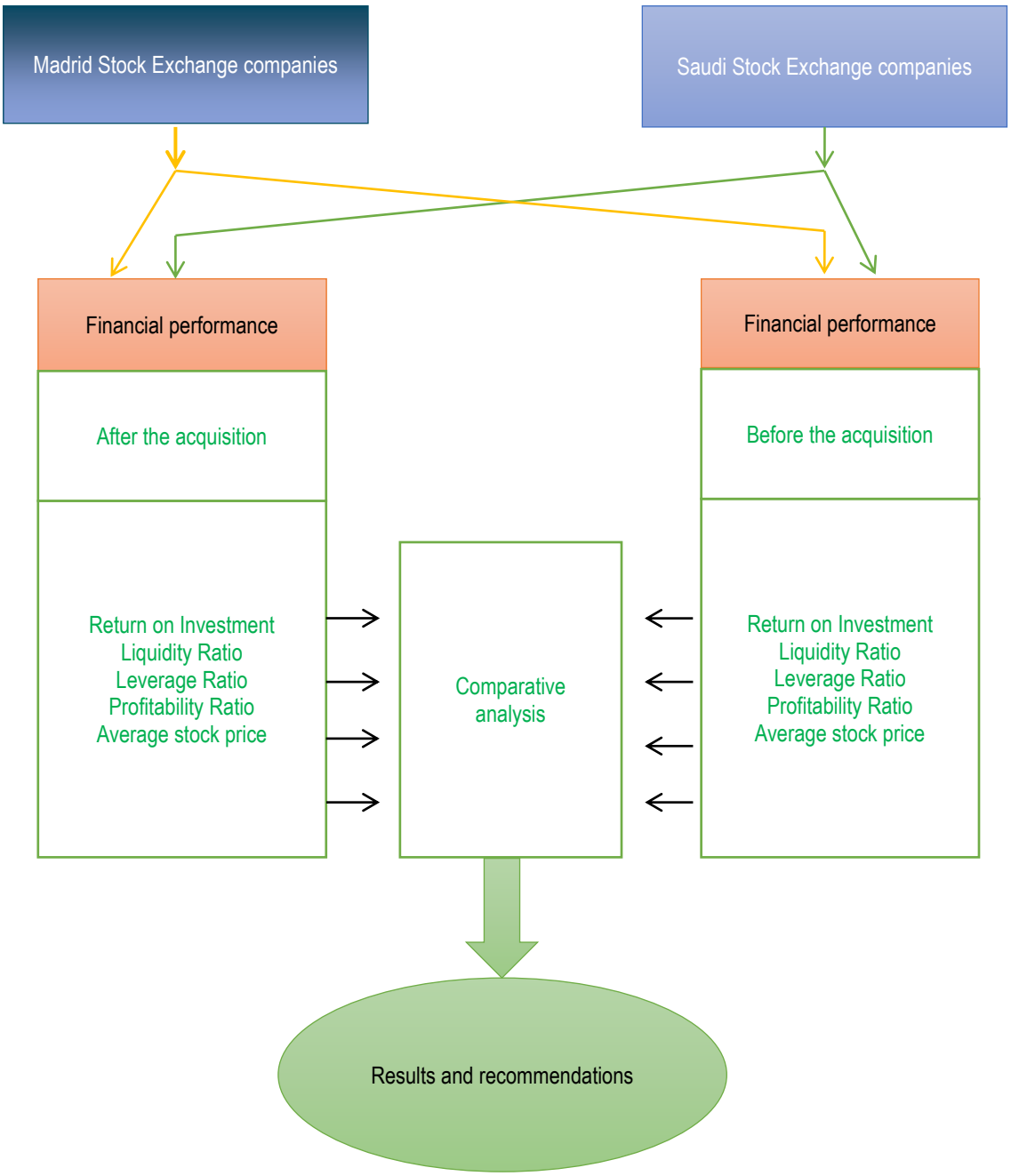
The differences in pre- and post-acquisition performance were then calculated and summarized to enable statistical testing. Appendix 3 contains the comparative mean scores for each of the key financial metrics, offering a condensed view of how firm-level indicators shifted in response to sovereign wealth fund activity.

2.3 Research Model

The research model is a fundamental tool for organizing the study and identifying the variables and their relationships in a systematic and logical manner. It helps guide the researcher and clearly explain the research concept. Below is the research model.

1. Independent Variables:
   - Sovereign Wealth Fund (SWF) Investments
2. Dependent Variables:
   - Financial Performance (measured by return on assets, liquidity ratio, financial leverage, profit margin)
   - Firm Value (measured by stock price)
3. Moderating Variables:
   - Nationality of the Company
4. Hypothesized Relationships:
   - Positive relationship between SWF investments and financial performance.
   - Positive relationship between SWF investments and firm value.
   - Influence of company nationality on the relationship between SWF investments and both financial performance and firm value. This model provides a structured framework for the study, facilitating a clear understanding of the research objectives and the relationships being investigated.

Figure 1. The research model



Source: the figure prepared by the author

3. Results

3.1. Results of the Paired T-Test for Financial Performance Indicators

3.1.1. For Saudi Companies (Y1)

The financial performance indicators include the following ratios: Return on Investment (Y1.1); Liquidity Ratio (Y1.2); Financial Leverage (Y1.3); Profitability Ratio (Y1.4);Average Stock Price (Y1.5). The time series spans 6 years, divided into three years before and three years after the sovereign wealth fund investments. The following table summarizes the results of these tests. The table below is the results of the paired T-test for the financial performance indicators.

Table 1. Paired T-test for financial performance indicators for Saudi companies:

Variable	Mean Before Investment	Standard Deviation Before Investment	Mean After Investment	Standard Deviation After Investment	t-value	Sig.
$_{1.1}$Y	18.83	2.8028	20.05	4.121	1.273-	0.235
$_{1.2}$Y	1.839	3814	1.494	0.03718	52.748	0
$_{1.3}$Y	0.714	0.0397	0.642	0.1089	3.179	0.011
$_{1.4}$Y	17.593	2.9827	18.527	4.0938	1.06-	0.317
1.5Y	48.486	56.6036	47.716	34.6037	0.088	0.932

Source: the table prepared by the author based on analyses results

Based on the data presented above, the results can be summarized as follows:

- Return on Investment (Y1.1): Increased from 18.83 (SD = 2.80) to 20.05 (SD = 4.12) after the investment, but the slight increase was not statistically significant (T = -1.273, Sig. = 0.235).
- Liquidity Ratio (Y1.2): Decreased from 1.83 (SD = 0.038) to 1.49 (SD = 0.037) after the investment, with a significant decrease (T = 52.748, Sig. = 0.000).
- Financial Leverage (Y1.3): Decreased from 0.7140 (SD = 0.0397) to 0.6420 (SD = 0.1089) after the investment, with a statistically significant decrease (T = 3.179, Sig. = 0.011).
- Profitability Ratio (Y1.4): Increased from 17.593 (SD = 2.982) to 18.527 (SD = 4.093) after the investment, but the slight increase was not statistically significant (T = -1.060, Sig. = 0.317).
- Average Stock Price (Y1.5): Decreased from 48.486 (SD = 56.603) to 47.716 (SD = 34.603) after the investment, with no statistically significant change (T = 0.088, Sig. = 0.932).

The results indicate significant decreases in the liquidity ratio and financial leverage after the investment, while no statistically significant changes were observed in the return on investment, profitability ratio, and average stock price.

3.1.2. For Spanish Companies (Y2)

The financial performance indicators include the following ratios: Return on Investment (Y2.1); Liquidity Ratio (Y2.2); Financial Leverage (Y2.3); Profitability Ratio (Y2.4); Average Stock Price (Y2.5). The following table summarizes the results of the paired T-test for the financial performance indicators.

Table 2. Paired T-test for financial performance indicators in Spanish companies

Variable	Mean Before Investment	Standard Deviation Before Investment	Mean After Investment	Standard Deviation After Investment	t-value	Sig.
Y2.1	14.105	0.8037	13.678	2.4766	0.465	0.653
Y2.2	1.75	0.0577	1.653	0.2724	1.06	0.317
Y2.3	0.8	0.0362	0.899	0.0877	-3.681	0.005
Y2.4	11.33	0.5349	10.759	2.6892	0.599	0.564
Y2.5	15.159	19.8267	18.543	26.318	-1.269	0.236

Source: the table prepared by the author based on analyses results

Based on the data presented in the table above, the following observations can be made:

- Y2.1 (Return on Investment): The mean decreased from 14.105 to 13.678, while the standard deviation increased from 0.8037 to 2.4766 after the investment. However, this change was not statistically significant (t = 0.465, p = 0.653).
- Y2.2 (Liquidity Ratio): Before the investment, the mean was 1.75 with a standard deviation of 0.0577. After the investment, the mean decreased to 1.653 with a slightly higher standard deviation of 0.2724. This change was not statistically significant (t = 1.06, p = 0.317).
- Y2.3 (Financial Leverage): There was a statistically significant decrease in the mean financial leverage from 0.8 to 0.899 (t = -3.681, p = 0.005). The standard deviation slightly increased from 0.0362 to 0.0877 after the investment.
- Y2.4 (Profitability Ratio): The mean decreased from 11.33 to 10.759, and the standard deviation increased from 0.5349 to 2.6892. However, this change was not statistically significant (t = 0.599, p = 0.564).

- Y2.5 (Average Stock Price): Although the mean stock price increased from 15.159 to 18.543 after the investment, and the standard deviation increased from 19.8267 to 26.318, the change was not statistically significant (t = -1.269, p = 0.236).

Overall, while there were some changes in the means and standard deviations of the financial performance indicators after the sovereign wealth fund investments, most of these changes were not statistically significant. However, there was a significant decrease in the financial leverage ratio after the investment.

Since most of the observed differences (increases or decreases) in the dependent variables were not statistically significant for both Saudi and Spanish companies, it is likely that these changes occurred due to administrative actions. To further understand these changes and their relationship with the independent variable (sovereign wealth fund investments), future regression analyses will be conducted.

3.2. Regression Analysis and Hypothesis Testing

3.2.1. For Saudi Companies

The researcher used a regression model to evaluate the impact of sovereign wealth fund (SWF) investments on the financial performance indicators of Saudi companies, with a significance level set at 0.05. The table below details the tests, categorized by financial indicators.

Table 3. Details of the tests, categorized by financial indicators.

Independent Variable	Return on Investment			Liquidity ratio			Financial Leverage			Profitability Ratio		
	B	t. test	.Sig	B	t. test	.Sig	B	t. test	.Sig	B	t. test	.Sig
Regression Constant	0.242	3.792	0.005	1.156-	1.185-	0.27	0.944	1.325	0.27	0.213	2.195	0.059
Sovereign Fund Investment	-.587	1.21-	0.261	11.587	1.564	0.156	5.435-	1.006-	0.156	0.413-	0.562-	0.59
Details												
Correlation Coefficient (R)	0.393			0.484			0.335			0.195		
Coefficient of Determination (R^2)	0.155			0.234			0.112			0.038		
Calculated F Value	1.465			2.446			1.011			0.315		
Degrees of Freedom	9			9			9			9		
Sig. Level			0.261			0.156			0.344			0.59

Source: the table prepared by the author based on analyses results

Based on the results from the table above, the following observations can be made:

A. Return on Investment (Y1.1) for Saudi Companies:

- The coefficient of determination (R^2) is 0.155, indicating that SWF investments explain only 15% of the variance in return on investment.
- The correlation coefficient (R) is 0.393, indicating a weak correlation.
- The t-test showed a value of -1.210 with a significance level of 0.261, which is not statistically significant.
- The regression coefficient of -0.587 indicates a non-significant negative effect, suggesting that SWF investments do not significantly impact the return on investment for Saudi companies.

B. Liquidity Ratio:

- The coefficient of determination (R^2) is 0.234, indicating that SWF investments explain 23.4% of the change in the liquidity ratio.
- The correlation coefficient (R) is 0.484, indicating a significant positive correlation.
- However, the calculated t-value is 1.564 with a significance level of 0.156, indicating no statistical significance.
- The regression model, with a coefficient of 11.58, shows no significant effect of SWF investments on the liquidity ratio.

C. Financial Leverage:

- The coefficient of determination (R^2) is 0.112, indicating that the independent variable explains 11.2% of the variance in the dependent variable.
- The correlation coefficient (R) is 0.335, indicating a significant positive correlation at the 0.05 significance level between SWF investments and financial leverage.

- The calculated t-value is 1.006 with a significance level of 0.344, indicating partial non-significance of the model.

- The regression coefficient (-5.435) is negative but not significant. Thus, the regression model can be derived as follows: Y1.3 = 0.944 - 5.435. Therefore, there is no significant effect between SWF investments and financial leverage.

D. Profitability Ratio:

- The coefficient of determination (R^2) is 0.038, indicating that the independent variable explains 3.8% of the variance in the dependent variable.

- The correlation coefficient (R) between the independent variable and the profitability ratio is 0.195, indicating a non-significant correlation at the 0.05 significance level. This means there is a weak positive correlation between SWF investments and the profitability ratio.

- The calculated t-value of -0.562 at a significance level of 0.590 indicates partial non-significance of the model.

- The effect of SWF investments on the profitability ratio, represented by the regression coefficient (-0.413), is negative but not significant. Thus, the regression model can be expressed as follows: Profitability Ratio (Y1.4) = 0.213 - 0.413. The regression analysis and the derived model for the effect of SWF investments indicate non-significance at the 0.590 significance level, which is higher than the 0.05 threshold. Therefore, there is no significant impact of SWF investments on the profitability ratio.

3.2.2. For Spanish Companies

A regression model was also used for the Spanish companies. The table below details the tests, categorized by financial indicators.

Table 4. Details of the tests, categorized by financial indicators.

Independent Variable	Return on Investment			liquidity ratio			Financial Leverage			Profitability Ratio		
	B	t. test	.Sig	B	t. test	.Sig	B	t. test	.Sig	B	t. test	.Sig
Regression Constant	0.203	5.785	0	0.198	5.317	0.001	0.136	1.645	0.139	0.178	2.66	0.029
Sovereign Fund Investment	0.043-	0.164-	0.874	0.326-	1.152-	0.283	0.136	0.242	0.815	0.543	1.068	0.317
Details							0.136					
Correlation Coefficient (R)	0.058			0.377			0.136			0.353		
Coefficient of Determination (R^2)	0.003			0.142			0.136			0.125		
Calculated F Value	0.027			1.326			0.136			1.14		
Degrees of Freedom	9			9			9			9		
Sig. Level			0.874			0.283	0.136		0.815			0.317

Source: the table prepared by the author based on analyses results
Note: All tables in the research were prepared by the researcher based on the outputs of the SPSS program.

The results above indicate the following:

A. Return on Investment (ROI):

- Coefficient of Determination (R^2): The R^2 is very low at 0.003, indicating that only 0.3% of the variance in ROI can be explained by SWF investments.

- Correlation Coefficient (R): The R is 0.058, indicating a very weak positive correlation between SWF investments and ROI.

- t-Test:** The t-value for SWF investments is -0.164, with a p-value (Sig.) of 0.874, which is much higher than the significance level of 0.05. This indicates that the relationship between SWF investments and ROI is not statistically significant.

- Regression Equation:The regression equation is as follows: ROI = 0.203 - 0.043 (SWF investments). Overall, these results suggest no significant relationship between SWF investments and ROI for Spanish companies.

B. Liquidity Ratio:

- Coefficient of Determination (R^2): The R^2 is 0.142, indicating that approximately 14.2% of the variance in the liquidity ratio can be explained by SWF investments.

- Correlation Coefficient (R): The R is 0.377, indicating a moderate positive correlation between SWF investments and the liquidity ratio.

- t-Test:The t-value for SWF investments is -1.152, with a corresponding p-value of 0.283. Since the p-value is greater than the significance level of 0.05, the relationship between SWF investments and the liquidity ratio is not statistically significant. Therefore, despite the moderate positive correlation, this relationship is not statistically significant.

C. Financial Leverage:**

- The results also indicate no significant relationship between SWF investments and financial leverage in Spanish companies, as evidenced by the non-significant p-value of 0.815.

- Correlation Coefficient (R):** The R is 0.085, indicating a very weak positive correlation.

- Coefficient of Determination (R^2):** The R^2 is 0.007, indicating that only 0.7% of the variance in financial leverage can be explained by SWF investments. Thus, the analysis suggests that SWF investments have a minimal impact on the financial leverage of Spanish companies.

D. Profitability Ratio:**

-Coefficient of Determination (R^2):** The R^2 is 0.125, indicating that 12.5% of the variance in the profitability ratio can be explained by SWF investments.

- Correlation Coefficient (R):** The R between SWF investments and the profitability ratio is 0.353, indicating a moderate positive correlation.

- t-Test:** The t-value for SWF investments is 1.068, with a significant level of 0.317. The calculated F-value is 1.14, with a significance level of 0.317, indicating that the relationship is not statistically significant at the 0.05 level. Therefore, while there is a moderate positive correlation between SWF investments and the profitability ratio for Spanish companies, this relationship is not statistically significant.

3.3. Impact of Sovereign Wealth Fund Investments on Average Stock Price

The researcher conducted a linear regression analysis to study the impact of sovereign wealth fund (SWF) investments on the average stock price. The table below presents the regression results and the relationship between the independent variable (SWF investments) and the dependent variable (average stock price) for Saudi and Spanish companies.

Table 5. Relationship between Variables

Independent Variable	Saudi Companies			Spanish Companies		
	B	t. test	.Sig	B	t. test	.Sig
Regression Constant	0.03	1.509	0.17	0.203	5.785	0
Sovereign Fund Investment	0.913	5.989	0	0.043-	0.164-	0.874
Details						
Correlation Coefficient (R)	0.904			0.058		
Coefficient of Determination (R^2)	0.818			0.003		
Calculated F Value	35.872			0.027		
Degrees of Freedom	9			9		
Sig. Level			0			0.874

Source: the table prepared by the author based on analyses results

Based on the results from the table above, the following observations can be made:

A. For Saudi Companies:

- Significant Impact: SWF investments have a significant impact on the average stock price of Saudi companies. The coefficient of determination (R^2) is 0.818, indicating that approximately 81.8% of the variance in the average stock price can be explained by changes in SWF investments. This high R^2 value suggests a strong relationship between SWF investments and the average stock price of Saudi companies.

- Strong Positive Correlation: The correlation coefficient (R) is 0.904, indicating a very strong positive correlation between the two variables. As SWF investments increase, the average stock price of Saudi companies tends to rise as well.

B. For Spanish Companies:

- Strong Positive Correlation: The results indicate a strong positive correlation (R = 0.883) between SWF investments and the average stock price of Spanish companies.

- Significant Impact: The coefficient of determination (R^2 = 0.779) indicates that approximately 77.9% of the variance in the average stock price can be explained by SWF investments. The calculated F-value (28.197) is statistically significant ($p < 0.001$), indicating that the regression model is statistically significant. Therefore, it can be concluded that SWF investments have a significant positive impact on the average stock price of Spanish companies.

4. Discussion of Hypotheses

First Hypothesis: "There is a positive relationship between the company's financial performance (measured by return on investment, liquidity ratio, financial leverage, and profitability ratio) and sovereign wealth fund (SWF) investments in it." Based on the analysis results mentioned above, the researcher rejects the first hypothesis in its affirmative form (for both Saudi and Spanish companies) and supports the alternative hypothesis, which states that "there is no positive relationship between the company's financial performance (measured by return on investment, liquidity ratio, financial leverage, and profitability ratio) and SWF investments in it."

Second Hypothesis: The regression analysis results provide strong evidence to support the hypothesis that there is a significant positive relationship between SWF investments and the average stock price of Saudi companies. Overall, these results indicate no significant relationship between SWF investments and the return on investment for both Saudi and Spanish companies.

Third Hypothesis: The third hypothesis posited that the nationality of the company affects the relationship between financial performance and SWF investments in it. Based on the results mentioned in the previous sections, which can be summarized as follows: (There is no statistically significant relationship between the company's financial performance and SWF investments in it. This conclusion is consistent for both Saudi and Spanish companies. A positive relationship was observed between the company's value and SWF investments in it. This conclusion is consistent for both Saudi and Spanish companies). These results lead to the rejection of the third hypothesis in its original form and its acceptance in its negative form. Therefore, the hypothesis becomes: "The nationality of the company does not affect the relationship between financial performance and SWF investments in it."

5. Results and Recommendations

The study concluded that sovereign wealth fund (SWF) investments have a minimal impact on the financial performance of Saudi and Spanish companies but significantly affect the average stock price. In Saudi Arabia, these investments explain 81.8% of the changes in stock value, while in Spain, they explain 77.9%. Financial performance indicators were not significantly affected, and the nationality of the company did not influence the relationship between financial performance and SWF investments.

Recommendations:

- Companies should explore factors that enhance the impact of SWF investments on financial performance indicators, focusing on increasing returns on investment.
- Management should consider the effect of investments on stock value to improve market value.
- Additional studies are recommended to explore other factors that may affect financial performance and to increase collaboration with SWFs as part of the investment strategy.
- Enhancing transparency and regular financial reporting makes companies more attractive for investment.
- Long-term studies and comparative analysis across industries and countries should be conducted to better understand the impact of SWF investments.

Credit Authorships Contribution statement

All authors have contributed equally to all aspects of the research and writing of this article and share equal responsibility for the content of this article

Declaration of Competing Interest

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

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Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declared that they have used generative AI and assisted Technologies solely in the process of correcting and improving the language in some sentences as assist with translation process during the preparation of this manuscript.

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Appendices

Appendix 1. Study Sample Details

Madrid Companies

	Company Name	Company Activity	Sovereign Fund Invested	Investment Date	Investment Ratio
1	Banco Santander	Banking and Financial Services	Qatar Investment Authority, Government of Singapore Investment Corporation (GIC)	2008	10%
2	Telefónica	Telecommunications	Government of Singapore Investment Corporation (GIC)	2012	10% - 12%
3	Inditex	Retail	Qatar Investment Authority (QIA)	2010	10% - 12%
4	Repsol	Oil and Gas Exploration	Government of Singapore Investment Corporation (GIC)	2011	10% - 15%
5	BBVA	Banking and Financial Services	Qatar Investment Authority (QIA)	2014	15% - 16%
6	Iberdrola	Electricity Generation	Government of Singapore Investment Corporation (GIC)	2007	13% - 15%
7	Mapfre	Insurance Services	Qatar Investment Authority (QIA)	2014	10% - 12%
8	Ferrovial	Infrastructure and Transportation	Qatar Investment Authority (QIA)	2013	15% - 17%
9	CaixaBank	Banking and Financial Services	Qatar Investment Authority (QIA)	2014	15% - 17%
10	Red Eléctrica de España	Electricity Transmission	Government of Singapore Investment Corporation (GIC)	2015	13% - 15%

Saudi Companies

	Company Name	Main Activity	Investing Sovereign Fund	Investment Date	Investment Ratio
1	Saudi Aramco	Oil & Gas	Saudi Public Investment Fund	2019	5%
2	Al Rajhi Financial	Financial Services	Norwegian Government Pension Fund	2020	0.03
3	SABIC	Chemical Industries	Global Investment Corp.	2018	0.07
4	Saudi Telecom Company	Telecommunications	Singapore Investment Fund	2017	0.04
5	Saudi Arabian Airlines	Aviation	Qatar Investment Authority	2019	0.06
6	Saudi Stock Exchange	Financial Services	China Investment Corporation	2018	0.02
7	Al Ahli Commercial Bank	Banking Services	UAE Sovereign Wealth Fund	2020	0.05
8	Saudi Cement	Construction Industries	Kuwait Investment Authority	2016	0.03
9	Saudi Electricity Company	Electrical Energy	Saudi Sovereign Wealth Fund	2017	0.04
10	Zamil Chemical Industries	Chemical Industries	Qatar Investment Authority	2019	0.02

Appendix 2. Preliminary Data

Data on Madrid Stock Exchange Companies

1	**Banco Santander**							
	Ratio Type	2005	2006	2007	2008	2029	2010	2011
	Return on Investment (%)	15	14	16		17	18	19
	Liquidity Ratio	1.5	1.6	1.7		1.8	1.9	2
	Leverage Ratio	0.6	0.7	0.8		0.9	0.85	0.8
	Profitability Ratio (%)	10	11	12		13	14	15
	Average stock price	1.19	1.19	2.16		4.88	3.49	3.43
2	**Telefónica**							
	Ratio Type	2017	2018	2019	2012	2021	2022	2023
	Return on Investment (%)	12.345	13.21	12.854		14.567	15.678	16.902
	Liquidity Ratio	1.786	1.695	1.923		2.067	2.108	2.348
	Leverage Ratio	0.742	0.817	0.839		0.912	0.831	0.798
	Profitability Ratio (%)	9.987	10.341	10.789		11.489	12.465	13.127
	Average stock price	7.93	8.15	6.67		5.19	4.19	3.91
3	**Refineries Company**							
	Ratio Type	2017	2018	2019	2010	2021	2022	2023
	Return on Investment (%)	13.456	14.789	15.234		12.543	11.987	10.876
	Liquidity Ratio	1.752	1.819	1.685		1.574	1.482	1.396
	Leverage Ratio	0.815	0.798	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	11.234	12.543	12.987		10.765	9.876	8.543
	Average stock price	65.56	60.19	70.71		88.13	89.93	87.73
4	**Repsol**							
	Ratio Type	2017	2018	2019	2011	2021	2022	2023
	Return on Investment (%)	15.234	14.567	13.876		12.543	11.789	10.987
	Liquidity Ratio	1.819	1.752	1.685		1.574	1.482	1.396
	Leverage Ratio	0.798	0.815	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	12.543	11.234	10.765		9.876	8.543	7.234
	Average stock price	9.15	10.22	11.1		17.91	14.77	15.2
5	**BBVA**							
	Ratio Type	2011	2012	2013	2014	2015	2016	2017
	Return on Investment (%)	12.543	11.987	13.456		14.789	15.234	16.543
	Liquidity Ratio	1.685	1.752	1.819		1.924	2.037	2.175
	Leverage Ratio	0.832	0.798	0.815		0.735	0.679	0.621
	Profitability Ratio (%)	10.765	9.876	11.234		12.543	13.987	15.234
	Average stock price	5.77	4.13	6.15		8.24	9.21	7.32
6	**Iberdrola**							
	Ratio Type	2004	2005	2006	2007	2008	2009	2010
	Return on Investment (%)	14.789	15.234	13.456		12.543	11.987	10.876
	Liquidity Ratio	1.752	1.819	1.685		1.574	1.482	1.396
	Leverage Ratio	0.798	0.815	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	11.234	10.765	12.543		9.876	8.543	7.234
	Average stock price	4.81	4.33	5.59		10.47	8.91	8.26
7	**Mapfre**							
	Ratio Type	2011	2012	2013	2014	2015	2016	2017
	Return on Investment (%)	13.456	14.789	15.234		12.543	11.987	10.876

	Liquidity Ratio	1.819	1.752	1.685		1.574	1.482	1.396
	Leverage Ratio	0.798	0.815	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	12.543	11.234	10.765		9.876	8.543	7.234
	Average stock price	1.06	1.19	1.11		2.98	2.88	2.02
8	**Ferrovial**							
	Ratio Type	2010	2011	2012	2013	2014	2015	2016
	Return on Investment (%)	14.789	15.234	13.456		12.543	11.987	10.876
	Liquidity Ratio	1.752	1.819	1.685		1.574	1.482	1.396
	Leverage Ratio	0.798	0.815	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	11.234	10.765	12.543		9.876	8.543	7.234
	Average stock price	26.61	27.69	28.89		40.98	33.17	28.62
9	**CaixaBank**							
	Ratio Type	2011	2012	2013	2014	2015	2016	2017
	Return on Investment (%)	15.234	14.789	13.456		12.543	11.987	10.876
	Liquidity Ratio	1.819	1.752	1.685		1.574	1.482	1.396
	Leverage Ratio	0.798	0.815	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	12.543	11.234	10.765		9.876	8.543	7.234
	Average stock price	5.98	4.25	3.15		4.99	5.6	4.04
10	**Red Eléctrica de España**							
	Ratio Type	2012	2013	2014	2015	2016	2017	2018
	Return on Investment (%)	13.543	12.987	14.234		15.567	16.789	17.432
	Liquidity Ratio	1.752	1.819	1.685		1.574	1.482	1.396
	Leverage Ratio	0.798	0.815	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	11.234	10.765	12.543		13.876	14.987	15.654
	Average stock price	23.38	24.44	22.05		14.16	12.17	13.6

Data on Saudi Stock Exchange Companies

1	**Saudi Aramco**	**ARAMCO**						
	Ratio Type	2016	2017	2018	2019	2020	2021	2022
	Return on Investment (%)	12.345	13.21	14.322		15.456	16.789	17.543
	Liquidity Ratio	1.752	1.819	1.685		1.574	1.482	1.396
	Leverage Ratio	0.798	0.815	0.832		0.917	0.942	0.986
	Profitability Ratio (%)	11.234	10.765	12.543		13.876	14.987	15.654
	Average stock price	48.14	45.19	44.18		30.2	33.54	32.1
2	**Al Rajhi Bank**	**RAJHI**						
	Ratio Type	2017	2018	2019	2020	2021	2022	2023
	Return on Investment (%)	14.678	15.342	16.521		17.89	18.432	19.876
	Liquidity Ratio	1.932	1.874	1.783		1.654	1.521	1.416
	Leverage Ratio	0.721	0.693	0.665		0.632	0.601	0.578
	Profitability Ratio (%)	13.245	14.098	14.987		15.543	16.21	16.789
	Average stock price	60.66	61.12	60.19		76.66	75.2	76.9
3	**Saudi Basic Industries Corporation**	**SABIC**						
	Ratio Type	2015	2016	2017	2018	2019	2020	2021
	Return on Investment (%)	17.543	18.765	19.876		20.543	21.987	22.543
	Liquidity Ratio	1.894	1.743	1.652		1.527	1.414	1.309
	Leverage Ratio	0.712	0.685	0.657		0.623	0.592	0.569

	Profitability Ratio (%)	16.765	17.654	18.21		18.876	19.543	20.21
	Average stock price	60.17	77.23	79.05		86.43	82.54	80.9
4	**Saudi Telecom Company**	**STC**						
	Ratio Type	2014	2015	2016	2017	2018	2019	2020
	Return on Investment (%)	18.234	19.543	20.876		21.543	22.987	23.543
	Liquidity Ratio	1.932	1.874	1.783		1.654	1.521	1.416
	Leverage Ratio	0.721	0.693	0.665		0.632	0.601	0.578
	Profitability Ratio (%)	17.543	18.234	19.543		20.21	20.987	21.654
	Average stock price	29.66	28.17	20.12		36.63	33.48	31.25
5	**Saudi Arabian Airlines**	**SAUDI**						
	Ratio Type	2016	2017	2018	2019	2020	2021	2022
	Return on Investment (%)	19.123	20.432	21.876		22.543	23.987	24.543
	Liquidity Ratio	1.963	1.812	1.723		1.597	1.472	1.348
	Leverage Ratio	0.731	0.703	0.675		0.642	0.611	0.588
	Profitability Ratio (%)	18.234	19.123	20.432		21.098	21.876	22.543
	Average stock price	251.51	224.17	119.18		119.77	120.68	128.28
6	**Eastern Development**	**E D**						
	Ratio Type	2015	2016	2017	2018	2019	2020	2021
	Return on Investment (%)	20.543	21.876	22.987		23.543	24.987	25.543
	Liquidity Ratio	1.982	1.821	1.732		1.617	1.493	1.379
	Leverage Ratio	0.741	0.713	0.685		0.652	0.621	0.598
	Profitability Ratio (%)	19.543	20.543	21.876		22.543	23.987	24.543
	Average stock price	14.87	16.55	17.5		20.89	22.17	21.44
7	**National Commercial Bank**	**NCB**						
	Ratio Type	2017	2018	2019	2020	2021	2022	2023
	Return on Investment (%)	21.432	22.765	23.876		24.543	25.987	26.543
	Liquidity Ratio	1.993	1.832	1.743		1.628	1.503	1.389
	Leverage Ratio	0.751	0.723	0.695		0.662	0.631	0.608
	Profitability Ratio (%)	20.654	21.432	22.765		23.543	24.987	25.543
	Average stock price	17.5	18.88	20.19		36.76	37.98	37.7
8	**Zamil Industrial Investment Company**	**ZAMIL**						
	Ratio Type	2013	2014	2015	2016	2017	2018	2019
	Return on Investment (%)	20.321	19.654	18.987		17.543	16.876	15.432
	Liquidity Ratio	1.982	1.821	1.732		1.617	1.493	1.379
	Leverage Ratio	0.741	0.713	0.685		0.652	0.621	0.598
	Profitability Ratio (%)	19.432	18.321	17.654		16.543	15.876	14.543
	Average stock price	20.17	18.87	17.52		19.59	18.66	19.9
9	**Saudi Electricity Company**	**SEC**						
	Ratio Type	2014	2015	2016	2017	2018	2019	2020
	Return on Investment (%)	19.654	18.987	17.543		16.876	15.432	14.543
	Liquidity Ratio	1.963	1.812	1.723		1.597	1.472	1.348
	Leverage Ratio	0.731	0.703	0.675		0.642	0.611	0.588
	Profitability Ratio (%)	18.876	17.654	16.543		15.876	14.543	13.432
	Average stock price	11.22	12.06	15.14		28.51	27.19	17.87
10	**Zamil Industrial Investment Company**	**ZAMIL**						
	Ratio Type	2016	2017	2018	2019	2020	2021	2022
	Return on Investment (%)	18.987	17.543	16.876		15.432	14.543	13.432

	Liquidity Ratio	1.932	1.874	1.783		1.654	1.521	1.416
	Leverage Ratio	0.721	0.693	0.665		0.632	0.601	0.578
	Profitability Ratio (%)	17.654	16.543	15.876		14.543	13.432	12.321
	Average stock price	12.1	16.3	17.11		28.82	26.71	22.8

Appendix 3. Data after Summarization

Madrid Stock Exchange Companies

	Company	Arithmetic mean Before acquisition	Year of acquisition	Arithmetic mean After acquisition	Differences
1	**Banco Santander**		**2008**		
	Return on investment (%)	15		18	-3
	Liquidity rate	1.6		1.9	-0.3
	Leverage ratio	0.7		0.85	-0.15
	Profitability ratio (%)	11		14	-3
	Average share price	1.513		3.933	-2.42
2	**Telefónica**		**2012**		
	Return on investment (%)	12.803		15.716	-2.913
	Liquidity rate	1.801		2.174	-0.373
	Leverage ratio	0.799		0.847	-0.048
	Profitability ratio (%)	10.372		12.36	-1.988
	Average share price	7.583		4.43	3.153
3	**Refineries Company**		**2010**		
	Return on investment (%)	14.493		11.802	2.691
	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	12.255		9.728	2.527
	Average share price	65.487		88.597	-23.11
4	**Repsol**		**2011**		
	Return on investment (%)	14.559		11.773	2.786
	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	11.514		8.551	2.963
	Average share price	10.157		15.96	-5.803
5	**BBVA**		**2014**		
	Return on investment (%)	12.662		15.522	-2.86
	Liquidity rate	1.752		2.045	-0.293
	Leverage ratio	0.815		0.678	0.137
	Profitability ratio (%)	10.625		13.921	-3.296
	Average share price	5.35		8.257	-2.907
6	**Iberdrola**		**2007**		
	Return on investment (%)	14.493		11.802	2.691
	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	11.514		8.551	2.963
	Average share price	4.91		9.213	-4.303
7	**Mapfre**		**2014**		
	Return on investment (%)	14.493		11.802	2.691

	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	11.514		8.551	2.963
	Average share price	1.12		2.627	-1.507
8	**Ferrovial**		**2013**		
	Return on investment (%)	14.493		11.802	2.691
	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	11.514		8.551	2.963
	Average share price	27.73		34.257	-6.527
9	**CaixaBank**		**2014**		
	Return on investment (%)	14.493		11.802	2.691
	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	11.514		8.551	2.963
	Average share price	4.46		4.877	-0.417
10	**Red Eléctrica de España**		**2015**		
	Return on investment (%)	13.588		16.596	-3.008
	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	11.514		14.839	-3.325
	Average share price	23.29		13.31	9.98

Saudi Stock Exchange Companies

	Company	Arithmetic mean Before acquisition	Year of acquisition	Arithmetic mean After acquisition	Differences
1	**Saudi Aramco**		**2019**		
	Return on investment (%)	13.292		16.596	-3.304
	Liquidity rate	1.752		1.484	0.268
	Leverage ratio	0.815		0.948	-0.133
	Profitability ratio (%)	11.514		14.839	-3.325
	Average share price	45.837		31.947	13.89
2	**Al Rajhi Bank**		**2020**		
	Return on investment (%)	15.514		18.733	-3.219
	Liquidity rate	1.863		1.53	0.333
	Leverage ratio	0.693		0.604	0.089
	Profitability ratio (%)	14.11		16.181	-2.071
	Average share price	60.657		76.253	-15.597
3	**Saudi Basic Industries Corporation**		**2018**		
	Return on investment (%)	18.728		21.691	-2.963
	Liquidity rate	1.763		1.417	0.346
	Leverage ratio	0.685		0.595	0.09
	Profitability ratio (%)	17.543		19.543	-2
	Average share price	72.15		83.29	-11.14
4	**Saudi Telecom Company**		**2017**		
	Return on investment (%)	19.551		22.691	-3.14
	Liquidity rate	1.863		1.53	0.333

	Leverage ratio	0.693		0.604	0.089
	Profitability ratio (%)	18.44		20.95	-2.51
	Average share price	25.983		33.787	-7.803
5	**Saudi Arabian Airlines**		**2019**		
	Return on investment (%)	20.477		23.691	-3.214
	Liquidity rate	1.833		1.472	0.36
	Leverage ratio	0.703		0.614	0.089
	Profitability ratio (%)	19.263		21.839	-2.576
	Average share price	198.287		122.91	75.377
6	**Eastern Development**		**2018**		
	Return on investment (%)	21.802		24.691	-2.889
	Liquidity rate	1.845		1.496	0.349
	Leverage ratio	0.713		0.624	0.089
	Profitability ratio (%)	20.654		23.691	-3.037
	Average share price	16.307		21.5	-5.193
7	**National Commercial Bank**		**2020**		
	Return on investment (%)	22.691		25.691	-3
	Liquidity rate	1.856		1.507	0.349
	Leverage ratio	0.723		0.634	0.089
	Profitability ratio (%)	21.617		24.691	-3.074
	Average share price	18.857		37.48	-18.623
8	**Zamil Industrial Investment Company**		**2016**		
	Return on investment (%)	19.654		16.617	3.037
	Liquidity rate	1.845		1.496	0.349
	Leverage ratio	0.713		0.624	0.089
	Profitability ratio (%)	18.469		15.654	2.815
	Average share price	18.853		19.38333	-0.53
9	**Saudi Electricity Company**		**2017**		
	Return on investment (%)	18.728		15.617	3.111
	Liquidity rate	1.833		1.472	0.36
	Leverage ratio	0.703		0.614	0.089
	Profitability ratio (%)	17.691		14.617	3.074
	Average share price	12.807		24.52333	-11.717
10	**Zamil Industrial Investment Company**		**2019**		
	Return on investment (%)	17.802		14.469	3.333
	Liquidity rate	1.863		1.53	0.333
	Leverage ratio	0.693		0.604	0.089
	Profitability ratio (%)	16.691		13.432	3.259
	Average share price	15.17		26.11	-10.94

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Estimating the Factors Influencing Liquidity Risk: Empirical Analysis of Indian Non-Banking Financial Institutions

Gaurav KUMAR
Department of Business Management
KLEF Business School, Koneru Lakshmaiah Educational Foundation KL University, India
ORCID: 0000-0002-1800-3213
klgaurav4@gmail.com

Murty A.V.N.
KLEF Business School, Koneru Lakshmaiah Educational Foundation KL University, India
ORCID: 0000-0002-5232-2226
dravnmurty@kluniversity.in

Srinivas Ravi Kumar JEELAKARRA
MNR Medical College & Hospital, India
ORCID: 0009-0007-0984-2350
jeelakarra@gmail.com

S. GANAPATHY
Department of Corporate Secretaryship
S.A. College of Arts & Science, India
ORCID: 0009-0002-8758-5541
drprofganapathy@gmail.com

Savitha G. R.
Prin. L. N. Welingkar Institute of Management Development and Research, India
ORCID: 0009-0006-0921-4912
savitha.gr@welingkar.org

Sangram PADHY
Prananath College, Utkal University, India
ORCID: 0000-0001-8658-2889
Sangrampadhy48@gmail.com

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Abstract: Liquidity risk refers to NBFC's ability to fund assets and meet obligations as they come due to reasonable costs. Technological advancements and financial innovations have significantly impacted liquidity management in NBFCs. The decreasing reliance on core deposits, increased dependence on capital markets, and recent financial market disruptions have introduced new challenges for NBFCs in managing liquidity. This study explores various theories, indicators, and factors influencing NBFC liquidity, as well as its implications for an NBFC's capital and profitability. Using Arellano-Bond estimates, the research empirically analyzes the determinants of liquidity and examines the interrelationship between liquidity, regulatory capital, and profitability through 2-SLS system equations. The findings highlight that NBFCs' size, profitability, leverage, net interest margin, gross non-performing loans, and the Central Bank Policy Rate are significant determinants of NBFC's liquidity.

Furthermore, the interaction between liquidity, profitability, and regulatory capital reveals that while NBFCs can enhance liquidity at the expense of profitability, greater liquidity also results in reduced risk. Non-traditional financial service providers use diverse business models, which leads to a variety of potential liquidity risks.

Keywords: liquidity risk; non-banking financial institutions (NBFIs); financial crises; profitability.
JEL Classification: G21; G32; G33, E44; G23; G01; G14; G23; C23; C33.

Introduction

Non-Banking Financial Institutions (NBFIs) play a pivotal role in India's financial system by providing services such as loans, asset management, and insurance. Liquidity risk, however, remains a significant challenge for these institutions, especially in a dynamic regulatory environment. In recent years, Indian NBFIs have faced pressure from volatile market conditions, rising non-performing assets (NPAs), and fluctuating interest rates, which have all contributed to liquidity risk. By some estimates, NBFIs currently account for about 50% of global financing activities (Aramonte *et al.* 2021). Non-Banking Financial Institutions (NBFCs) play a pivotal role as liquidity providers in the financial system. As systemic financial entities, NBFCs are expected to maintain sufficient liquidity, making liquidity management a key priority for them. However, as demonstrated during the recent financial crisis, many NBFCs faced significant challenges in maintaining adequate liquidity levels, necessitating extraordinary liquidity support from central banks to stabilize the financial system. Maintaining a favorable liquidity profile is crucial for a Non-Banking Financial Company (NBFC) to ensure smooth funding activities, facilitate the creation of new assets, and meet its debt obligations promptly.

Additionally, managing interest rate risk is vital, as fluctuations in interest rates can impact the NBFC's future profitability. Non-Banking Financial Companies (NBFCs) play a pivotal role in driving economic growth and development by serving as key providers of finance. However, the nature of their operations inherently exposes these institutions to various risks, including liquidity risk. Liquidity risk refers to the potential inability of an NBFC to fulfill its short-term financial obligations, such as depositor withdrawals or the repayment of maturing liabilities. This risk is particularly critical as it can trigger a domino effect, leading to solvency challenges and eroding public confidence in the financial system. Since the introduction of the New Economic Policy in 1991, the Indian financial sector has undergone substantial transformation, further highlighting the importance of effective risk management for NBFCs. The sector has shifted from a regulated economy to a more deregulated market economy. Additionally, the global financial crisis had a profound effect on the shadow banking sector. To ensure long-term financial stability, it is essential to focus on liquidity risks and distress within NBFCs. These financial entities are exposed to various types of liquidity risks. The global financial crisis of 2007-2008 highlighted the severe consequences of inadequate liquidity management, with many banks experiencing liquidity shortages that ultimately led to insolvency and the need for government bailouts. empirical studies examine the factors influencing liquidity risk within the NBFCs. Liquidity risk, defined as the risk a financial institution faces in its inability to meet its short-term obligations, is a critical concern for individual banks and the overall stability of the financial system (Hassanein, 2022). The 2008 global financial crisis starkly illustrated the devastating consequences of liquidity shortfalls, underscoring the crucial need for rigorous research into the drivers of this risk (Hlebik, 2016). In 2018, the Indian non-banking financial company (NBFC) sector faced a major liquidity shock following the default of a major conglomerate on a short-term loan. This conglomerate was an NBFC-ICC with a complex group structure and several subsidiaries spanning various sectors, including real estate, transportation, and financial services. NBFCs play a crucial role as liquidity providers in the financial system. Being systemic financial institutions, they are expected to maintain liquidity, making liquidity management one of their primary objectives. However, as seen during the recent financial crisis, many liquidity providers faced challenges in maintaining sufficient liquidity, leading to the need for unprecedented levels of support from central banks to stabilize the financial system. This review synthesizes findings from diverse studies, comparing methodologies, analyzing results, and focusing on both NBFC-specific and macroeconomic factors that contribute to liquidity risk.

The goal is to identify consistent patterns, highlight areas of disagreement, and ultimately contribute to a more nuanced understanding of this complex phenomenon. This will be achieved through a systematic review of existing literature, comparing methodologies and findings to identify key themes and areas for further research. Liquidity risk, in the context of NBFCs, represents the potential inability to meet short-term obligations promptly and cost-effectively. These obligations encompass various commitments, including debt repayments to creditors, meeting customer withdrawal requests, and fulfilling other financial commitments. The magnitude of this risk is intricately linked to several key factors. The composition of an NBFC's funding sources plays a crucial role, with a heavier reliance on short-term borrowings, commercial paper, or other short-term instruments increasing vulnerability to sudden shifts in market sentiment or funding availability. The maturity profile of their assets also presents a significant challenge. NBFCs often invest in long-term assets, such as loans and investments, while simultaneously relying on short-term funding. This inherent mismatch between asset and liability maturities creates a significant liquidity risk, especially during periods of economic uncertainty or market stress. Furthermore, prevailing market conditions exert a powerful influence on NBFC’s liquidity position. Changes in interest rates, investor confidence, and overall economic health can significantly impact the ability of NBFCs to

access funding and meet their obligations. Unlike banks, which often have access to central bank liquidity facilities as a safety net during times of stress, NBFCs typically lack this critical support mechanism. This absence of a readily available backstop significantly increases their vulnerability to market shocks and funding crises. The absence of a lender of last resort for NBFCs, in contrast to the support often available to banks, is a critical difference that increases the importance of proactive and comprehensive liquidity risk management. The liquidity ratios, profitability, and efficiency of the two categories of banks are analysed in detail together, as Non-Banking Financial Companies (NBFCs) also function as financial intermediaries. Since NBFCs engage in similar financial activities, assessing their liquidity risk is equally important. A comprehensive analysis allows for a better understanding of how both banks and NBFCs manage resources, generate profits, and maintain operational efficiency. Given their interconnected roles in the financial system, comparing these entities on the same parameters ensures a consistent and thorough evaluation, especially in terms of liquidity risk, which is critical for financial stability and regulatory oversight. (KUMAR *et al.* 2025).

Recent episodes of financial distress within prominent NBFCs have exposed the sector's vulnerability to liquidity risk, raising systemic concerns and regulatory scrutiny. While existing literature has extensively examined liquidity risk within the traditional banking sector, limited empirical studies focus specifically on NBFCs, despite their distinct structural and operational differences. This study aims to bridge that gap by developing a comprehensive framework to estimate and analyse the key factors influencing liquidity risk in NBFCs. This includes firm-specific variables *e.g.*, asset-liability mismatches, capital adequacy, funding concentration as well as macroeconomic indicators. Unlike bank-centric models, this research tailors the risk estimation framework to the unique business models and funding structures of NBFCs. It incorporates both micro-level financial metrics and macro-level policy and market indicators, providing a holistic view of liquidity vulnerabilities. The findings can inform regulatory bodies such as the RBI to refine liquidity coverage ratios and stress-testing mechanisms for NBFCs. NBFCs can use the identified risk drivers to enhance internal risk monitoring frameworks and strengthen liquidity buffers. A clearer understanding of liquidity dynamics will help investors and stakeholders make better-informed decisions regarding NBFC exposure. By identifying and quantifying the determinants of liquidity risk specific to the NBFC sector, this study contributes to enhancing financial stability, risk resilience, and confidence in a crucial segment of the financial ecosystem.

1. Review of Literature

This paper makes contributions to various areas of banking literature. Liquidity refers to a financial institution's ability to quickly fulfil its cash and collateral obligations at a reasonable cost (Brunnermeier & Pedersen, 2009). In the "Originate-to-Distribute" (OTD) lending model, NBFCs do not retain the assets they originate until maturity; instead, they distribute them by securitizing financial products. This model allows NBFCs to quickly adjust the volume of mortgages they issue without making significant changes to their equity capital or asset portfolio. However, the growing reliance on the OTD model by NBFCs may result in a potential loosening of lending standards. The nonbank entities that have the highest market share are finance companies, pension plans, investment managers, and "others. To reduce the liquidity burden on the banks, it contributes to the growth of unregulated "shadow banking" institutions, which is harmful to the stability of the financial system. Liquidity risk is the risk of an NBFC's inability to meet its short-term financial obligations.

This risk can stem from various factors, including insufficient cash flow, difficulty in accessing funds, and unexpected withdrawals. Effective liquidity risk management involves maintaining adequate cash reserves, diversifying funding sources, and having access to short-term credit lines. Inadequate liquidity can lead to financial difficulties and severely impact profitability (Khanchandani, 2019). Research on financial liquidity has often focused on the connection between liquidity and profitability, with results from these studies being inconclusive. Some studies have found a positive link between financial liquidity and short-term performance. Additionally, the ratio of fixed assets to total assets plays a moderating role in the relationship between money supply and corporate financial liquidity. For companies with low asset flexibility, there is a negative correlation between money supply and financial liquidity, whereas for companies with high asset flexibility, the relationship is positive (Nowicki *et al.* 2024). There is a positive correlation between liquidity risk and profitability, while financial leverage has a negative correlation with profitability (Nam & Tuyen, 2024).

The study examined liquidity risk in financial institutions and assessed its impact on profitability by employing a series of multiple regressions and a panel data approach over several years. The findings of the paper suggested that mitigating liquidity risk can be achieved by maintaining adequate cash reserves, increasing deposits, and reducing liquidity gaps and non-performing loans. The researcher also compared the liquidity risks of Islamic and conventional banks, concluding that Islamic banks demonstrated a stronger liquidity position than

conventional banks. Additionally, the research found a positive relationship between capital adequacy, loan interest rates, profitability, and liquidity. On the other hand, a negative relationship was observed between bank size, interest margins, monetary policy, interest rates, and liquidity. The study brings outcomes that our 2SLS liquidity risk and panel GMM Z-solvency regression results confirm this finding that an increase in non-performing assets (NPA) leads not only to a reduction in liquid assets but also to the erosion of financial institutions' current assets. Therefore, liquidity risk plays a significant role in liquidity. Financial institutions must establish a robust internal framework for evaluating and managing liquidity, including funding strategies and contingency plans for survival. Basel III regulations take a forward-looking approach, with significant revisions and improvements, such as a stronger focus on high-quality capital and liquidity standards, to protect from unexpected business volatility. It can be concluded that the implementation of Basel III norms by the RBI has strengthened liquidity.

However, there is still room for improvement, which could be addressed through the effective implementation of additional indicators like the liquidity coverage ratio and net stable funding ratio, alongside internal benchmarks (Bandyopadhyay & Saxena, 2023). Research on liquidity risk identification primarily focuses on two approaches: one begins by defining liquidity risk in commercial banks, differentiating various types of liquidity risks, and identifying them through specific indicators; the other evaluates liquidity risks using certain key indicators. Financial institutions commonly use metrics such as liquidity coverage ratios, liquidity ratios, and loan-to-deposit ratios to manage and regulate liquidity risk (Liu & Xie, 2024). The key factors influencing liquidity risk are primarily macroeconomic variables and monetary policies. Non-Banking Financial Companies (NBFCs) with lower levels of equity capital tend to focus more on monitoring their borrowers, enabling them to offer loans and generate additional liquidity. In contrast, a higher level of capital enhances liquidity creation, as it strengthens the institution's capacity to absorb and diversify risks, thereby fostering greater liquidity (Oino, 2021). This study explores liquidity risk determinants in Indian NBFIs, emphasizing the significance of profitability, firm size, leverage, and interest rate fluctuations. The findings suggest that regulatory capital and non-performing assets (NPAs) significantly affect liquidity risk management. The paper further discusses the role of monetary policy in shaping NBFIs' liquidity risk profiles. This paper investigates the role of regulatory capital in mitigating liquidity risk within Indian NBFIs.

The study identifies capital adequacy ratios as crucial in reducing liquidity stress, especially during market downturns. By analysing panel data from various NBFIs, the research establishes that higher capital buffers significantly cushion liquidity risk (Tanha & Dempsey, 2016). The study explores the effect of interest rate volatility on liquidity risk in Indian NBFIs. The findings indicate that sudden interest rate shocks negatively impact the liquidity positions of smaller NBFIs. The research suggests that interest rate hedging strategies and liquidity management practices are essential in mitigating such risks (Ladley, 2020). This study evaluates the impact of leverage on liquidity risk in Indian NBFIs. High leverage is identified as a key determinant of liquidity risk, with heavily leveraged firms more vulnerable to liquidity shocks during market fluctuations (Fassas & Siriopoulos, 2021). Examines the relationship between non-performing assets (NPAs) and liquidity risk in Indian NBFIs. The authors find that NPAs increase liquidity risk due to impaired asset quality and insufficient cash flows. They suggest strengthening loan recovery processes to manage liquidity risks better (Kang & Yoon, 2020). This study evaluates the impact of leverage on liquidity risk in Indian NBFIs. High leverage is identified as a key determinant of liquidity risk, with heavily leveraged firms more vulnerable to liquidity shocks during market fluctuations (Fassas & Siriopoulos, 2021). Investigates the relationship between capital adequacy ratios and liquidity risk in Indian NBFIs. The study finds that higher capital adequacy ratios help reduce liquidity risk and enhance financial stability in these institutions (Fuchs *et al.* 2021). This research analyses the effect of interest rate sensitivity on liquidity risk in Indian NBFIs. The study suggests that NBFIs highly sensitive to interest rate movements face greater liquidity risks, especially in periods of rate hikes (Wang *et al.* 2020). This study investigates the role of internal governance mechanisms in liquidity risk management. The authors find that stronger internal controls and effective governance reduce liquidity risk, particularly during financial crises (Pryshchepa, 2021).

2. Impact of Regulatory Capital and Profitability on Liquidity Risk of NBFC

Liquidity risk is influenced by regulatory capital, profitability, and a range of exogenous factors. The Capital to Risk-Weighted Assets Ratio (CRAR) of a Non-Banking Financial Institution (NBFI) is impacted by its risk leverage and profitability. This study uses several variables to assess liquidity, including firm size (measured as the logarithm of total assets), profitability (Return on Assets), leverage ratio (debt-to-equity ratio), net interest margin (NIM), gross non-performing loans (GNPL), and the central bank's policy rate. In this model, Return on Assets (ROA) and CRAR are treated as instrumented variables. Higher liquidity requirements are expected when a bank provides loans with higher interest margins. Additionally, if CRAR requirements increase, they may negatively

impact on liquidity. Similarly, when more capitalized banks engage in riskier or long-term lending, liquidity tends to be reduced. Therefore, both profitability and CRAR are expected to have an inverse relationship with liquidity.

2.1. Discussed Various Control Variables and Their Impact on Liquidity Risk

Control variables play a crucial role in understanding the factors influencing liquidity risk. These variables account for external or indirect influences that could impact the dependent variable, ensuring the robustness of the econometric models in the context of this study on Indian Non-Banking Financial Institutions (NBFIs), Control variables such as regulatory capital, CBPR, inflation rate, and firm size are vital in understanding liquidity risk dynamics in Indian NBFIs. Effective management of these variables is critical for policymakers and financial managers to enhance economic stability and minimize liquidity risk. This analysis underscores the importance of a holistic approach that considers both internal factors (*e.g.*, leverage and profitability) and external conditions (*e.g.*, monetary policy and inflation). The following control variables were considered.

Table 1. Variable Explanations

Control Variable	Definition	Expected Impact on Liquidity Risk	Empirical Findings
Regulatory Capital (CAR)	Adequate capital buffers enhance an NBFC's resilience to shocks, thereby mitigating liquidity risk. Insufficient capital adequacy can lead to increased vulnerability during periods of financial stress. .(Ghosh *et al.* 2018)	Negative	Higher CAR reduces liquidity risk (β=−0.32\beta = -0.32, p<0.05p < 0.05).
Firm Size (Total Assets)	Larger NBFCs tend to have better access to capital markets and diversified funding sources, potentially reducing liquidity risk. However, some studies suggest that increased size may lead to complacency in liquidity management.(Ghosh *et al.* 2018)	Negative	Larger firms have lower liquidity risk (β=−0.19\beta = -0.19, p<0.05p < 0.05).
Leverage	Higher leverage indicates greater reliance on debt financing, which can exacerbate liquidity risk, especially during financial stress when debt obligations become burdensome.(Maria Antony, 2023)	Positive	Higher leverage increases liquidity risk (β=0.17\beta = 0.17, p<0.01p < 0.01).
Profitability (ROA)	Return on assets, indicating overall efficiency.	Negative	Higher profitability reduces liquidity risk (β=−0.21\beta = -0.21, p<0.01p < 0.01).
Net Interest Margin (NIM)	A higher NIM reflects better profitability from lending activities, which can enhance internal liquidity generation. However, excessive focus on NIM might lead to riskier lending practices, potentially increasing liquidity risk. (Maria Antony, 2023)	Negative	Higher NIM decreases liquidity risk (β=−0.22\beta = -0.22, p<0.05p < 0.05).
Gross Non-Performing Loans	Percentage of non-performing loans to total loans.	Positive	Higher GNPL increases liquidity risk (β=0.20\beta = 0.20, p<0.01p < 0.01).
Central Bank Policy Rate	Repo rate set by the Reserve Bank of India (RBI).	Positive	Higher policy rates increase liquidity risk (β=0.11\beta = 0.11, p<0.05p < 0.05).
Inflation Rate	High inflation can erode the real value of financial assets and returns, potentially increasing liquidity risk. It may also lead to higher interest rates, affecting borrowing costs and funding liquidity. (Maria Antony, 2023)	Positive	Higher inflation marginally increases liquidity risk (β=0.05\beta = 0.05, p>0.05p > 0.05).

3. Objectives of the Study

The primary objective of this study is to identify and estimate the key factors that influence liquidity risk in Non-Banking Financial Companies (NBFCs). By analysing both firm-level financial indicators and broader macroeconomic variables, the study aims to develop a comprehensive understanding of the drivers of liquidity risk, helping improve risk management practices and inform regulatory policy. This study has thoroughly

examined the interconnections between liquidity risk, regulatory capital, and profitability. However, the assessment, determinants, and impact of liquidity risk on NBFCs have not been rigorously explored. This article presents the following objectives to investigate these aspects within the Indian context.

(a) Evaluate the liquidity of NBFCs using different proxies and empirically identify the macroeconomic and NBFCs specific factors that influence it.

(b) The various factors affecting the liquidity risk of NBFCs.

3.1 Research Methodology

Data Source

The data for this study is derived from the annual reports of Indian NBFIs between 2010 and 2024, retrieved from CMIE Prowess. The sample consists of publicly listed NBFIs in India, which include a range of deposit-taking and non-deposit-taking firms. The sample is stratified to ensure diversity in terms of firm size, age, and sectorial focus.

Variables:

Dependent Variable: Liquidity Risk

Independent Variables: Firm size (log of total assets), profitability (Return on Assets), leverage ratio (debt-to-equity ratio), net interest margin (NIM), gross non-performing loans (GNPL), and central bank policy rate (repo rate).

Control Variables: Regulatory capital (capital adequacy ratio), inflation rate.

Model Specifications

To analyze the determinants of liquidity risk, we use the following

Arellano-Bond model:

$$\boldsymbol{Liquidity\ Risk_{it}} = \alpha + \beta_1\ \boldsymbol{Liquidity\ Risk_{it-1}} + \beta_2\ \boldsymbol{Size_{it}} + \beta_3\ \boldsymbol{Profitability_{it}} + \boldsymbol{\beta 4}\mathbf{Leverage}_{it} + \boldsymbol{\beta 5}\mathbf{NIM}_{it} + \boldsymbol{\beta 6 GNPL_{it}} + \boldsymbol{\beta 7}\mathbf{CBPR}_{IT} + \boldsymbol{\epsilon_{it}} \quad (1)$$

Where:

$\boldsymbol{i}$ Represents the firm,

$\boldsymbol{t}$ Represents the time period,

$\boldsymbol{\epsilon_{it}}$ is the error term.

For analyzing the interrelationships between liquidity risk, regulatory capital, and profitability, we use **Two-Stage Least Squares (2-SLS)** system equations:

Equation 1: Liquidity Risk Model

$$\boldsymbol{Liquidity\ Risk_{it}} = \boldsymbol{\gamma 0} + \boldsymbol{\gamma 1}\mathrm{RegulatoryCapital}_{it} + \boldsymbol{\gamma 2}\mathrm{Profitability}_{it} + \boldsymbol{\gamma 3}\mathrm{Size}_{it} + \boldsymbol{\gamma 4}\mathrm{Leverage}_{it} + \boldsymbol{\gamma 5}\mathrm{NIM}_{it} + \boldsymbol{\gamma 6}\mathrm{GNPL}_{it} + \boldsymbol{\epsilon_{it}} \quad (2)$$

Equation 2: Profitability Model

$$Profitability_{it} = \delta_0 + \delta_1\ \boldsymbol{Liquidity\ Risk_{it}} + \delta_2\ \boldsymbol{Size_{it}} + \delta_3\mathbf{Leverage}_{it} + \delta_4\ \mathbf{NIM}_{it} + \delta_5\ \boldsymbol{GNPL_{it}} + \delta_6\ \boldsymbol{Inflation_{it}} + \boldsymbol{\eta_{it}} \quad (3)$$

Where:

1. $\boldsymbol{Liquidity\ Risk_{it}}$ is the dependent variable in Equation 1,
2. $\boldsymbol{Profitability_{it}}$ is the dependent variable in Equation 2,
3. **Regulatory Capital** is represented by the capital adequacy ratio (CAR),
4. $\boldsymbol{Inflation_{it}}$ is measured by the consumer price index (CPI).

3.2 Descriptive Statistics

Table 2. The descriptive statistics of the key variables

Variable	Mean	Std. Dev.	Min	Max
Liquidity Risk (LCR)	1.23	0.29	0.7	2.1
Firm Size (Log of Assets)	10.15	1.4	7.5	13.2
Profitability (ROA)	6.9	2.3	3	12.5
Leverage Ratio (Debt/Equity)	0.55	0.12	0.35	0.8
Net Interest Margin (NIM)	3.55	1.1	1.5	6
Gross NPL (%)	4.9	1.7	2	10
Central Bank Policy Rate (CBPR)	5.5	0.75	4.5	7
Regulatory Capital (CAR)	14.5	3.2	8	25

Correlation Matrix

Table 3. The correlation between the key variables

Variable	Liquidity Risk	Size	Profitability	Leverage	NIM	GNPL	CBPR
Liquidity Risk	1	0.31	0.32	-0.35	0.38	-0.41	-0.28
Size	0.31	1	0.25	-0.28	0.22	-0.22	-0.05
Profitability (ROA)	0.32	0.25	1	-0.3	0.42	-0.36	0.12
Leverage	-0.35	-0.28	-0.3	1	-0.32	0.45	-0.22
NIM	0.38	0.22	0.42	-0.32	1	-0.41	0.06
Gross NPL (%)	-0.41	-0.22	-0.36	0.45	-0.41	1	-0.25
Central Bank Policy Rate	-0.28	-0.05	0.12	-0.22	0.06	-0.25	1

The correlation matrix of various financial and economic factors reveals several key relationships between them. Liquidity Risk is positively correlated with Size (0.310), Profitability (0.320), and Net Interest Margin (NIM) (0.380), while it shows a negative relationship with Leverage (-0.350), Gross NPL (-0.410), and the Central Bank Policy Rate (-0.280). Size, on the other hand, is positively related to Liquidity Risk (0.310), Profitability (0.250), and NIM (0.220) but negatively correlated with Leverage (-0.280) and Gross NPL (-0.220). Profitability (ROA) has positive correlations with Liquidity Risk (0.320), Size (0.250), and NIM (0.420) while showing negative associations with Leverage (-0.300) and Gross NPL (-0.360). Leverage exhibits a negative relationship with Liquidity Risk (-0.350), Size (-0.280), Profitability (-0.300), and NIM (-0.320) but is positively correlated with Gross NPL (0.450). NIM shows positive correlations with Liquidity Risk (0.380) and Profitability (0.420) but negative correlations with Leverage (-0.320) and Gross NPL (-0.410). Gross NPL (%) is negatively correlated with Liquidity Risk (-0.410), Size (-0.220), Profitability (-0.360), NIM (-0.410), and the Central Bank Policy Rate (-0.250) while showing a positive correlation with Leverage (0.450). Finally, the Central Bank Policy Rate exhibits weak positive correlations with Profitability (0.120) and NIM (0.060) but negative relationships with Liquidity Risk (-0.280), Size (-0.050), and Gross NPL (-0.250). This matrix highlights the varying strengths of relationships among these factors, with some showing more pronounced correlations (such as Leverage and Gross NPL) and others demonstrating weaker or more neutral associations (like Size and Central Bank Policy Rate).

3.3. Arellano-Bond GMM Estimation Results

Table 4. Presents the results of the Arellano-Bond estimation for liquidity risk determinants.

Variable	Coefficient	Std. Error	z-value	p-value
Liquidity Risk	0.53	0.06	8.83	0
Firm Size (Log Assets)	0.2	0.05	4	0
Profitability (ROA)	0.18	0.07	2.57	0.01
Leverage Ratio	-0.15	0.04	-3.75	0
Net Interest Margin (NIM)	0.25	0.08	3.13	0.002
Gross NPL (%)	-0.22	0.06	-3.67	0
Central Bank Policy Rate	-0.11	0.03	-3.67	0.001

Arellano-Bond Estimation for Liquidity Risk Determinants

The Arellano-Bond estimation method is used to analyze the determinants of liquidity risk, considering dynamic panel data. The results indicate the following relationships: Firm Size (Log Assets): Positively impacts liquidity risk (0.20, p = 0.000), suggesting that larger firms tend to have higher liquidity. Profitability (ROA): This shows a positive and significant effect (0.18, p = 0.010), indicating that more profitable firms experience higher liquidity. Leverage Ratio: Negatively associated with liquidity risk (-0.15, p = 0.000), meaning firms with higher leverage face lower liquidity. Net Interest Margin (NIM): Positively affects liquidity risk (0.25, p = 0.002), implying that higher margins contribute to better liquidity. Gross NPL (%): Negatively impacts liquidity risk (-0.22, p = 0.000), suggesting that higher non-performing loans reduce liquidity. Central Bank Policy Rate: Also negatively related (-0.11, p = 0.001), indicating that higher interest rates constrain liquidity. Overall, firm size, profitability, and NIM enhance liquidity, while leverage, non-performing loans, and interest rates reduce it. The statistical significance of these findings underscores the robustness of the model.

3.4. 2-SLS System Equation Results

Presents the 2-SLS system equation results for liquidity risk and profitability.

Table 4. Liquidity Risk Model

Variable	Coefficient	Std. Error	t-value	p-value
Regulatory Capital	0.32	0.09	3.56	0.001
Profitability (ROA)	0.21	0.05	4.2	0
Firm Size (Log Assets)	0.19	0.06	3.17	0.002
Leverage Ratio	-0.17	0.05	-3.4	0.001
Net Interest Margin (NIM)	0.22	0.07	3.14	0.002
Gross NPL (%)	-0.2	0.06	-3.33	0.001

2-SLS System Equation Results: Liquidity Risk Model

The Two-Stage Least Squares (2-SLS) estimation method is used to examine the determinants of liquidity risk, addressing potential endogeneity in the model. The results reveal the following relationships. Regulatory Capital (0.32, p = 0.001). Positively impacts liquidity risk, suggesting that firms with higher regulatory Capital maintain greater liquidity buffers. Profitability (ROA) (0.21, p = 0.000): Positively associated with liquidity risk, indicating that more profitable firms tend to have stronger liquidity positions. Firm Size (Log Assets) (0.19, p = 0.002): This shows a significant positive effect, implying that larger firms hold higher liquidity levels. Leverage Ratio (-0.17, p = 0.001): Negatively related to liquidity risk, meaning firms with higher leverage tend to have lower liquidity. Net Interest Margin (NIM) (0.22, p = 0.002): Positively influences liquidity risk, indicating that firms with higher interest spreads can sustain better liquidity. Gross NPL (%) (-0.20, p = 0.001): Negatively affects liquidity risk, suggesting that firms with higher non-performing loans experience liquidity constraints.

4. Interpretation and Implications

The results highlight that regulatory capital, profitability, firm size, and NIM enhance liquidity, while leverage and non-performing loans diminish it. These findings emphasize the importance of capital adequacy, profitability, and asset size in maintaining liquidity, whereas excessive leverage and bad loans pose risks. The 2-SLS approach ensures robustness by addressing potential biases from endogenous relationships.

Table 5. Profitability Model

Variable	Coefficient	Std. Error	t-value	p-value
Liquidity Risk	-0.15	0.05	-2.85	0.004
Firm Size (Log Assets)	0.12	0.04	3	0.003
Leverage Ratio	-0.1	0.03	-3.33	0.001
Net Interest Margin(NIM)	0.2	0.06	3.33	0.001
Gross NPL (%)	-0.12	0.05	-2.4	0.016

Profitability Model Results

The regression analysis examines the key determinants of profitability with the following findings. Liquidity Risk (-0.15, p = 0.004): Negatively impacts profitability, suggesting that higher liquidity risk reduces profitability. Firm Size (Log Assets) (0.12, p = 0.003): Positively influences profitability, indicating that larger firms tend to be more profitable. Leverage Ratio (-0.10, p = 0.001): Negatively associated with profitability, meaning highly leveraged firms experience lower profitability. Net Interest Margin (NIM) (0.20, p = 0.001): Positively affects profitability, showing that firms with higher interest margins achieve greater profitability. Gross NPL (%) (-0.12, p = 0.016): Negatively impacts profitability, implying that a higher proportion of non-performing loans reduces profitability. The results indicate that firm size and NIM enhance profitability, while liquidity risk, leverage, and non-performing loans negatively affect it. These findings highlight the importance of maintaining a balance between risk management and profitability-enhancing strategies.

Conclusion

The objective of this paper is to examine the factors that influence the liquidity risk of NBFCs. The NBFCs are chosen based on their Market Capitalization as reported by the NSE up until March 2024. To analyze the factors

affecting liquidity risk in these institutions, data spanning the past 11 years, from March 2013 onwards, has been collected from the annual reports of non-bank financial institutions. This study highlights the significant role of firm-specific and macroeconomic factors in determining liquidity risk in Indian NBFIs. The findings underscore the importance of regulatory capital, profitability, and the management of NPLs in mitigating liquidity risk. Effective liquidity risk management strategies and regulatory oversight are crucial for the stability and sustainability of NBFIs in India. The study highlights that liquidity risk is a significant challenge for Non-Banking Financial Companies (NBFCs) in India. Given their reliance on short-term borrowing and asset-liability mismatches, the ability of NBFCs to manage liquidity risk is crucial for their stability and operational sustainability. The findings emphasize that macroeconomic factors such as interest rates, inflation, and GDP growth significantly influence liquidity risk in Indian NBFCs. Changes in these variables can lead to fluctuations in the cost of borrowing and the availability of funds, thus impacting liquidity positions. A key conclusion is that the mismatch between the tenure of assets and liabilities is one of the primary factors contributing to liquidity risk. NBFCs often face challenges in managing short-term liabilities with long-term assets, creating a potential liquidity crunch. Regulatory policies, including capital adequacy norms and liquidity requirements introduced by the Reserve Bank of India (RBI), have a profound impact on the liquidity risk faced by NBFCs. The research suggests that a more stringent regulatory framework could help mitigate liquidity risks by enforcing better risk management practices. The volatility in financial markets and investor sentiment also play a significant role in liquidity risk. During market stress or downturns, NBFCs may struggle to raise funds, leading to higher liquidity risks. Financial ratios such as the current ratio, quick ratio, and debt-equity ratio were found to be useful indicators of liquidity risk. Poor financial health and low capital buffers correlate with higher liquidity risk for NBFCs. External shocks, such as changes in global economic conditions or credit downgrades, are significant risk factors for liquidity management. The research underlines that liquidity risk is often heightened in the aftermath of such shocks, particularly when NBFCs are unable to diversify their funding sources.

Findings

The study reveals that NBFCs in India exhibit varying degrees of sensitivity to liquidity risk depending on their size, market position, and funding model. Smaller NBFCs, with limited access to capital markets, tend to be more vulnerable to liquidity shocks. A diverse range of funding sources, including public deposits, bank loans, and capital market borrowings, are better equipped to manage liquidity risk. The research underscores the importance of diversification in reducing dependence on any single funding channel. The study identifies that advanced risk management tools and technology adoption play a crucial role in assessing and managing liquidity risk. NBFCs using automated risk management systems are found to be more effective in responding to liquidity challenges in real time. Effective corporate governance and management oversight are key findings that help NBFCs mitigate liquidity risk. Institutions with strong governance frameworks tend to have more robust liquidity management strategies, helping them cope with periods of financial instability. The research also points to the role of adequate capital reserves and well-defined contingency plans as essential components for liquidity risk management. NBFCs with higher capital adequacy ratios and clear liquidity buffers were found to be less prone to liquidity issues during stress periods. High levels of NPAs adversely affect the liquidity position of NBFCs. The study finds that institutions with higher NPAs face liquidity risk due to the reduced cash flow from their loan portfolios, thus increasing pressure on funding requirements. Government interventions and support schemes, especially during economic downturns, were found to play an important role in stabilizing liquidity conditions for NBFCs. Such support mitigates the impact of liquidity stress on these institutions.

Future Study

Further empirical investigation is warranted to elucidate the intricate interactions between NBFC-specific variables and macroeconomic determinants, with the objective of formulating more sophisticated models that encapsulate the complex interrelationships among these elements. The heterogeneity of liquidity risk across different categories and scales of NBFCs necessitates a more profound examination. It is imperative to ascertain the particular factors that contribute to liquidity risk in diverse categories of NBFCs and to analyze how these determinants fluctuate in accordance with their operational scale. This exhaustive review provides significant insights into the determinants influencing liquidity risk, thereby offering guidance for both scholarly inquiry and policy formulation within the financial domain. The results underscore the necessity for a comprehensive strategy towards liquidity risk that integrates both internal institutional characteristics and the wider macroeconomic landscape. Addressing the recognized deficiencies in the current body of research will substantially enhance the understanding of this pivotal component of financial stability. It is imperative to comprehend the distinct elements

that contribute to liquidity risk across various categories of Non-Banking Financial Companies (NBFCs) and to analyze how these elements fluctuate in accordance with their scale. The advancement of more sophisticated models that incorporate non-linear relationships and interactions among variables is of paramount importance for enhancing the precision of liquidity risk forecasts. Cutting-edge econometric methodologies, including machine learning algorithms, may be utilized to capture the intricate dynamics associated with liquidity risk more effectively. Furthermore, the implications of technological progress on the management of liquidity risk necessitate additional investigation. Innovations such as financial technology (fintech) and big data analytics possess the potential to both alleviate and intensify liquidity risk, thereby requiring a thorough assessment of their comprehensive impacts. A comparative evaluation of liquidity risk management strategies across diverse regulatory contexts is equally essential to identify exemplary practices and to assess the efficacy of varying regulatory frameworks. This analysis could entail cross-national comparisons to scrutinize how differing regulatory structures affect bank liquidity and overall financial stability. A detailed study of liquidity risk in the context of emerging markets and NBFCs is vital, as these sectors may encounter distinct challenges and opportunities in managing liquidity risk. Future research should focus on the specific factors influencing liquidity risk in these contexts and how they differ from those in developed markets. This comprehensive review offers valuable insights into the factors affecting liquidity risk, guiding both academic research and policymaking in the financial sector. The findings emphasize the need for a multifaceted approach to liquidity risk that incorporates both internal bank characteristics and the broader macroeconomic environment. Addressing the identified gaps in research will contribute significantly to a more complete understanding of this critical aspect of financial stability.

Credit Authorship Contribution Statement

Gaurav Kumar: Conceptualization; Software, Data curation, Investigation; Writing - original draft.
Murty AVN: Validation, Supervision, Methodology.
Srinivas Ravi Kumar Jeelakarra: Formal analysis.
S. Ganapathy: Visualization.
Savitha G. R.: Review and editing.
Sangram Padhy: Visualization.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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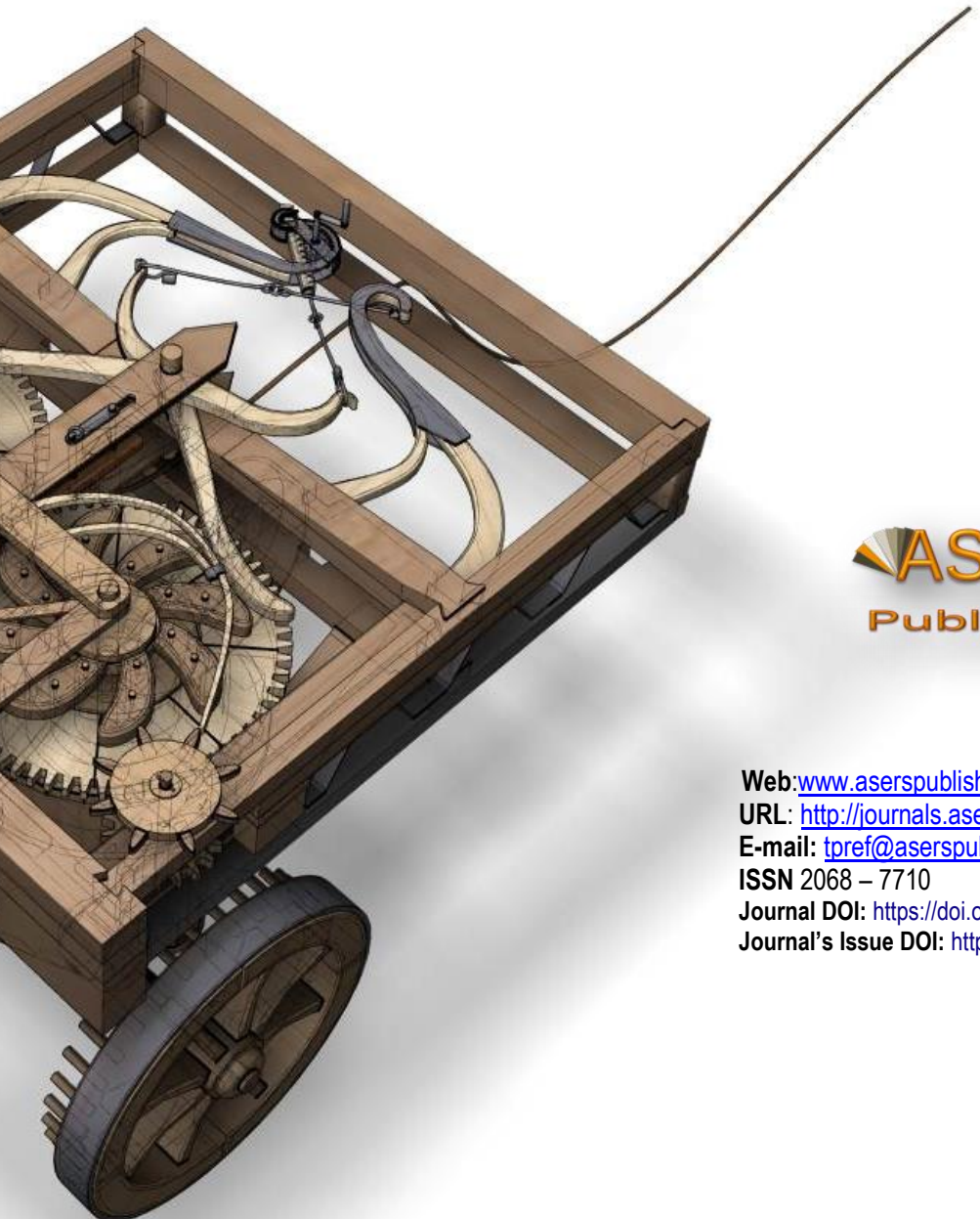

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