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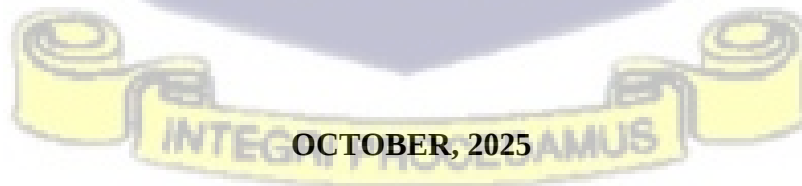
**STUDIES ON MONETARY POLICY, FINANCIAL TECHNOLOGY AND FINANCIAL
DEVELOPMENT: CONTEXTUAL EVIDENCE FROM EMERGING AND
DEVELOPING COUNTRIES**

BY

JAMES ATAMBILLA ABUGRE

(10552116)

**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA,
LEGON IN PARTIAL FULFILMENT FOR THE REQUIREMENTS FOR
THE AWARD OF DOCTOR OF PHILOSOPHY(PhD) FINANCE
DEGREE**



DECLARATION

I declare that this thesis is the result of my own research conducted under supervision. It has not been submitted for any academic award at this or any other institution. All references to the work of others have been appropriately cited. I take full responsibility for any shortcomings in this work.



JAMES ATAMBILLA ABUGRE

(CANDIDATE)

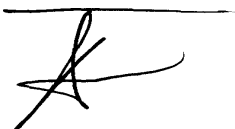
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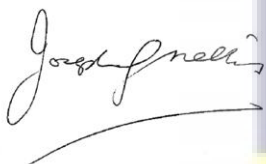
CERTIFICATION

We hereby certify that this thesis was supervised in accordance with procedures laid down by the University of Ghana.



Prof. Joshua Yindenaba Abor
(Lead Supervisor)

13th OCTOBER, 2025



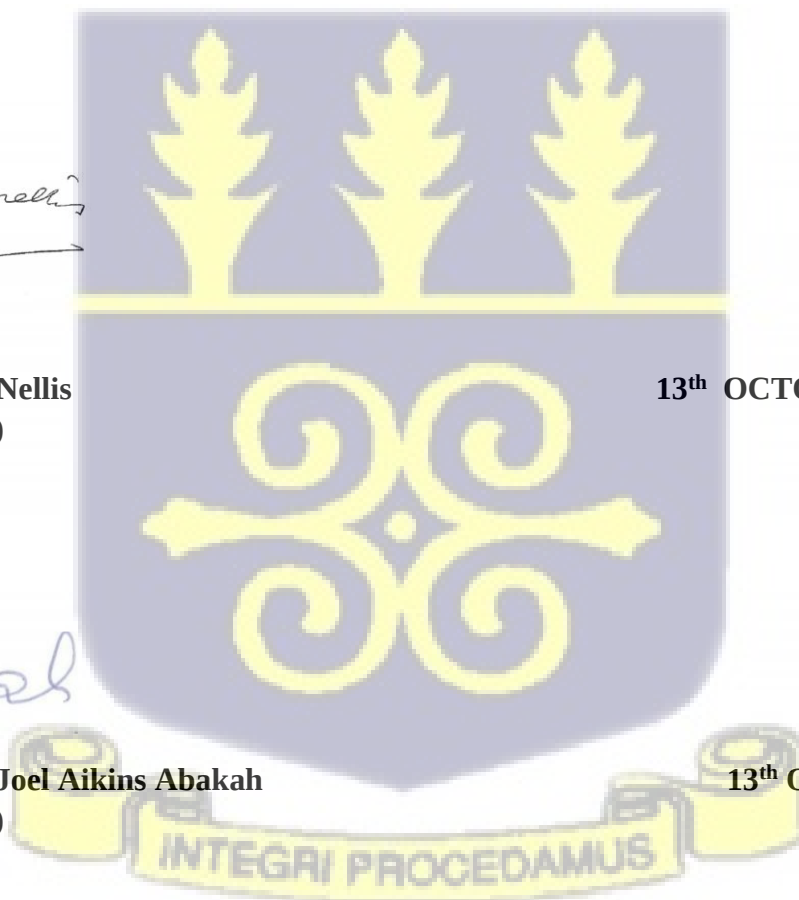
Prof Joseph G. Nellis
(Co-Supervisor)

13th OCTOBER, 2025



Dr. Emmanuel Joel Aikins Abakah
(Co-Supervisor)

13th OCTOBER, 2025



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DEDICATION

This thesis is dedicated to my parents. Your inspiring voices kept me going anytime I got tired and wanted to take a rest. I would simply place a call for a quick conversation with you and that becomes a stimulant for me to carry on.



ABSTRACT

This thesis presents a comprehensive analysis of monetary policy, financial technology, and financial development, with an emphasis on how they affect financial markets, economic and financial stability, and sustainable economic development. It is composed of three independent empirical studies.

Paper (I) examines the separate and combined effects of monetary policy and financial technology (FinTech) on financial development. Utilizing panel data from 82 countries worldwide, the study finds a negative correlation between financial development (especially in emerging and developing nations) and expansionary monetary policy, which is defined by a decrease in policy rates.

Additionally, the analysis finds that FinTech also exhibits an inverse relationship with financial development. When monetary policy and FinTech interact, they have an adverse effect on the financial system's stability, resilience and efficiency, thereby hindering financial development.

These findings provide a valuable addition to the body of extant literature by deepening the understanding of how monetary policy and FinTech independently and jointly influence financial development. The study also offers novel insights into the adverse effects that arise when these two elements are implemented concurrently within an economy (shedding light on potential policy implications for enhancing financial stability and growth).

Paper (II) examines the impact of monetary policy and financial technology (FinTech) on financial stability in emerging and developing countries, using panel data from 82 countries between 2000 and 2021. The study applies the 'Dynamic System Generalized Method of Moments (GMM)' to analyze the data on how the interplay between the two variables affect stability of the financial space in these countries. The empirical findings indicate that both monetary policy and

FinTech positively influence financial stability, which enhances the overall efficiency and resilience of the financial system. Additionally, the relationship that exists between monetary policy and FinTech serves as a positive moderating factor which further enhances financial stability in these countries.

The study also finds that both tight monetary policy and FinTech independently play a significant role in improving financial stability during periods of financial distress or crises. However, the combined effect of monetary policy and FinTech during banking crises has a detrimental impact (exacerbating liquidity shortages and systemic risks faced by financial institutions).

This study makes a substantial addition to the extant body of literature by providing new insights into the complex relationships between monetary policy, FinTech, and financial stability. It particularly sheds light on how these factors influence the financial system's stability and robustness in times of crisis, offering important implications for policymakers and financial regulators seeking to strengthen financial resilience in emerging and developing economies.

Paper (III) investigates the impact of monetary policy and financial technology (FinTech) on inflation in emerging and developing countries, utilizing panel data from 80 nations over the period 2000 to 2021. The study employs the 'Dynamic System Generalized Method of Moments (GMM)' to analyze the data. The empirical findings reveal that monetary policy has a negative effect on inflation (with tighter policy measures effectively curbing inflationary pressures). Similarly, increased access to financial services through FinTech contributes to lowering inflation by enhancing financial inclusion and market efficiency. However, the broader utilization of FinTech services is found to promote inflationary pressures, likely due to increased money circulation and heightened demand within the economy.

Moreover, the study finds that the interaction between monetary policy and access to FinTech services is positively correlated with price stability, suggesting that when these factors work together, they help maintain stable prices. Conversely, the combination of tight monetary policy and extensive FinTech utilization is connected with an overall decrease in inflation rates in emerging and developing countries.

This study adds to the body of empirical evidence by offering a nuanced understanding of how monetary policy and FinTech independently and jointly affect inflation. It further provides fresh perspectives on the role of technological financial innovations in influencing the stability of prices for goods and services (particularly in economies experiencing rapid financial and technological changes). These findings have significant implications for policymakers aiming to balance inflation control with financial innovation and inclusivity.

Key Words: Monetary policy, financial technology, financial development, inflation, macroeconomic stability, financial stability, financial inclusion, banking crisis, emerging and developing countries.



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ABBREVIATIONS/ ACRONYMS

ATM	Automated Teller Machine
BigTech	Big Technology
CAGR	Compound Annual Growth Rate
CAR	Capital Adequacy Ratio
DeFi	Decentralized Finance
FDI	Financial Development Index
FinTech	Financial Technology
GDP	Gross Domestic Product
GDPPCI	Gross Domestic Product Per Capita Income
GFC	Global Financial Crisis
GMM	Generalized Method of Moments
GPII	Global Partnership for Financial Inclusion
ICO	Initial Coin Offering
IFS	International Financial Statistics
IMF	International Monetary Fund
LCR	Liquidity Coverage Ratio
MENA	Middle East and North Africa
MGI	McKinsey Global Institute
MNOs	Mobile Network Operators
NPL	Non-Performing Loans
P2P	Peer-to-Peer
PCA	Principal Component Analysis
POP	Point-of-Purchase
POS	Point-of-Sale
PVAR	Panel Vector Autoregression
SMEs	Small and Medium-sized Enterprises
SSA	Sub-Saharan Africa
UK	United Kingdom

USA	United States of America
VAR	Vector Autoregression
VIF	Variance Inflation Factor

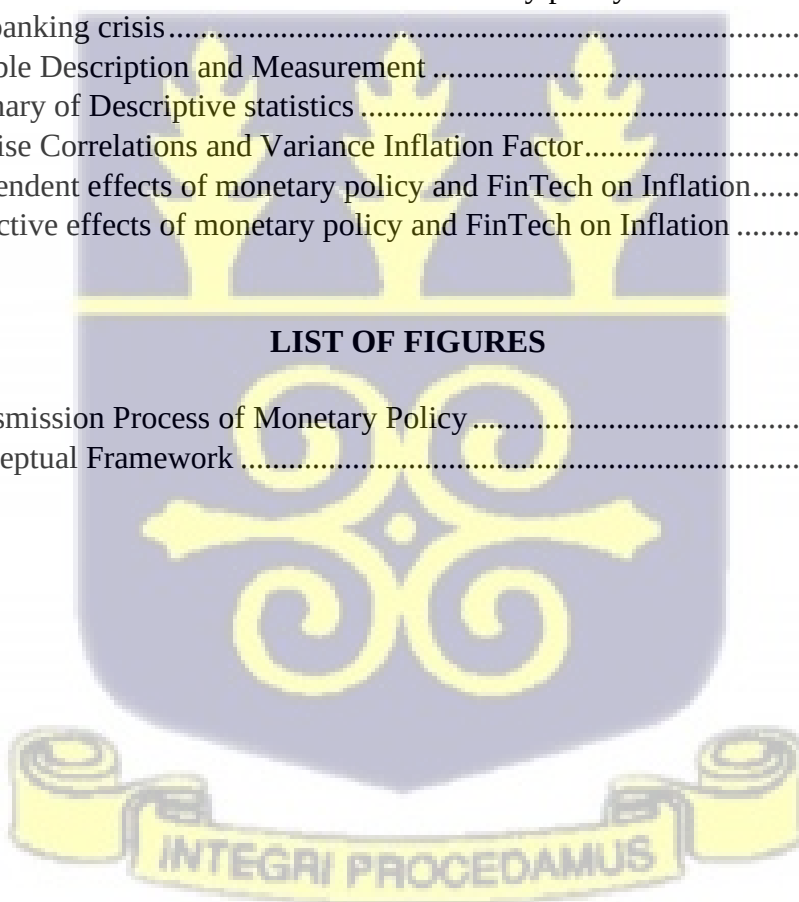


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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The global financial system has undergone a profound transformation over the past two decades, driven by rapid technological innovation, economic globalization, and evolving monetary policy frameworks. One of the most significant developments shaping this transformation is the rise of financial technology (FinTech), which is redefining how financial services are delivered, accessed, and regulated. At the intersection of these shifts lies financial development—the deepening and efficiency of financial markets, institutions, and instruments that underpin economic growth and macroeconomic stability. Understanding how FinTech and monetary policy interact to influence financial development has therefore become a central concern for policymakers and scholars alike.

The proliferation of FinTech across emerging and developing economies has been nothing short of transformative. Over the last two decades, innovations such as mobile money, digital lending, blockchain, and InsurTech have revolutionized financial transactions and intermediation. For instance, mobile money transaction values in Sub-Saharan Africa increased from less than US\$10 billion by 2010 to over US\$800 billion by 2022 (World Bank, 2023). Beyond payments, digital credit platforms and InsurTech applications have expanded access to credit, improved risk management, and supported small business resilience. Blockchain technologies are further reshaping the architecture of payment systems and capital markets, fostering transparency and efficiency in financial operations (IMF, 2022; Frost et al., 2023).

FinTech's rapid expansion has critical implications for monetary policy transmission. Traditionally, monetary policy operates through interest rate adjustments, reserve requirements, and open market operations to influence credit conditions, liquidity, and aggregate demand (Abor

et al., 2022). However, the integration of FinTech into financial systems is altering these transmission mechanisms. Digital payment platforms and decentralized finance systems have accelerated money circulation, reshaped liquidity flows, and increased the speed and complexity of policy transmission. These developments challenge central banks' ability to effectively monitor money supply, manage inflation, and maintain price stability, especially in economies where digital transactions occur largely outside the formal banking system (Ahamed & Mallick, 2019; Ozili, 2022).

FinTech therefore represents both an opportunity and a policy challenge. On one hand, it enhances financial inclusion, lowers transaction costs, and increases intermediation efficiency. By broadening access to savings, credit, and insurance, FinTech supports job creation, entrepreneurship, and poverty reduction—key drivers of inclusive economic growth. On the other hand, the unregulated expansion of digital finance introduces new risks, including cybersecurity threats, market concentration, regulatory arbitrage, and systemic vulnerabilities, which may undermine financial stability and complicate monetary management. The challenge for monetary authorities lies in adapting existing tools and frameworks to ensure that innovation strengthens rather than destabilizes the financial system.

The interaction between monetary policy, FinTech, and financial development has thus emerged as a pivotal issue in financial economics. Empirical evidence from emerging markets illustrates both the promise and complexity of this relationship. For example, mobile money platforms such as M-Pesa in Kenya and Paytm in India have boosted financial inclusion and liquidity circulation but also introduced new concerns about inflationary pressures, credit expansion, and banking sector competition (Beck et al., 2020). These developments suggest that the effects of FinTech are

context-dependent, varying across countries based on institutional quality, regulatory environment, and the level of financial maturity.

To capture these structural differences, this study adopts the World Bank's income-based classification to distinguish between emerging and developing economies. Emerging economies are typically middle-income countries with relatively advanced financial systems, diversified production bases, growing capital markets, and greater integration into global trade and finance (e.g., Malaysia, Brazil, and South Africa). In contrast, developing economies are predominantly low- and lower-middle-income countries characterized by less mature financial systems, higher levels of informality, limited credit access, and shallow capital markets (e.g., Ghana, Bangladesh, and Kenya). This classification is crucial, as the depth of financial infrastructure, regulatory oversight, and FinTech adoption vary significantly across these two groups, shaping the transmission of monetary policy and the nature of financial development outcomes.

In emerging economies, FinTech tends to complement monetary policy by enhancing payment efficiency, promoting financial deepening, and strengthening capital market linkages. Conversely, in developing economies, the effects may be more uneven: while digital financial inclusion improves liquidity circulation and access, weak institutional frameworks and regulatory gaps may exacerbate instability. These contrasts underscore the need for a differentiated analysis that recognizes FinTech's dual role as both an enabler of financial development and a potential source of systemic fragility.

Against this background, the present study investigates how FinTech and monetary policy jointly influence financial development, financial stability, and inflation across 82 emerging and developing economies from 2000 to 2021. The sample includes 25 African, 20 Asian, 15 Latin American, 10 European, and 12 other developing economies, ensuring balanced representation.

Data were sourced from the World Bank Global Financial Development Database (GFDD), IMF International Financial Statistics (IFS), and the Global FinTech Index.

The study is motivated by the need to understand the evolving macro-financial dynamics arising from digital transformation and policy adaptation. By analyzing the interactive effects of monetary policy and FinTech, this research contributes to the ongoing discourse on how economies can balance innovation with stability and design monetary frameworks that promote sustainable and inclusive financial growth in the digital era.

This study adopts a positivist research philosophy, emphasizing objectivity, quantifiable data, and empirically testable relationships. The design is quantitative and explanatory, seeking to examine cause–effect relationships between monetary policy, FinTech, and financial outcomes across multiple countries.

The use of secondary macroeconomic and FinTech data aligns with the positivist paradigm, as it allows for hypothesis testing through statistical modeling. A panel-data structure spanning 82 emerging and developing economies from 2000 to 2021 enables both cross-sectional and temporal analysis, capturing policy and technological variations over time.

1.2 Problem Statement

The adequacy of existing institutional frameworks and the tools available within an increasingly complex financial and economic landscape raises important questions for policymakers and financial institutions, especially in light of rising demands for financial stability, efficiency, and effective monetary policy (Lagarde, 2018). The evolution of financial technology has become a driver for change across global economies. Unlike earlier financial innovations, the recent FinTech revolution is characterized by its unprecedented speed, the extensive availability of data, and the

disruptive influence of BigTech companies and online platforms that do not belong to the conventional financial industry (Goldstein et al., 2019; Boot et al., 2021).

FinTech adoption has ramifications for the transmission of monetary policy and financial development as its influence and effect on the global economy grows. For instance, Buchak et al. (2018) argue that the market share of the non-bank financial intermediation increased globally from 14% to 38% between 2007 and 2015. Philippon (2016) and Lagarde (2018), argue that FinTech presents monetary policymakers with a "brave new world" to transform the financial ecosystem especially regarding financial inclusion and at the same time significant regulatory hurdles. These ramifications manifest through several channels. First, FinTech platforms alter the traditional monetary transmission mechanism by introducing new, often less regulated, credit channels that affect liquidity and interest rate responsiveness. Second, variations in regulatory quality and financial infrastructure across countries mean that FinTech's influence on monetary policy effectiveness is not uniform. In countries with robust institutional frameworks, FinTech enhances monetary policy transmission by expanding financial access and credit intermediation. Conversely, in weakly regulated economies, rapid FinTech expansion can exacerbate volatility and undermine monetary control.

Competition between banks and FinTech firms also introduces regulatory arbitrage where FinTech operates outside traditional supervision reducing the central bank's ability to influence credit conditions. This study therefore investigates the differentiated mechanisms through which FinTech competition, innovation, and regulatory gaps affect monetary policy transmission and financial development outcomes in emerging and developing contexts. Although research regarding the impact of FinTech on conventional financial services is expanding, little is known about how FinTech influences the transmission of monetary policy and financial development.

Since financial frictions are reduced and interest rates on nonbanks have a similar effect, adopting FinTech holds the ability to improve the monetary policy transmission mechanism and promote a strong and robust financial environment (Stein 2013, Rajan 2006). However, competition between traditional banks and FinTech, along with regulatory arbitrage, could also reduce the effectiveness of transmission with its attendant setbacks on financial inclusion and development (Buchak et al., 2018). Consequently, its function in monetary policy and financial development and intermediation remains an empirical gap across the globe.

Previously, monetary policy could be effectively implemented through traditional measures, such as altering the monetary base and reserve requirements so as to regulate the money supply.

However, the emergence of FinTech and innovations from nontraditional lenders may undermine the effectiveness of these policy measures. This risk arises when alternative credit providers enter the market under a more lenient regulatory framework, potentially limiting the impact and efficacy of conventional monetary policy. Lucas and Nicolini (2015), posit that the connection between prices and interest rates and monetary aggregates, including M1, M2, and the monetary base eroded in the 1980s and has never been restored. Therefore, central banks primarily use interest rates as a mechanism for market intervention when conducting monetary policy activities. As a result, monetary aggregates hold limited significance for policymakers implementing monetary policy. However, as it is clear in recent times this transmission route appears to be less efficient in a system with much liquidity. Furthermore, Lucas and Nicolini (2015) contend that minor adjustments to the reserve supply will not have an effect on interest rates as is the case in the United States (if there is sufficient liquidity moving through the system). To address this problem, the U.S. Federal Reserve has introduced new rates, including tools such as the “Interest on Excess Reserves (IOER) and Overnight Reverse Repurchase Agreements (ON RRP)”, which are

employed to influence banks' borrowing and lending behaviors. As traditional banks face increasing competition from credit-creating entities in the FinTech sector, the tools central banks use to implement monetary policy appear to be undergoing significant evolution. Together, these shifts seem to impact both the efficiency of monetary policy execution as well as financial markets.

The main risks connected to FinTech include those related to regulatory policy, firm management, technological networks, monetary policy, and illicit financial activities (Yan, 2013). However, based on experience with international development, the "monetary policy risk" (which includes issues with financial stability and monetary policy) has the strongest impact on digital finance and the health of the macroeconomy. Several detrimental consequences of digital finance on money supply, demand, and the transmission of monetary policies are measured by monetary policy risk. This further undermines the mechanism's ability of monetary policy changes to support the actual economy and the efficacy of macro-control including financial development.

Empirical study has shown that monetary policy and FinTech have an enormous impact on financial stability, exchange rate movements, price stability, financial development and the general well-being of the populace (Giorgio & Rotondi, 2011; Evans, 2016; Anarfo et al., 2019; Lapukeni, 2015; Mbutor & Uba, 2013; Tonuchi et al., 2021) in different monetary policy regimes and across different economies and regional blocs. Yet, there remain so many inconsistencies and mixed findings on the exact nature and impact of how monetary policy and/or FinTech individually or jointly impact (s) the objectives of macroeconomic variables of price stability, financial development, exchange rate, inequality and wellbeing and financial stability as evidenced by many research results (see: Tonuchi et al., 2021; Mehrota & Yetman, 2014; Saraswati et al., 2020; Ascari et al., 2011; Lapukeni, 2015; Amatus & Alireza, 2015; Dienillah, Azka & Anffraeni, 2016; Hannig & Jansen, 2010).

The reason for these inconsistencies and mixed findings is attributed to the focus of the studies on emerging and developing economies with ineffective capital markets and inadequate data. Additionally, it is caused by differences in structural and institutional frameworks between developed and developing countries. Importantly, the moderating effect of monetary policy and FinTech on the macroeconomic variables over different regimes, market periods, and economies is limited, except for Mehrota and Yetman (2014) who investigated the connection between financial inclusion and monetary policy in 130 countries worldwide, using both highly developed and less developed financial systems without considerations on shocks, policy regimes amongst others. It appears there is no study available that has delved into the joint effect of monetary policy shocks and FinTech adoption on the objectives of monetary policy and financial development on regional and bloc basis – which this study seeks to undertake.

While there is an expanding corpus of studies on the relationships between FinTech, monetary policy, and financial development, much of the literature tends to be concentrated in specific regions or contexts, particularly in developed economies. A significant gap exists in the research literature on how these dynamics play out in developing and emerging markets, where financial systems are less mature, and regulatory environments are less robust. More studies are needed to explore how FinTech can be leveraged to enhance monetary policy effectiveness and financial development in these contexts, where traditional financial infrastructure is often underdeveloped.

Few studies have also explored how FinTech innovations are influencing the transmission mechanisms of monetary policies. Studies by Vigna and Casey (2015) and Auer and Claessens (2018) discuss how ‘digital currencies, blockchain technology, and decentralized finance (DeFi)’ platforms are changing the landscape of monetary policy transmission. These technologies can impact the avenues through which policy measures are implemented, such as interest rate changes,

impact the broader economy. However, there is still a lack of comprehensive empirical research on how FinTech specifically alters different channels of transmission (credit, interest rate, and exchange rate channels). The existing studies tend to be theoretical or conceptual, often lacking robust empirical evidence that quantifies these changes. Additionally, there is a need for more research on how these changes vary across different financial systems, particularly in countries with varying levels of FinTech adoption and integration.

Financial crisis, uncertainty in the financial markets, exchange rate swings, inflationary pressures, interest rate hikes, unemployment and many other economic challenges over the years have plagued most developed and developing economies, resulting in frequent changes in monetary policies by monetary authorities. However, since monetary policy is increasingly becoming the policy of choice all over the world, exploring how financial development, FinTech, and monetary policy risks relate to each other in developing and emerging economies is relevant and crucial for monetary authorities, investors, scholars, practitioners, and policymakers. FinTech's potential to contribute to financial development by increasing efficiency, lowering costs, and fostering competition is well-documented in studies by Philippon (2016) and Thakor (2020). However, these innovations can also introduce new risks to financial stability. For example, Gomber et al. (2018) and Goldstein et al. (2019) have pointed out that FinTech, particularly in areas like peer-to-peer lending and cryptocurrency markets, can lead to increased volatility, fraud, and the potential for financial contagion.

Although a growing body of literature has explored the independent effects of monetary policy and FinTech on financial development, stability and inflationary pressures as discussed above, their interactive and joint effects remain insufficiently studied. Most existing studies examine FinTech's role in financial inclusion or innovation without explicitly linking it to monetary policy

transmission mechanisms or macro-financial outcomes. This creates a conceptual gap in understanding how FinTech innovations moderate rather than merely mediate the effects of monetary policy on financial development, stability, and inflation.

Furthermore, previous research tends to assume a uniform effect of FinTech across economies, overlooking the structural heterogeneity between emerging and developing countries. Institutional quality, regulatory capacity, and financial infrastructure vary widely, potentially altering how FinTech influences monetary policy effectiveness. This study therefore addresses these gaps by analyzing cross-country variations and employing a dynamic panel methodology capable of isolating both direct and interactive effects.

Finally, while much of the extant literature associates FinTech with enhanced efficiency and inclusion, emerging evidence suggests it may also generate instability through increased competition, regulatory arbitrage, and unmonitored liquidity expansion. The empirical contradictions in prior studies underscore the need for a systematic investigation into whether FinTech acts as a stabilizing or destabilizing force within the monetary policy framework, particularly in times of financial stress or crisis.

1.3 Objectives of the study

The study seeks to address three empirical research objectives as follows:

- i. To examine the independent and interaction effects of monetary policy and FinTech on financial development.
- ii. To investigate the independent and joint effects of monetary policy and FinTech on financial stability.

- iii. To examine the independent and combined effects of monetary policy and FinTech on inflation.

1.4 Study Scope and Limitations

The study relied on data from developing and emerging countries for the period- 2000 to 2021. The choice of the periods for the data is exclusively based on data availability. Even though this thesis is the first to provide empirical investigation on the independent and joint effects of monetary policy and FinTech on the various macroeconomic variables, there are few limitations which are discussed below:

First, the study used only one aspect of FinTech – mobile money, to represent FinTech innovations which may not be comprehensive and encompassing since FinTech is broad, widespread and varying. Mobile money, which typically involves transferring money, making payments, and accessing mobile phone-based financial services, represents only a fraction of the broader FinTech ecosystem. FinTech covers a wide range of technological innovations, comprising but not restricted to mobile money. These include digital lending platforms, cryptocurrencies, blockchain technology, robo-advisors, decentralized finance (DeFi), insurtech, regtech, and digital banking services. Focusing solely on mobile money overlooks the diversity of these innovations, each of which has distinct characteristics, benefits, and risks. By limiting the focus to mobile money, the study may fail to capture how other FinTech innovations are influencing different dimensions of the financial sector, such as capital markets, insurance, asset management, and cross-border payments. This narrow representation could result in an incomplete understanding of how FinTech as a whole is transforming financial systems, the challenges it poses to regulatory frameworks, and its overall impact on monetary policy efficacy and financial development.

Second, monetary policy relies on various channels of transmission, such as the credit, interest rate, exchange rate, and expectations channels. While mobile money can influence these channels by enhancing payment efficiency and financial inclusion, it does not fully represent the ways in which other FinTech innovations are affecting monetary policy transmission mechanisms. For example, digital lending platforms can change credit allocation dynamics, while cryptocurrencies and decentralized finance platforms can introduce new complexities to the control of money supply and financial stability. Studies which focus exclusively on mobile money may underestimate or ignore these broader impacts, leading to an incomplete analysis of how FinTech is altering the landscape of monetary policy and its effectiveness in achieving macroeconomic objectives.

Last, the FinTech landscape is constantly evolving, with ongoing innovations giving rise to new products and services that transform the financial sector. Mobile money, while significant, represents an earlier wave of FinTech innovation that has become more established over time. Newer FinTech developments, such as artificial intelligence in financial services, smart contracts, and quantum computing in trading algorithms, are rapidly emerging and will likely play increasingly important roles in shaping financial systems in the future. Studies that limit their focus may fail to account for these evolving trends, potentially rendering the conclusions short-lived as the FinTech landscape continues to change. This may affect the forward-looking insights and anticipation of how future FinTech developments might impact monetary policy, financial development, and economic stability.

Despite these limitations, this thesis still provides more parsimonious results at least in eliciting debates on the potential contribution of FinTech and monetary policy effects in the development of financial system, economic stability in developing and emerging countries. This is because the study offers a deeper comprehension of the implications of FinTech and monetary policy on

financial development, inflation and financial stability. These parameters are key in the advancement of sustainable economic stability in any economy especially developing and emerging ones who require stable macro variables and parameters such as the above to sustain their growth and development. Hence, the relevance and significance of this study cannot be over emphasized despite its limitation.

1.5 Significance of the Study

A study on the intersection of monetary policy, FinTech, and financial development is highly significant for emerging and developing countries due to the unique challenges and opportunities they face. The study explores how monetary policy and FinTech impact financial stability, price stability and financial development in emerging and developing countries. This topic is particularly relevant given the swift technological advancements and the rising demand for increased investment to promote sustainable development and economic progress, while also offering alternative policy solutions to reduce financial system fragility.

This study also investigates the distinct impact of monetary policy (represented by the policy rate) and FinTech (measured using a FinTech index based on supply-side and demand-side variables) on the stability of financial systems. It delves specifically into the soundness and resilience of the banking sector. Additionally, the study assesses how monetary policy interaction with FinTech adoption contributes to fostering a stable financial system.

No existing research shows how the interaction between monetary policy and FinTech, along with their concurrent implementation, impacts financial development within an economy's financial system. This research fills this gap in the body of literature and offers new policy recommendations for central banks, which now also focus on implementing macroprudential policies to achieve

financial stability and development through a policy mix that promotes financial inclusion and credit intermediation.

Given the above narrative, a conclusive statement can be made that this study has contributed to the existing literature on financial development and economic stability in light of the findings and theories proposed. Similarly, it has provided some new insights in policy formulation as to how developing countries can utilize the FinTech and monetary policy independently and simultaneously for a successful economic take-off and financial development to better the lives of ordinary citizens through the provision of efficient financial services.

1.6 Structure of the Study

The study is organized into six chapters, detailed as follows: Chapter One introduces the study, covering the background, problem statement, and objectives, scope and limitations, significance and structure of the study. Chapter two provides the stylized facts to the background overview of the main variables of the study including monetary policy, FinTech, inflation and financial development and stability vis a vis their interrelationships with each other in an economy. Chapter three presents the study's first objective and offers empirical explanations to the behaviour of the variables under study in both developing and emerging economies. It provides six sections, including the introduction, theoretical and empirical literature review, data sources and methodology, empirical results and discussion, as well as the conclusion, policy implications, and recommendations. Chapter four examines the second objective of the study (The effects of monetary policy, FinTech on financial stability during crisis: contextual evidence from emerging and developing countries). Again, this chapter provides a comprehensive discussion on the nexus between monetary policy, FinTech and financial stability by leveraging on banking sector during periods of normal and crises. It has six parts. It provides an introduction, theoretical and empirical

review of the literature. Data source and methodology, empirical results and discussion as well as the conclusion and policy implications and recommendations are also presented. Chapter five investigates how monetary policy and FinTech influence price stability in an economy. Here, the focus is to examine the interrelationship between monetary policy and inflation and the demand and supply sides of FinTech's influence on inflationary pressures. The study also sought to investigate the synergies, trade-offs and interlinkages between and among the various sides of FinTech on inflation. It has six parts. First, introduction; second, review of the literature; third, data source and methodology; fourth, empirical strategy; fifth, results and discussion; and, finally, conclusion and policy implications and recommendations. The sixth chapter provides the summary, conclusion and policy implications of the study. The chapter outlines the study's main findings and contributions and offers suggestions for further research.



CHAPTER TWO

MONETARY POLICY, FINANCIAL TECHNOLOGY AND FINANCIAL DEVELOPMENT: STYLIZED FACTS

2.1 Introduction

This chapter offers an analysis of trends and the behaviour of key variables in the research study. It provides an overview of monetary policy, FinTech, and financial development and inclusion, exploring how the interaction and combination of these factors influence the financial system, as well as economic growth and development. The interplay between monetary policy and FinTech is discussed whereas the intricacies of monetary policy and financial development interaction are also examined. Stylized facts on FinTech are highlighted as well as the interplay between FinTech and financial development. The chapter concludes with policy implications and recommendations.

2.2 Monetary Policy

Monetary policy encompasses the activities and processes undertaken by a country's government, central bank, or monetary authority to limit the money supply, regulate credit availability, and manage interest rates to achieve specific goals aimed at promoting economic growth, maintaining financial stability, controlling inflation, stabilizing currency and reducing unemployment. The efficacy of monetary policy is largely influenced by the relationship between the cost of borrowing and the money supply. In many developing and emerging economies, there has been a gradual alignment of monetary policies towards the primary goal of price stability (Heintz & Ndikumana, 2011). This trend is evident in countries such as South Africa, Ghana, Mauritius, and Uganda, which have adopted inflation-targeting frameworks (Klutse et al., 2022). These nations prioritize controlling domestic credit within their monetary policies to manage domestic demand and maintain price stability. This approach is consistent with the views of monetarists such as Milton

Friedman, and Friedrich Hayek, who argued that restricting money supply growth is a more effective way to control inflation than demand-management policies (Friedman & Schwartz, 1965; Hayek, 1976).

Monetary policy is primarily categorized into two types: loose and tight. Loose monetary policy is typically used during economic downturns or recessions. In this approach, the central bank lowers the cost of credit and increases the money supply to boost economic activity. By reducing interest rates, the cost of credit decreases, which encourages business investments and consumer spending, potentially leading to job creation and economic growth. This policy may also involve quantitative easing, where the central bank directly injects liquidity into the economy by purchasing financial assets. Conversely, during periods of elevated inflation or economic overheating, contractionary monetary policy is implemented. This typically involves raising interest rates and reducing the money supply to limit excessive spending and investment. “By increasing interest rates, the cost of borrowing rises, which reduces consumer spending and business investment, ultimately slowing inflation and tempering economic growth” (Klutse et al., 2022).

Monetary authorities utilize both conventional and unconventional tools to conduct monetary policy. Conventional tools, such as “open market operations, reserve requirements, policy rates, and moral suasion, are typically employed during periods of economic stability”, where there are no major shocks or crises (Friedman & Schwartz, 1965). These tools are most effective in maintaining economic stability under normal conditions. However, during economic crises, such as the 2020 COVID-19 pandemic, conventional monetary tools may prove insufficient for stabilizing the economy. In such scenarios, unconventional tools become necessary. These may include liquidity provision measures, asset purchases (Quantitative Easing), and expectations

management strategies (such as Forward Guidance, which involves setting a zero-interest rate policy for both short- and long-term rates).

Monetary policy implementation involves a range of strategies that central banks and monetary authorities use to achieve specific economic objectives, including curbing inflation, propelling economic growth, maintaining full employment, and enhancing financial stability. The choice of strategy is influenced by the economic context, the institutional framework, and the central bank's objectives. Central banks typically utilize both operating and intermediate targets to fulfill their mandates. These targets serve as benchmarks to evaluate the effectiveness of the policy tools employed (Klutse et al., 2022).

An operating target refers to a specific indicator, such as inflation, interest rates, or other financial metrics, that a central bank seeks to achieve using its monetary policy instruments. These targets are crucial for guiding policy decisions and adjusting the money supply to meet desired economic goals. By establishing and tracking these targets, the central bank can evaluate the efficacy of its actions and implement necessary adjustments. For example, while the Federal Reserve oversees the broader economy, it does not directly control variables like GDP or consumer prices. Instead, it selects intermediate targets that provide a clearer gauge of economic performance. These targets, which are closely connected to broader economic outcomes, help manage inflation or deflation by influencing the money supply. Operating targets are chosen because they are easily measurable and adjustable, allowing the central bank to effectively concentrate its energies on attaining its policy goals and maintaining economic stability (Anarfo et al., 2022).

Intermediate targets, in contrast, are economic and financial factors that the central bank can shape using its policy instruments., although they are not the primary objectives of monetary policy.

These targets serve as a connection between the central bank's short-term initiatives and its long-term objectives, including maintaining inflation low and achieving full employment. Intermediate targets are often adjusted to reflect shifts in policy direction, ensuring a predictable trajectory toward the central bank's stated objectives. These targets often include variables like economic growth, interest rates, and money supply, which guide the central bank's interventions and bridge the gap between policy instruments and final outcomes. Among the intermediate goals are shifts in 'interest rates, the money supply, and employment levels' while central banks aim to achieve overarching economic goals such as 'high employment, currency stability, low inflation, and sustainable economic growth'—they do not directly control prices, long-term interest rates, or private-sector employment levels. Instead, they use instruments such as reserve requirements, open market activities, and discounting to sway intermediate objectives that are closely linked to their ultimate objectives.

Understanding how monetary policy decisions influence the broader economy is crucial and remains a topic of continuous discussion among economists and researchers. The effectiveness and thoroughness of monetary policy transmission can vary significantly across different economies due to institutional differences and level of financial inclusion and development (Anarfo et al., 2022). Various theories have been proposed to explain how these transmission mechanisms work. These include the Workhorse mechanism, the credit channel and the exchange rate mechanism. In this discussion, the three widely recognized frameworks that explain the transmission of monetary policy, as outlined in Figure 2.1. are examined.

These frameworks share a common starting point- the monetary policy transmission process begins when monetary authorities alter their policy stance. For example, a contraction in the monetary base might result from a policy aimed at adjusting rates of short-term interest to curb

inflationary pressure so as to stabilize the economy. This, in turn, affects the rate at which commercial banks lend to each other (interbank rate).

One of the key transmission mechanisms is known as the "Workhorse mechanism." This model suggests that a contractionary monetary policy, which leads to higher interest rates, will impact economic output by increasing the cost of borrowing. As borrowing becomes more expensive, both businesses and individuals minimize their spending and investment respectively, resulting in a drop in output and general economic activity.

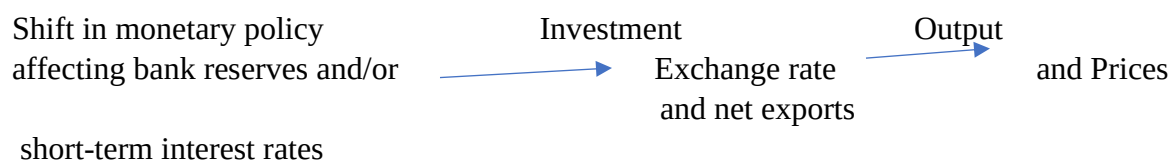
Another important channel of transmission is the exchange rate channel. Through this mechanism, monetary policy influences the economy by affecting net exports. A rise in the supply of money generally results in lower interest rates, which may cause the exchange rate to appreciate in value.

While a stronger currency makes imports cheaper, it reduces the competitiveness of exports, ultimately decreasing net exports and, consequently, aggregate demand.

Finally, the credit channel, also known as the bank lending channel, highlights the critical role that banks and other financial institutions play in monetary policy transmission process. In this mechanism, a reduction in the money supply leads to a decline in bank deposits, which limits the ability of banks to extend loans to deficit agents. As a result, businesses and households face credit constraints, reducing investment and consumption, which further dampens economic output.

Together, these three frameworks provide a thorough comprehension of how changes in monetary policy can cause a ripple effect through the economy- affecting interest rates, exchange rates, bank lending, and ultimately, economic activity and the economy's financial stability.

Figure 2.1: Transmission Process of Monetary Policy



2.2.1 Monetary Policy Reaction Functions

2.2.1.1 McCallum's Rule

The McCallum Rule, developed by Bennett McCallum, is a monetary policy framework designed to stabilize “nominal GDP by regulating the growth rate of the money supply”. This rule emphasizes key monetary aggregates, particularly the monetary base, which consists of bank reserves and currency in circulation. By managing the growth rate of the money supply, the McCallum Rule aims to support sustainable economic growth while keeping inflationary pressures in check (McCallum, 1988).

Unlike other rules that target inflation or interest rates directly, the McCallum Rule places nominal GDP at the center of its policy considerations. It operates under the preposition that fluctuations in the money supply can directly influence economic activity, thus providing a way to manage both inflation and output gaps. When nominal GDP deviates from its target, the central bank is expected to intervene by adjusting the money supply accordingly.

For instance, if nominal GDP falls below the target level, the rule prescribes an expansionary monetary policy. This liquidity infusion into the economy is designed to stimulate demand by making borrowing cheaper and encouraging spending and investment. As a result, economic activity should accelerate, and GDP should rise toward its target. Conversely, if nominal GDP exceeds the target, “the central bank would lower the money supply's rate of expansion, cooling down the economy and preventing inflationary pressures” (McCallum, 2000).

The underlying principle of the McCallum Rule is its reliance on monetary aggregates as the primary tool for economic stabilization. This differs from other widely discussed rules, such as the Taylor Rule, which focuses on adjusting “short-term interest rates to manage inflation and output” (Taylor, 1993). McCallum's approach is particularly useful in environments where controlling inflation is a priority, but it also provides a clear response mechanism when the economy is underperforming relative to its potential.

One of the advantages of the McCallum Rule is its flexibility in dealing with different economic conditions. By directly linking monetary policy to nominal GDP, it offers a dynamic framework that can adjust to both inflationary and deflationary pressures. Additionally, the rule encourages economic growth to occur naturally by avoiding excessive interventions unless there is a deviation from the nominal GDP target (McCallum, 1999).

However, there are also limitations to the McCallum Rule. It makes the assumption that nominal GDP and monetary aggregates have a steady relationship, which may not always hold true, especially in the context of innovations in finance that present new business models and promote financial inclusion or changes in money demand that could be triggered by economic dynamics. In modern economies, the transmission of monetary policy through traditional aggregates like the monetary base may be less predictable due to the growth of digital money, FinTech, and the changing role of banking systems. Furthermore, central banks today tend to focus more on interest rates than money supply growth as their primary tool for economic management (Woodford, 2001).

2.2.1.2 Taylor's Rule

The Taylor Rule is a widely recognized monetary policy guideline designed to help central banks manage inflation and stabilize the economy by forecasting interest rates. Developed by John B. Taylor in 1992 and formalized in his seminal 1993 paper, "Discretion Versus Policy Rules in Practice," the rule provides a formulaic approach to setting short-term “interest rates based on deviations in inflation and economic output” (Taylor, 1993). The Taylor Rule’s practical application is most commonly seen in its use by central banks, such as the Federal Reserve, to determine appropriate adjustments to “interest rates in response to changing economic conditions”.

At its core, the Taylor Rule provides guidelines for central banks on how to adjust “short-term nominal interest rates based on two key factors: the deviation of inflation from its target rate and the gap between actual GDP growth and its potential or long-term trend”. Specifically, the rule indicates that when inflation exceeds the central bank’s target or when GDP grows at a faster pace than its “potential, the central bank should raise interest rates”. Conversely, if inflation falls below the ‘target or if GDP growth lags behind potential’, the rule recommends lowering interest rates to stimulate economic activity (Mishkin, 2000).

The mathematical representation of the Taylor Rule is as follows:

$$I = R^* + \pi + 0.5(\pi - \pi^*) + 0.5(Y - Y^*)$$

Where:

I is the nominal interest rate or the federal funds rate,

R^* is the real federal funds rate or equilibrium interest rate,

π is the current inflation rate,

π^* is the target inflation rate,

Y is the logarithm of real output,

Y^* is the logarithm of potential output (the economy's long-term sustainable growth rate)".

This formula assumes that central banks base their decisions on the rational expectations hypothesis, meaning that economic agents create projections for the state of the economy in the future (such as inflation) and adjust their behavior accordingly. The Taylor Rule, therefore, provides a methodical, structural and rule-based approach to monetary policy, as opposed to discretionary decision-making, providing transparency and predictability in the way central banks react to economic fluctuations.

In recent years, the application of the Taylor Rule has evolved as central banks face new challenges such as low inflation, the lower bound of zero for interest rates, and the rise of financial innovations like FinTech. Some economists argue that the Taylor Rule should be adjusted or supplemented with additional factors, such as financial stability concerns, to more accurately depict the intricacies of the contemporary economy (Orphanides, 2003).

The simplicity and clarity of the Taylor Rule are two of the main advantages it offers. By offering a clear formula for setting interest rates, the rule provides a framework that both policymakers and market participants can use to anticipate future policy moves. This predictability can help reduce uncertainty in financial markets, as businesses and investors are better positioned to make informed borrowing decisions, lending, and investment based on expected interest rate movements.

Additionally, the Taylor Rule helps central banks strike a “balance between controlling inflation and fostering economic growth”. By adjusting “interest rates in response to changes in both

inflation and output”, it enables central banks to pursue a “dual mandate of maintaining price stability and achieving maximum employment”, which is particularly relevant for the Federal Reserve.

However, while the Taylor Rule has been influential, it is not without limitations. One key criticism is that it relies on accurate estimates of ‘potential output’ (Y^*) and the ‘equilibrium real interest rate’ (R^*), both of which are difficult to measure in real time. Misestimating these values can lead to inappropriate policy decisions, such as setting interest rates too high or too low.

Moreover, the Taylor Rule assumes a relatively “stable relationship between inflation, output, and interest rates”, which may not always be case, particularly during periods of economic instability or financial crises. For instance, during the 2008 Global Financial Crisis, the Federal Reserve lowered interest rates to near zero; a move that deviated from the Taylor Rule’s prescription (as the rule would have suggested higher rates based on inflation data alone). This highlights the need for flexibility in monetary policy, particularly during periods of economic stress.

Nevertheless, the Taylor Rule remains an essential tool in the toolkit of central banks. While it may not be followed strictly, its principles continue to guide monetary policy decisions and provide a valuable benchmark for assessing the appropriateness of interest rate settings.

2.2.2 Monetary Policy Frameworks

Central banks implement monetary policy through structured frameworks that guide their decision-making processes and policy actions. Choosing a specific framework function as a strategic roadmap, helps central banks determine appropriate interventions to stabilize the economy. These frameworks not only assist in the decision-making process but also play a critical role in

communicating the central bank's policies and intentions to the public, fostering transparency and managing expectations (Blinder, 1998). By clearly outlining the rationale behind their actions, central banks can enhance their credibility and maintain market confidence which is essential for the effective transmission of monetary policy.

Central banks generally operate within three main monetary policy frameworks: 'monetary aggregate targeting, inflation targeting, and exchange rate targeting'. The framework selection is determined by the particular economic goals of the central bank, such as controlling inflation, stabilizing the currency, or fostering sustainable economic growth.

2.2.2.1 Monetary Aggregate Targeting

This regime focuses on controlling and regulating a selected monetary aggregate's growth rate such the money supply (M1, M2) to influence inflation and broader economic activity. This approach is predicated on the premise that the sustained expansion of an economy is directly tied to the money supply. Central banks operating under this regime direct their policy tools toward managing these aggregates, which are seen as the primary drivers of inflation (Friedman, 1968). The main premise is that the central bank may indirectly manage inflation by altering the money supply which will result in pricing levels changing proportionately.

This framework gained prominence in the 1970s and 1980s, heavily influenced by the monetarist theories of Milton Friedman, who famously argued that "inflation is always and everywhere a monetary phenomenon." Central banks sought to stabilize prices and foster economic growth by targeting the supply of money. For example, if inflationary pressures were rising, the central bank could reduce the money supply, thereby lowering demand and stabilizing prices.

However, the effectiveness of monetary aggregate targeting has been increasingly questioned, especially in light of financial innovations and changes in how money circulates within economies. The relationship between the money supply and inflation is now less predictable due to developments in financial technology and the spread of digital currencies. These innovations have altered money velocity (the speed at which money changes hands through the economy) thereby making it harder to maintain the intended link between monetary aggregates and inflation (Bernanke & Mishkin, 1997).

Additionally, selecting the appropriate monetary aggregate to target has proven to be a challenge. While monetary aggregates were once seen as reliable indicators of inflationary trends, the introduction of new financial instruments and products has diluted their effectiveness as a tool for managing inflation. In today's economic landscape, the complexity of financial systems has rendered the traditional relationship between money supply and inflation less clear-cut. This has led some central banks (particularly in advanced economies) to shift toward frameworks like inflation targeting, which rely on interest rates rather than money supply control as the primary policy tool. Nevertheless, in some emerging markets, monetary aggregate targeting continues to be used in conjunction with other policy instruments to stabilize inflation and maintain economic growth.

2.2.2.2 Exchange Rate Targeting

Exchange rate targeting is a central bank policy designed to maintain a stable value for the local currency by deliberately aligning its exchange rate with a foreign currency or a group of currencies. This policy framework is particularly effective for open economies that are small and mainly

dependent on international trade, as it provides stability in foreign exchange markets, reduces uncertainty, and fosters economic growth. By stabilizing the currency's value to its major trading partners, the environment for investment and trade can be made more predictable by central banks which is crucial for sustaining economic development (Alagidede & Mauzu, 2016).

In an exchange rate targeting framework, the central bank aims to maintain 'nominal exchange rate stability by using a range of monetary policy tools'. These include adjustments in interest rates and direct foreign exchange interventions. In order to maintain the target exchange rate level, the central bank intervenes in the foreign currency market by purchasing or disposing of foreign currencies. Interest rate adjustments are also used to influence capital flows and align domestic economic conditions with those of the anchor currency. A stable exchange rate, in turn, helps to control inflation, particularly in economies where price levels are sensitive to changes in import prices (Obstfeld & Rogoff, 1995).

To successfully maintain a stable exchange rate, central banks must adopt a comprehensive policy mix that includes several critical elements. First, there needs to be a low inflation differential between the domestic economy and the anchor country. High inflation relative to the anchor currency can undermine the fixed rate of exchange and lead to speculative attacks. Second, the central bank needs to maintain an adequate level of international reserves to defend the currency peg against market pressures. Additionally, maintaining the credibility of the country's competitiveness and ensuring political stability is essential to sustaining investor confidence and supporting the exchange rate regime (Alagidede & Mauzu, 2016).

However, there are significant trade-offs associated with exchange rate targeting. One major drawback is the loss of independence in monetary policy. When a central bank pegs its currency to a foreign currency, it effectively relinquishes control over its domestic interest rates, as these

must be aligned the rates of the anchor country to maintain the peg. This restricts the central bank's ability to independently address domestic economic issues, such as unemployment or recessions (Fischer, 2001). Moreover, exchange rate targeting requires the central bank to maintain a large pool of foreign reserves to defend the peg, which can be costly and difficult to sustain, especially in the face of speculative attacks or external shocks.

As a result, while exchange rate targeting can be an effective tool for stabilizing the economy, particularly in the short term, it is not without its risks. Many emerging markets have gradually moved away from rigid exchange rate targeting in favor of exchange rate regimes that are more flexible. These regimes are often paired with inflation targeting, which allows central banks to focus on price stability while maintaining some degree of flexibility in responding to external shocks and changes in the global economy (Fischer, 2001). This shift toward flexibility reflects the growing recognition that fixed exchange rate regimes, while useful in certain circumstances, can impose significant constraints on a country's broader economic policy options.

2.2.2.3 Inflation Targeting

As part of the inflation targeting monetary policy framework, the central bank establishes a specific inflation target and commits to reaching that goal over a certain period, typically using interest rate adjustments and other monetary tools. The primary goal of this approach is to maintain steady and moderate inflation, which is seen to be crucial for fostering long-term growth in the economy. Inflation targeting emphasizes price stability, believing that controlling inflation is key to economic health, and it is one of the most widely adopted frameworks in modern central banking. This policy framework was initially introduced by 'the Reserve Bank of New Zealand' in the early 1990s and has since gained popularity across advanced and developing economies (Svensson, 1999).

In an inflation-targeting framework, the central bank adjusts interest rates and other monetary policy instruments to maintain inflation at or near a predetermined target. This target, usually set as an annual percentage is designed to shape public expectations about future inflation. For example, the Bank of Ghana aims for an inflation target of $8\% \pm 2\%$ annually. When inflation exceeds the target, the central bank increases interest rates to curtail spending and investment, which helps to cool the economy. In the same vein, the monetary authority lowers interest rates to boost growth when inflation falls below its target to whip up borrowing and promote economic activity. (Mishkin, 2004).

Several key elements contribute to the success of inflation targeting:

1. **Announcement of the inflation target:** The central bank publicly announces its inflation target for a specific period, such as one year, which helps guide market expectations.
2. **Commitment to price stability:** The main goal of the central bank is to maintain price stability, and this long-term commitment shapes its monetary policy decisions.
3. **Information-inclusive decision-making:** The central bank considers a wide range of economic variables, including growth, employment, and external factors, to make informed policy decisions.
4. **Transparency and communication:** Regular communication with the public ensures transparency and allows the central bank to explain its policy actions and inflation targets, which helps anchor inflation expectations.
5. **Accountability:** Central banks operating under this regime are held accountable for meeting their inflation targets, enhancing their credibility and effectiveness.

Inflation targeting has been particularly successful in achieving price stability in developed economies. For example, countries such as the United States of America, the United Kingdom, and the Eurozone have adopted this framework and experienced reductions in inflation volatility, contributing to more stable economic growth (Svensson, 1999). In developing economies, inflation targeting can also be beneficial by increasing monetary policy transparency and encouraging broader economic reforms. By setting clear inflation targets and using consistent policy actions, the credibility of central banks can be improved and inject confidence in their economies, thereby supporting investment and long-term growth.

However, inflation targeting is not without challenges. It requires having strong monetary policy discipline and the capacity to adapt to shocks to the economy. Additionally, in countries where inflation is influenced by external factors, such as fluctuating exchange rates or unpredictable commodities prices, maintaining an inflation target can be difficult. Despite these challenges, inflation targeting remains one of the most effective frameworks for central banks seeking to achieve ‘price stability and foster sustainable economic growth’.

2.3 Financial Development

Financial development is the expansion and enhancement of a country's financial markets, institutions and overall, the financial system. It encompasses the expansion and deepening of financial services, increased access to credit and investment opportunities, better allocation of capital, and the enhancement of financial infrastructure. An advanced financial system is essential for ‘economic growth, poverty reduction, and financial stability’, as it facilitates efficient resource allocation, risk management, and financial intermediation (Abor et al, 2022).

2.3.1 Key Components of Financial Development

2.3.1.1 Financial Institutions

Financial institutions are essential to the financial development of any economy. Acting as intermediaries in the financial system, they facilitate the movement of funds between savers and deficit consumers, support capital formation, optimize resource allocation, and drive overall economic growth.

Banks: Financial institutions, including banks, gather savings from individuals and businesses and direct these funds into productive investments. They offer a range of financial products, like savings accounts, fixed deposits, and bonds, each with distinct risk-return profiles, to accommodate different saving preferences. By pooling these savings, financial institutions can support large-scale investments that would be beyond the reach of individual savers. Banks, therefore, constitute one of the cornerstones of financial systems, providing essential services including payment, credit, and savings services (Mishkin, 2004). The development of a robust banking sector is crucial for ‘mobilizing savings and channeling them into productive investments’. Efficient allocation of these pooled resources is vital for financial development. Banks assess and manage risk, price credit appropriately, and allocate capital to sectors and firms that are likely to yield the highest returns. This allocation is based on creditworthiness assessments, market analyses, and other financial metrics, ensuring that resources are channeled toward the most productive uses.

Non-bank Financial Institutions: These include insurance companies, pension funds, mutual funds, and microfinance institutions. NBFIs complement banks by offering specialized financial services that target several market segments of the economy.

Regulatory Bodies: Financial institutions function within a regulatory framework aimed at preserving financial stability, safeguarding consumers, and preventing financial crimes. Adhering

to these regulations strengthens the credibility and reliability of financial institutions and fosters greater participation in the financial system. Effective regulation and supervision are essential for maintaining the stability and integrity of financial institutions. Regulatory bodies ensure that financial institutions operate transparently and adhere to sound risk management practices (Abor et al, 2018). For example, capital adequacy requirements, liquidity ratios, and risk management guidelines help in guaranteeing that financial institutions remain solvent and resilient during periods of economic stress. By following sound regulatory practices, financial institutions help create a stable financial environment, minimizing the risk of crises that could hinder financial development. Stable financial institutions build trust among savers and investors, supporting a steady flow of funds and sustained economic growth.

2.3.1.2 Financial Markets

These markets encompass both capital markets (equity and debt markets) and money markets. Efficient financial markets facilitate the raising of capital, risk-sharing, and liquidity. Well-functioning financial markets ensure that funds flow from savers to borrowers and that prices of financial assets reflect all available information (promoting transparency and fair pricing) (Anarfo et al., 2022).

Capital Markets: Capital markets which include equity and debt markets, are essential for providing long-term financing options to companies and governments. They mobilize capital from a diverse range of investors, such as individuals, institutional investors, and foreign entities, by offering various financial instruments such as stocks, bonds, and derivatives. These markets attract savings and direct them into productive investments, enabling businesses to expand, governments to finance infrastructure projects, and entrepreneurs to access the resources needed for innovation

and growth (Abor et al., 2018). A robust capital market is vital for providing alternative financing sources and facilitating risk diversification.

Capital markets are instrumental in ensuring efficient resource allocation within an economy. Through the trading of securities, they create a mechanism for pricing capital based on supply and demand, allowing funds to flow toward the most profitable and productive investments. This process of price discovery supports increased productivity, economic growth, and a more dynamic economy. In addition, well-developed capital markets contribute to financial stability by diversifying the sources of funding available to firms, reducing their reliance on traditional bank lending. During periods of economic stress, access to capital markets provides businesses with alternative ways to raise funds, thereby mitigating liquidity risks. The availability of various financial instruments also enhances risk-sharing and risk management, reducing the chances of systemic crises (Abor et al., 2018).

Capital markets promote transparency and accountability by requiring listed companies to meet stringent disclosure standards and regularly provide accurate and timely information on their financial performance. This transparency helps build investor confidence, which is essential for the effective functioning and growth of financial markets (Mishkin, 2004). Furthermore, capital markets encourage firms to maintain strong corporate governance practices. Companies with robust governance and ethical standards generally benefit from higher valuations and lower capital costs, fostering an environment of trust, attracting investment, and supporting the long-term resilience of the financial system.

By integrating domestic economies with global financial markets, capital markets enhance financial development. This integration facilitates the inflow of foreign capital, diversifies funding

sources, and increases the availability of investment capital. Access to international capital markets enables domestic firms to raise funds more competitively, attract foreign direct investment, and drive economic development. Global integration also promotes the adoption of international best practices, enhances market efficiency, and strengthens the financial system's resilience by enabling broader risk-sharing.

A well-functioning capital market supports the growth of other financial institutions and services such as investment banks, brokerage firms, credit rating agencies, and financial advisors. These institutions provide essential services, including underwriting, market-making, and risk assessment, that are crucial for market operations. This interconnected ecosystem improves the overall efficiency, depth, and sophistication of the financial sector, contributing to its continued development.

Money Markets: The money market is crucial for managing liquidity within the financial system, enabling institutions like banks to meet their short-term funding needs efficiently. Banks often use the money market to borrow or lend funds among themselves, allowing them to adjust their liquidity positions and meet regulatory reserve requirements and customer demands. This process helps maintain confidence in both the banking sector and the wider financial system (Abor et al., 2018).

By providing a mechanism for effective liquidity management, the money market reduces the risk of liquidity shortages that could lead to bank runs or financial crises. A well-developed money market enhances the resilience of financial institutions, promotes financial stability, and supports broader financial development.

The money market also serves as a key channel for monetary policy execution. Central banks employ various money market operations, including open market operations and adjustments to the discount rate to manage 'short-term interest rates and control the money supply in the economy'. These actions allow central banks to impact inflation, consumption, investment, and overall economic activity. For instance, by purchasing or selling government assets in the money market, the banking system can receive liquidity injections or withdrawals from central banks thereby influencing interest rates. Changes in these short-term rates affect borrowing and lending behaviors, shaping credit conditions, consumer spending, and investment decisions. Effective transmission of monetary policy through the money market is essential for maintaining macroeconomic stability and fostering financial development.

The money market provides a range of securities, including 'commercial paper, Treasury bills, and certificates of deposit' that help manage and mitigate risks. These instruments are generally considered low-risk investments due to their short maturities and the creditworthiness of their issuers, offering investors a safe place to park excess funds while earning returns and maintaining portfolio flexibility. Additionally, the money market helps financial institutions and firms manage interest rate and liquidity risks by offering short-term funding options. For example, repurchase agreements (repos) and reverse repos enable institutions to temporarily borrow or lend securities, helping them manage short-term funding needs while minimizing risk exposure (Abor et al., 2018).

Furthermore, the money market facilitates the efficient functioning of the systems for payments and settlements which is essential to preserving financial stability. It provides the necessary funds for financial institutions to meet short-term commitments and obligations such as clearing and settlement of transactions, preventing disruptions in the financial system, reducing uncertainty,

and fostering confidence among market participants. In times of financial stress or crisis, a well-developed money market acts as a buffer, allowing central banks and financial institutions to quickly access short-term liquidity, reducing the risk of systemic collapse and supporting overall financial stability (key factors for sustained financial development).

A well-functioning money market lays the groundwork for the development of other financial markets such as capital markets. Its short-term instruments serve as benchmarks for pricing longer-term securities like bonds and equities (Abor et al., 2018). Money market interest rates often act as reference rates for various financial contracts, influencing pricing across the financial spectrum. By fostering stability and efficiency in short-term funding, the money market supports the growth of longer-term financial markets, creating a more comprehensive and interconnected financial system. This interconnectedness is essential for deepening financial markets and promoting sustainable economic growth.

Foreign Exchange Markets: A worldwide, decentralized platform for currency trading is the foreign exchange market or Forex market. It manages an astounding \$6 trillion in trade volume every day, making it ‘the biggest and most liquid financial market in the world’. A wide variety of players are present in the Forex market including individual traders, hedge funds, commercial banks, central banks, financial institutions, and multinational organizations. Its primary function in the global economy is to promote ‘economic stability, foreign investment, and commerce’ (Abor et al, 2018).

Facilitating the exchange of one currency for another is one of the primary functions of the Forex market which is essential for cross-border transactions. Businesses and governments use the Forex market to convert currencies for purchasing goods and services, settling trade balances, or

investing abroad (Abor et al., 2018). For example, an American company importing products from Europe would need to exchange US dollars (USD) for euros (EUR) to make payments. This currency conversion mechanism supports international economic activities, allowing businesses to expand globally, fostering competition, and encouraging foreign direct investment (FDI)—all vital components of financial development.

The Forex market is also the main venue where exchange rates are determined. Exchange rates represent the price at which one currency can be traded for another which are influenced by several factors including interest rates, inflationary pressure, political stability, economic performance, and market sentiment. The Forex market reflects real-time supply and demand for different currencies, providing a transparent process for price discovery.

Exchange rates affect nearly every aspect of an economy including inflation, interest rates, trade balances, and capital flows. A well-functioning Forex market ensures that exchange rates are set efficiently which is crucial for economic stability and financial development. This efficiency enables policymakers and market players to make informed decisions based on accurate, up-to-date currency values.

The Forex market also offers a variety of financial instruments, such as forwards, futures, options, and swaps that help participants hedge against currency risk. Currency risk arises from exchange rate variations that may affect the value of cross-border transactions, investments, and profits. For example, an exporter concerned about a potential decline in a foreign buyer's currency may use a forward contract to secure a favorable exchange rate in advance. These hedging tools help businesses and investors manage currency risks, reducing uncertainty and protecting against potential losses (Abor et al., 2018). This risk management is essential for fostering international

trade and investment, promoting a stable economic environment, and supporting overall financial development.

Additionally, the Forex market creates opportunities for speculation and arbitrage, which enhance market liquidity and efficiency. Speculators such as individual traders and hedge funds, aim to profit from short-term changes in exchange rates by buying currencies at lower prices and selling them at higher prices. Their activities provide liquidity and facilitating the buying and selling process for market participants with minimal price disruption.

Arbitrageurs, on the other hand, take advantage of price differences between various Forex markets or financial instruments, helping align prices across markets and ensuring that the price discovery process remains efficient. This activity prevents significant price discrepancies, contributing to the overall Forex market's efficiency and stability.

2.3.1.3 Financial Instruments

Financial instruments are essential tools in the financial markets used for a range of purposes including investment, financing, risk management, and speculation. They can be broadly categorized into several types, each serving different functions and playing a unique role in the financial system. A well-developed financial system offers a variety of products that meet the diverse needs of different market participants including consumers, investors, and corporations. The various instruments and services provided by a well-functioning financial system include:

Debt Instruments: These are financial tools used by entities such as governments, corporations, and other organizations to raise capital. Debt instruments include bonds, loans, and other forms of credit. Debt instruments provide borrowers with the necessary capital while offering investors a fixed income. These instruments represent a loan made by an investor to the issuer which is

obligated to repay the principal amount along with interest over a specified period. Debt instruments play a vital role in financial markets and economic development by providing a mechanism for financing and investment.

Equity Instruments: These comprise stocks and shares and signify ownership in a company.

Equity instruments provide companies with the capital needed for expansion while giving investors a claim on future profits.

Derivatives: These are financial agreements whose value is determined by how well underlying assets such as stocks, bonds, commodities, or indices and rates for various purposes, including hedging, speculation, and arbitrage. Derivatives can be complex and come in several forms, each with distinct features and uses. Futures, Options, Swaps and Forwards contracts are the common types of derivatives which are widely used globally.

2.3.1.4 Financial Infrastructure

One essential element of financial development is financial infrastructure which encompasses the systems, institutions, and regulations that support the efficient functioning of financial markets and the broader financial system. It provides the foundation for financial transactions, market operations and overall stability thereby contributing significantly to the advancement of economic growth and development. These include payment systems, credit information systems, legal and regulatory frameworks, and institutional arrangements that support the financial system's functioning. Robust financial infrastructure enhances efficiency, reduces transaction costs, and supports financial stability.

2.3.1.5 Access to Finance

The availability of financial services to various societal groups such as small enterprises and individuals with low incomes, is an important aspect of financial development. Broad access to finance promotes economic inclusion, enhances social mobility, and reduces inequality.

2.3.1.6 Financial Stability

Financial development should also involve maintaining stability in the financial system, which means minimizing risks such as bank runs, systemic failures, or financial crises. A stable financial system supports sustainable economic growth by reducing the likelihood of disruptive events.

2.3.2 Determinants of Financial Development

Several factors influence financial development, including:

2.3.2.1 Economic Factors

Economic Growth: Economic growth and financial development are often regarded as mutually reinforcing forces that drive long-term prosperity in an economy. Economic growth creates new opportunities and challenges for financial systems, necessitating adaptations and innovations that contribute to financial development (Levine, 2020). Conversely, a well-functioning financial system supports sustainable economic growth by efficiently allocating resources, reducing transaction costs, and facilitating investment.

One of the key mechanisms through which economic growth affects financial development is by boosting the demand for financial services. As economies grow, the expansion of businesses and household wealth generates a higher demand for credit, investment opportunities, and risk management tools. This demand drives the evolution of the financial sector as financial institutions innovate and offer more sophisticated services to meet the needs of a growing economy.

A study by Levine (2020) emphasizes that financial development is closely tied to the demands generated by economic expansion. As firms grow, they require more capital, better risk management, and a broader range of financial products. Similarly, households accumulate savings that need to be efficiently intermediated through financial institutions. This process enhances the depth and breadth of financial markets, leading to the development of stock markets, bond markets, and other financial instruments.

Economic growth promotes capital accumulation, which is essential for financial development. As economies grow, Sahay et al. (2015) suggest that economic growth increases the volume of financial transactions, which strengthens the financial system by improving liquidity and reducing transaction costs. This leads to the development of more sophisticated financial instruments and institutions. For example, as more businesses and individuals seek to invest their savings, financial intermediaries such as banks, pension funds, and insurance companies expand their services to accommodate this growing demand. The increase in available capital also encourages innovation in the financial sector, leading to the creation of new financial products and services.

Another important channel through which economic growth affects financial development is by fostering institutional reforms and policy changes that enhance the efficiency and stability of the financial system. As countries grow, they tend to implement reforms that strengthen financial regulation, improve governance, and enhance the rule of law. These reforms are crucial for creating a stable environment in which financial institutions can operate effectively.

Findings by Beck et al. (2020) show that economic growth is often accompanied by improvements in frameworks of legal and regulatory structures, which are essential for financial development. Stronger institutions reduce the risks associated with lending and borrowing, thereby encouraging

more efficient capital allocation. Moreover, effective regulation fosters greater transparency and accountability, which contributes to the financial system's increased credibility.

Income Levels: Countries with higher income levels tend to have more developed financial systems because of the greater demand for diverse financial products and services. Empirical evidence from Beck and Levine (2020) suggests that economies with more developed financial systems experience higher long-term growth rates. A robust financial sector ensures that capital is allocated to the most productive investments thereby improving overall economic efficiency. Further, a well-functioning financial system can lessen the dangers posed by economic shocks, contributing to the robustness of the economy in the face of global financial volatility.

Macroeconomic Stability: Low inflation, stable interest rates, and predictable exchange rates create a conducive environment for financial development. Levine (2020) posits that financial development is more likely to occur in environments where macroeconomic fundamentals are stable. A stable macroeconomic environment reduces the uncertainty associated with investment decisions, lowers risk premiums and encourages the flow of capital into the financial sector.

When inflation is volatile or fiscal deficits are unsustainable, financial markets are more likely to become distorted, leading to reduced confidence in financial institutions. High inflation erodes the value of financial assets and savings, while fiscal imbalances can lead to sharp increases in interest rates, making borrowing more expensive. This discourages both domestic and foreign investors from engaging in long-term financial transactions, stifling financial market development.

Boyd et al. (2022) find that inflation negatively affects financial development by reducing the incentives for individuals to save and invest in financial assets. When inflation is high, people prefer to hold real assets (such as property or commodities) rather than financial assets, which lose

value over time. Furthermore, financial intermediaries, such as banks, struggle to provide stable returns in high-inflation environments, as the cost of borrowing rises and the risk of default increases. This, in turn, reduces the availability of credit, hampers capital formation, and slows financial deepening. Similarly, Reinhart and Rogoff (2020) argue that unsustainable fiscal deficits crowd out private investment by raising the cost of credit for businesses and households. When governments run large deficits, they issue more debt, which increases demand for credit and drives up interest rates. This reduces the availability of credit for private sector borrowers, limiting their ability to invest and grow. Further, fiscal imbalances can result in inflationary pressures when governments issue money to finance deficits, hence, further destabilizing the financial system.

2.3.2.2 Institutional Factors

Legal and Regulatory Framework: Effective laws and regulations protect property rights, enforce contracts and promote transparency which are necessary for financial markets and institutions to operate efficiently. North (2021) further emphasizes the importance of strong institutions in promoting financial development by ensuring that property rights are protected, contracts are enforced, and the rule of law is maintained. These factors are crucial for fostering ‘trust in financial institutions’ and encouraging investment in financial markets. A stable political environment with strong institutions promotes ‘confidence in the financial system’ which is essential for financial development.

Quality of Governance: Good governance practices, including regulatory quality, rule of law, and control of corruption, positively impact financial development.

2.3.2.3 Technological Factors

Financial Technology: Technological advancements, such as digital payments, mobile banking, and blockchain, have revolutionized the financial sector by increasing efficiency, lowering costs, and expanding access to finance.

2.3.2.4 Social and Demographic Factors

Education and Financial Literacy: Higher levels of education and financial literacy increase the ability of consumers to efficiently access and make use of financial services. Findings by Beck et al (2020) and Levine and Zervos (2021) conclude that higher levels of education are associated with deeper financial markets and a more developed banking system. People with higher levels of education are more inclined to save money and make investments in assets, and this contributes to the growth of financial markets. Moreover, education enhances entrepreneurial skills, enabling individuals to start and expand businesses which drives demand for financial services such as credit, insurance, and payment systems.

Population Growth and Urbanization: Demographic changes like rapid population growth and urbanization, can influence financial development by altering the demand for different financial products and services.

2.3.2.5 Political Factors

Political Stability: A stable political environment is essential for investor confidence and the development of financial markets and institutions. Political instability, on the other hand, increases the risk of abrupt policy changes, which can undermine macroeconomic stability and destabilize financial markets. Uncertain political environments often lead to capital flight, as investors seek safer opportunities elsewhere. This reduces the amount of credit available and slows the development of financial institutions.

2.3.3 Importance of Financial Development

Economic Growth: Mobilizing savings and channeling them into productive investments and a well-functioning financial system can enhance capital accumulation, improve resource allocation, and promote technological innovation to propel economic growth.

Poverty Reduction and Financial Inclusion: Financial development can help reduce poverty by improving access to finance for low-income households and small businesses. This access allows them to invest in education, health, and entrepreneurial activities, contributing to social and economic mobility.

Improved Efficiency and Competitiveness: A developed financial sector promotes competition, reduces transaction costs, and enhances efficiency in the distribution of resources. It also fosters innovation in financial products and services, contributing to the overall competitiveness of the economy.

Risk Management: Advanced financial markets and institutions provide a variety of tools for risk management, such as derivatives, insurance products, and diversification options. This helps both individuals and businesses mitigate financial risks and uncertainty.

Macroeconomic Stability: Although financial development can sometimes lead to increased volatility (e.g., through rapid credit expansion or asset bubbles), a well-regulated and diversified financial system generally enhances overall economic stability by providing mechanisms for risk sharing, liquidity management, and crisis resolution.

Monetary Policy Effectiveness: Financial development strengthens the transmission mechanism of monetary policy by improving the responsiveness of financial markets and institutions to policy

changes. This helps central banks in achieving their macroeconomic objectives such as encouraging growth and reducing inflation,

2.3.4 Recent Trends in Financial Development

Digital Financial Services: The rise of digital financial services including mobile banking, digital payments, and online lending platforms, has transformed financial systems. These innovations have increased financial inclusion, especially in developing countries.

Sustainable Finance: There is growing interest in sustainable finance which involves integrating ‘environmental, social, and governance (ESG) factors’ into financial decision-making. Sustainable finance promotes investments that contribute to the realization of the ‘sustainable development goals’.

Regulatory Reforms: In reaction to the world economic crisis and subsequent challenges, significant regulatory changes have been made in a number of countries to increase consumer protection, transparency and financial stability.

Financial Inclusion Initiatives: Governments and international organizations are increasingly focusing on financial inclusion as a critical component of financial development. Initiatives such as microfinance, digital banking, and financial literacy programs aim to bring more people into the formal financial system.

2.3.5 Measurement of Financial Development

Financial development is measured through indicators that assess financial depth, access, efficiency, stability and innovation. These measurements provide insights about the financial system's maturity and health in order to support financial inclusion and sustainable development.

2.3.5.1 Financial Depth

Financial Institutions: Private credit, as defined in the literature of financial development, is the ‘amount of credit given to the private sector by deposit money banks as a percentage of GDP’. This has emerged as a key indicator of financial depth. Numerous studies have established a strong connection between financial depth, commonly measured as private sector credit to GDP, and its relationship with ‘long-term economic growth and poverty reduction’ (see: Demirgüç-Kunt & Levine, 2008). Cross-country regression analyses consistently reveal a robust positive relationship between financial depth and economic growth.

Another metric used as an alternative to private credit is the ratio of total banking assets to GDP. This measure encompasses a broader spectrum of financial activities, including credit to the government and other banking assets beyond private sector credit. While it offers a more comprehensive view of the financial sector's size, it is available for fewer countries and is less frequently utilized in the literature. Nonetheless, private credit and total banking assets exhibit a strong correlation, with a coefficient of approximately 0.9, making private credit a reliable proxy for total banking assets.

Although most research has focused on banks, the recent financial crisis has underscored the importance of non-bank financial institutions (NBFIs). Data on NBFIs is less extensive compared to that on banks, but the Global Financial Development Database helps address this gap. It encompasses variables such as the total assets of non-bank financial institutions (NBFIs) relative to GDP, the ratios of the assets of insurance companies, pension funds, mutual funds, and life and non-life insurance premiums to the GDP.

Financial Markets: Financial market data is accessible globally, covering stock and bond markets, including both sovereign and corporate bonds. The most widely used measure of stock market size

is the ratio of stock market capitalization to GDP. In contrast, bond market size is typically assessed using the ‘outstanding volume of debt securities’ both private and public as a percentage of GDP. This analysis primarily focuses on "stock value traded," which evaluates stock market transactions as a percentage of GDP. Unlike measures limited to the value of listed shares, this indicator offers insights into both the ‘size and activity of the stock market’, providing a more comprehensive view of its development.

According to research by Levine and Zervos (1998), “the trading of firm ownership claims is closely linked to economic development rates”. There is significant variation in stock value traded among countries, with an average of about 29% of GDP and a standard deviation that is nearly twice that amount. For instance, between 1980 and 2008, the average stock value traded was below 0.23% of GDP in Armenia, Tanzania, and Uruguay (10th percentile), while it exceeded 75% in China (Mainland and Hong Kong SAR), Saudi Arabia, Switzerland, and the United States (90th percentile).

“The relative size of financial institutions and markets is a central focus in the financial development literature” especially in studies of "financial structures" (Demirgüç-Kunt & Levine, 2001; Demirgüç-Kunt et al., 2012). The financial structure ratio which compares the size of banks to that of financial markets is used to determine whether a financial system is more bank-based or market-based. Financial structures differ considerably across economies.

2.3.5.2 Financial Access

Financial Institutions: A commonly used indicator of access to financial institutions is “the number of bank accounts per 1,000 adults”. Other key metrics include the “number of commercial bank branches per 100,000 adults and the percentage of firms that have access to a line of credit”,

with a particular focus on small businesses (Demirgüç-Kunt et al., 2012). However, these measures have certain limitations. For instance, the relevance of the number of bank branches is decreasing due to the growth of branchless banking. While the number of bank accounts avoids this issue, it has its limitations as it only captures access within the banking sector and does not account for clients holding multiple accounts.

Financial Markets: There is a dearth of information regarding financial market accessibility.

To estimate this access, market concentration measures are frequently used, as a higher concentration typically signals greater barriers for new or smaller issuers (Demirgüç-Kunt & Levine, 2001). Key indicators of market access encompass several dimensions including the proportion of market capitalization held by companies outside the top 10 largest firms as well as the percentage of trading volume attributed to companies beyond the top 10 most traded. Additional important measures include government bond yields (such as those for 3-month and 10-year bonds), the ratio of domestic debt securities to total debt securities, the ratio of private debt securities to total domestic debt securities, and the ratio of new corporate bond issuances relative to GDP (Demirgüç-Kunt & Levine, 2001). These indicators collectively provide a comprehensive view of market access and its underlying dynamics.

2.3.5.3 Financial Efficiency

The efficiency of financial intermediaries plays a vital role in ensuring the smooth functioning of financial systems as an aspect of financial development, as it directly affects the allocation of resources and the overall performance of the financial system. Efficiency is primarily assessed by analyzing the costs and margins associated with credit intermediation which reflects how

effectively financial institutions manage their resources and operations (Demirgüç-Kunt & Levine, 2001).

Key indicators of institutional efficiency include **overhead costs relative to total assets** which measure the administrative and operational expenses incurred by financial institutions in proportion to their asset base. A lower ratio typically indicates higher efficiency.

The **net interest margin** calculated as the ‘difference between interest income generated and interest paid out relative to interest-earning assets’, provides insight into the profitability of lending activities. Similarly, the **lending-deposit spread** reflects the difference between the rates charged on loans and those paid on deposits, serving as another critical indicator of efficiency and competitiveness in the financial sector.

Other measures such as **‘non-interest income as a percentage of total income’**, highlight the diversification of revenue sources and the extent to which financial institutions rely on fees and commissions rather than traditional interest income. The **cost-to-income ratio** evaluates the proportion of operating costs to total income, with a lower ratio signifying better cost management and operational efficiency.

In addition to these indicators, **profitability metrics** such as return on assets (ROA) and return on equity (ROE) are widely used to assess financial performance. ROA measures how effectively a financial institution utilizes its assets to generate profit, while ROE indicates the returns generated for shareholders relative to their equity investment. Although there is often a positive relationship between institutional efficiency and profitability, this correlation can vary due to external factors such as market competition, regulatory frameworks, and macroeconomic conditions (Demirgüç-Kunt & Levine, 2001).

Moreover, the efficiency of financial intermediaries is influenced by structural aspects such as the level of technological adoption, the quality of management, and the regulatory environment. For instance, institutions that adopt advanced financial technologies can reduce overhead costs, improve service delivery and enhance operational efficiency thereby improving their performance metrics. However, inefficiencies may arise in less competitive markets or those with regulatory constraints that hinder innovation and cost management (Angelidis and Lyroudi, 2006).

Understanding and improving financial intermediary efficiency is critical for policymakers, as it has far-reaching implications for financial stability, access to credit, and economic growth. While efficiency improvements often lead to higher profitability, the relationship is not always straightforward as factors like risk-taking behavior and external economic shocks can disrupt this dynamic (Demirgüç-Kunt & Levine, 2001). Thus, a comprehensive evaluation of financial efficiency requires considering both quantitative indicators and qualitative factors that impact institutional performance.

For instance, an inefficient financial system may show high profitability during periods of economic growth, whereas an otherwise efficient system may incur losses when faced with adverse economic shocks.

In some cases, it is possible to construct more refined efficiency indices using data envelopment analysis (DEA) or other advanced techniques. For example, Angelidis and Lyroudi (2006) employed DEA and neural networks to evaluate the efficiency of Italian banks. However, such sophisticated analyses require detailed data that are only available for a limited number of countries.

When it comes to financial markets, efficiency measures focus less on transaction costs and more on transaction volume and liquidity. A fundamental measure of stock market efficiency is the turnover ratio, which is the ratio of market turnover to total market capitalization. A higher turnover ratio is generally interpreted as a sign of greater liquidity and, therefore, market efficiency (Demirgüç-Kunt & Levine, 2001). In the bond market, commonly used indicators include “the bid-ask spread's tightness and the turnover ratio, although the latter is often affected by incomplete data”.

Several other proxies for market efficiency have been used in empirical research. One such measure is **price synchronicity**, which assesses the extent of co-movement between individual stock returns in an equity market. This metric aims to capture how well stock prices reflect firm-specific information, as an efficient market is one where prices reflect the performance of individual firms. Another indicator is the trading of private information, which represents the percentage of firms whose trading patterns suggest the use of non-public or privileged information. This is calculated by analyzing daily price-volume patterns to detect trading based on insider knowledge.

Last, efficiency can also be approximated by real transaction costs. This metric uses daily return data from listed stocks to estimate the expenses incurred when trading a certain security to provide insight into the barriers to market efficiency.

2.3.5.4 Financial Stability

Financial stability is a critical aspect of the financial sector, and there is extensive research focused on measuring systemic risk, conducting stress tests, and employing other tools to ensure stability. Due to its significance for overall macroeconomic stability, financial stability is often considered

a distinct area of study. However, it remains an integral component of the broader financial development process.

To illustrate this, consider a scenario where banks in a country adopt overly lenient lending practices, providing loans indiscriminately without adequate risk management or monitoring. At first glance, this may appear to indicate rapid growth and increased financial access and the financial sector might seem efficient temporarily due to the reduction in costs associated with a lack of stringent loan approval processes. However, this approach is inherently unstable and is likely to result in a financial crisis once the loans begin to default.

A key indicator of financial stability is the z-score, which assesses the relationship between a financial institution's buffers such as capitalization and returns and potential risks, particularly the volatility of returns. The z-score is inversely correlated with the likelihood of insolvency, meaning that a higher z-score indicates a lower probability of the institution becoming insolvent.

Despite its widespread use, the z-score has several limitations. It relies solely on accounting data, which may not accurately reflect an institution's true financial health if the underlying accounting and auditing practices are weak. Moreover, the z-score assesses individual financial institution, thereby ignoring systemic risks that arise when a default in one institution triggers losses across the financial system. Nonetheless, the z-score can be applied to institutions lacking more sophisticated, market-based data and allows for risk comparison among different groups of institutions, regardless of their ownership or objectives.

Additional indicators of financial stability including the 'ratio of regulatory capital to risk-weighted assets' and the proportion of 'non-performing loans to total gross loans', can be found

in the IMF's Financial Soundness Indicators Database. While nonperforming loan ratios are widely recognized, they are also lagging indicators of financial health.

Another measure of financial instability is **excessive credit growth**. A healthy financial sector generally experiences credit growth, which is necessary for deepening financial markets and providing access to services. However, very rapid credit growth is often associated with banking crises as evidenced by research showing that since credit expansions are usually driven by excessively optimistic expectations about future income and asset prices, 75% of credit booms in emerging economies end in crises (Demirgüç-Kunt et al., 2012). These are occasionally amplified by capital inflows. When these expectations are not met, a surge in non-performing loans and defaults can occur, potentially triggering a banking crisis.

Recent studies propose using how the credit-to-GDP ratio deviates from its long-term trend as a metric for determining countercyclical regulatory capital buffer requirements. This indicator reflects the accumulation of systemic vulnerabilities that may precipitate financial crises. A notable advantage of this credit growth measure is its forward-looking perspective, making it straightforward to observe and monitor over time. However, it has limitations in identifying crises already underway, as credit growth may be negative once financial sector problems have fully materialized.

In financial markets, market volatility is the most commonly used indicator of stability. Additional metrics, including the skewness of stock returns and susceptibility to earnings manipulation, also provide insights. For instance, a market with negatively skewed stock returns has a higher likelihood of experiencing significant negative returns, signaling lower stability. Earnings manipulation vulnerability, measured as the percentage of firms on an exchange prone to such practices, further reflects stability. In emerging and developing economies, nearly all firms may

exhibit earnings manipulation risks, whereas this affects fewer than 10% of firms in high-income economies. Additional measures like the price-to-earnings (P/E) ratio and bond duration are also used to approximate stock market volatility, as they capture expectations of future cash flows and growth potential.

These various measures and indicators, while each having their limitations, collectively help in assessing and managing financial stability across different contexts.

2.3.6 Financial Innovation and Infrastructure

2.3.6.1 Digital Financial Services Penetration

This refers to the degree to which digital channels are utilized to deliver financial services to individuals and businesses. It encompasses the adoption and usage rates of various digital tools such as mobile banking apps, internet banking platforms, digital wallets, and other online financial services. Penetration can be measured through several indicators including the number of digital financial service providers in the market, the volume and value of transactions carried out online, and the proportion of the population that uses digital financial services. The increasing penetration of digital financial services is a key indicator of financial innovation, reflecting a shift towards more efficient, inclusive, and accessible financial systems (Beck et al., 2007).

Digital financial services penetration is a crucial measure of financial development because it highlights the extent to which financial systems are adapting to technological advancements and meeting the needs of a digitally connected population. The widespread use of digital platforms enhances financial inclusion by providing access to financial services to individuals and businesses who were previously excluded from traditional banking systems (Abor et al, 2018). For example, mobile money platforms such as M-Pesa in Kenya and bKash in Bangladesh have brought millions of unbanked individuals into the financial system, facilitating savings, payments, and credit access.

The penetration of digital financial services also fosters efficiency in financial transactions by reducing costs, speeding up processes and minimizing the need for physical infrastructure. Digital tools enable faster and cheaper payments, lower transaction costs, and reduce the barriers to accessing financial services. This is particularly important in remote or underserved areas where physical bank branches are scarce or non-existent. By improving the reach and efficiency of financial services, digital penetration contributes significantly to financial development and economic growth.

Assessing digital financial services penetration involves several key metrics that capture the adoption and usage of digital tools within a financial system:

Percentage of the Population Using Digital Financial Services: This metric measures the share of individuals who use digital platforms for banking, payments, savings, or investments. High penetration rates indicate that a larger portion of the population has access to and utilizes digital financial services, reflecting a more inclusive financial system.

Volume and Value of Digital Transactions: The total number and value of transactions conducted through digital platforms such as digital banking, online payments, and mobile money transfers, offer information about the volume of activity in digital financial services. A higher volume and value of digital transactions suggest greater adoption and trust in digital platforms.

Number of Digital Financial Service Providers: The number of companies and platforms offering digital financial services, including banks, FinTech startups, and telecom operators, is another measure of penetration. A diverse range of providers indicates a competitive and innovative financial ecosystem.

Mobile and Internet Penetration Rates: A good indicator of the potential reach of digital financial services is the proportion of the population having internet and mobile phone connectivity. Higher mobile and internet penetration rates enable broader access to digital platforms, fostering greater financial inclusion.

Digital Literacy Rates: The populace's level of digital literacy has an impact on the penetration of digital financial services. Higher digital literacy rates are associated with increased usage and adoption of digital platforms, as users are more comfortable navigating and using digital tools.

2.3.7 Credit Information Index

The Credit Information Index, also referred to as the "depth of credit information index," measures the extent to which rules and practices regarding the availability, scope, and accessibility of credit information facilitate access to credit. It is used to assess the effectiveness of a country's credit reporting systems. The index evaluates the availability of credit information through various mechanisms, such as credit bureaus and credit registries, and scores countries based on several parameters, including the coverage of credit information, the inclusion of both positive and negative credit data, the depth of data collected, and the number of years covered.

The Credit Information Index is a vital measure of financial innovation for several reasons. First, it reflects a country's ability to facilitate access to credit, which is a crucial element of financial development. A higher index score indicates a more comprehensive credit reporting system, enabling lenders to make more informed decisions based on accurate credit histories. This, in turn, reduces information asymmetries between deficit and surplus agents, lowers the cost of borrowing, and enhances access to credit, particularly for small businesses and individuals who might otherwise be excluded from formal financial markets.

Second, the Credit Information Index is a proxy for the transparency and efficiency of a country's financial system. When credit information is readily available and easily accessible, it promotes greater transparency in the financial sector, reduces the risk of default, and encourages responsible lending practices. By reducing the risk of adverse selection and moral hazard, the index helps build trust between financial institutions and borrowers, fostering a more stable and efficient financial environment.

The Credit Information Index comprises several components that capture the breadth and depth of a country's credit reporting infrastructure:

Coverage of Credit Information: This component measures the percentage of adults covered by public credit registries or private credit bureaus. Higher coverage indicates that more individuals and businesses have credit histories, enhancing lenders' ability to assess creditworthiness and make informed lending decisions.

Scope of Credit Information: The scope refers to the types of credit information collected and shared by credit bureaus or registries. It includes both positive information (such as repayment history and credit limits) and negative information (such as defaults and late payments). A broader scope of credit information improves the predictive power of credit reports, allowing lenders to assess both the risk and potential of borrowers.

Depth of Credit Information: The depth measures the amount and variety of data included in credit reports, such as data from various credit providers, including banks, microfinance institutions, retailers, and utility companies. Greater depth of information ensures that credit reports provide a comprehensive view of a borrower's creditworthiness, supporting more accurate risk assessment.

Accessibility of Credit Information: This component examines how easily credit information can be accessed by lenders and borrowers. It includes factors such as the availability of online credit reports, the frequency of data updates, and the ease with which individuals can access their own credit information. Easy access to accurate and up-to-date credit information promotes transparency and trust in the credit market.

Data Privacy and Consumer Protection: Effective credit reporting systems must also balance data collection with privacy and consumer protection. This component assesses whether credit information is handled according to legal and regulatory standards, ensuring that individuals' privacy rights are protected while allowing necessary data to be shared for credit evaluation.

2.3.8 Payment System Efficiency

Payment system efficiency refers to the ability of a financial system to process payments swiftly, securely, and at a low cost to users. It involves the infrastructure, processes, and regulatory frameworks that facilitate transactions between different economic agents, including individuals, businesses, and governments. An efficient payment system enables these transactions to occur seamlessly, thus supporting economic activities such as trade, investment, and consumption. The efficiency of a payment system is based on a number of variables such as transaction speed, the cost of payment services, the reliability and security of payment networks, and the accessibility of payment services to all segments of the population.



2.4 Financial Technology (FinTech)

The World Bank's Global Findex Database report reveals that around 30% of the global adult population remains unbanked, with a substantial portion of these individuals located in developing regions, including sub-Saharan Africa (SSA). As of 2017, only 38% of adult men and 27% of adult women in SSA held accounts with formal financial institutions (Demirgüç-Kunt et al., 2018). This low degree of financial inclusion is caused by a number of factors including geographical constraints (Demirgüç-Kunt et al., 2018), 'low income and education levels' (Nanziri, 2017), high transaction costs, and stringent records requirements (Honohan & Beck, 2008). However, the growing use of FinTech services, such as mobile money technologies, has been reducing the disparity in financial inclusion among countries that are developing. For example, the proportion of mobile money accounts in SSA 'more than doubled between 2011 and 2017' (Demirgüç-Kunt et al., 2018, p. 22). This growth is largely driven by the region's limited 'access to formal financial services and the rapid expansion of mobile technology' (Ahmad et al., 2020; Allen et al., 2016).

This trend underscores the potential of FinTech innovations to overcome traditional barriers to financial inclusion and reduce informational asymmetries, particularly in developing and emerging markets (AFI, 2018; Demir et al., 2020; Morse, 2015). Consequently, FinTech is anticipated to promote inclusive economic growth in addition to assisting in the integration of the underbanked population into the regulated financial system (Demirgüç-Kunt et al., 2018; GPFI, 2016a). By changing the ways that 'money is saved, borrowed, invested, transferred, spent, and protected', FinTech is completely changing the financial industry (Skan et al., 2016).

FinTech encompasses a broad range of technological innovations within the banking and financial services sector that improve or revolutionize how financial services are delivered. These advancements have driven substantial changes across both “personal and commercial finance”. Although there is no universally accepted definition of FinTech, the “Financial Stability Board” describes it as “technologically enabled financial innovation that could result in new business models, applications, processes, or products with a material impact on financial markets, institutions, and the provision of financial services” (Financial Stability Board, 2017). Innovations in mobile networks, embedded systems, cloud computing, trust management, big data, and data analytics have all contributed to the expansion of FinTech in the financial services industry (Gai et al., 2018). With an impact on a number of industries including ‘lending technology, payments and billing, personal finance and wealth management, money transfers and remittances, institutional technology, capital markets, and security technology’, FinTech has grown to be a major area of investment for competitive financial institutions (Manyika et al., 2016). Automated Teller Machines (ATMs), integrated mobile payment systems, mobile banking solutions, SMS-based interactive banking, blockchain technology, cryptocurrencies, and crowdfunding are notable FinTech technologies that are constantly changing the way people interact with and access financial information.

FinTech initiatives serve several purposes, including enhancing security, speeding up service delivery, and reducing operational costs. These innovations may either improve specific aspects of the financial sector, like mobile internet banking platforms, or completely replace traditional service methods, such as the rise of digital-only banks and mobile money solutions in developing regions, particularly in Africa.

Like other disruptive innovations, FinTech has the potential to establish new value networks and marketplaces, potentially displacing existing financial structures and products or even giving rise to new firms. However, FinTech innovations exhibit distinct characteristics within financial markets (Philippon, 2016), primarily due to their potential to transform the industry. The current financial infrastructure is predominantly bank-centered, encompassing retail, wholesale, and commercial clients, including insurance and pension funds, as well as foreign exchange, money, and capital markets. This infrastructure is supported by payment system providers, central banks, and various regulatory bodies (Amadou et al., 2019).

While FinTech has become a significant force in several key global regions, its presence remains limited in others (Frost, 2020). In Africa, ongoing challenges continue to hinder financial inclusion, limiting opportunities for sustained growth, job creation, and poverty alleviation (Amadou et al., 2019). However, FinTech has the potential to play a crucial role in advancing financial inclusion by enabling households and businesses to access resources for timely investment, thereby enhancing productivity and promoting inclusive finance across the continent (Abor et al., 2018). Despite its promising benefits, the FinTech sector faces considerable threats from security issues such as fraud and trust deficits as well as vulnerabilities linked to new technologies and business models.

2.4.1 Typology of FinTech in the Financial Services Industry

The FinTech industry has developed to encompass five primary domains: “(i) finance and investments, (ii) operations and risk management, (iii) payment systems and infrastructure, (iv) data security and monetization, and (v) customer interface” (Abor et al, 2018). Each of these areas is outlined in further detail below.

2.4.1.1 Finance and Investment

FinTech provides alternative sources of financing and investment opportunities, with crowdfunding and peer-to-peer (P2P) lending being among the most widely used services. In addition, FinTech encompasses private equity, private placements, public offerings, and stock market listings. A 2015 report by Statista indicated that while P2P lending experienced substantial growth between 2012 and 2015, it is projected to expand ten times more by 2025. FinTech is also playing a progressively vital role in robo-advisory services, which utilize algorithms and software to deliver financial advice online with minimal human involvement.

2.4.1.2 Operations and Risk Management

FinTech enhances operational efficiency and improves data use and management, allowing firms to manage risks better and maximize profits. By offering services at lower costs, FinTech opens up opportunities for SMEs and individual customers. However, the industry also faces risks such as regulatory challenges and cyber-attacks (Lee & Shin, 2018).

2.4.1.3 Payments and Infrastructure

FinTech has revolutionized payment mechanisms through the internet and mobile telecommunications, playing a crucial role in advancing domestic and cross-border payment systems, an aspect of growing significance in both developed and developing economies. Its impact is particularly evident in facilitating large-scale transactions in markets like foreign exchange, where daily turnover reaches approximately \$5.4 trillion. Mobile money has gained substantial traction in several African nations, including Kenya, Uganda, Tanzania, and Ghana, where it supports both individual and commercial transactions efficiently across regions. Asia leads in this area, driven by advancements in Chinese FinTech firms like Alibaba. Africa follows,

with established mobile money systems in several countries. North America is third, followed by Europe and Latin America. The Middle East lags in mobile payments.

2.4.1.4 Data Security and Monetization

Digitalizing financial systems increases vulnerability to cyber-attacks. FinTech leverages big data to enhance system security and detect fraud in financial transactions using data science techniques and machine learning. Businesses manage their data innovatively to generate value, a practice known as data monetization. This involves creating monetary value from raw, processed, or analyzed data products (Kulhánek, 2019).

2.4.1.5 Customer Interface

FinTech is transforming customer interfaces in the financial industry, leading to a decline in branch networks, especially in developed countries like the UK, and an increase in technology-based interactions. Mobile money allows users including small and medium-sized enterprises to use their phones to conduct transactions from anywhere in developing nations, especially in Africa.

2.4.2 Role of FinTech in Banking and Financial Services

2.4.2.1 Mobile Money

Through the use of mobile phone networks, mobile money facilitates financial transactions in which mobile network operators (MNOs) hold the funds on behalf of their clients. For future transactions, these monies can be put straight into the customer's mobile wallet or originally bought as airtime. A key aspect of mobile money is its ability to facilitate financial transactions directly via MNOs, bypassing the need for a traditional bank account. Typically, mobile money is regulated under company law and by telecommunications authorities (Ahmad et al., 2020; Aker & Mbiti, 2010), though in some countries, financial regulators are increasingly overseeing these operations. Eliminating the need to manage money and enhancing openness through digital record-keeping,

improves mobile money security, which helps mitigate corruption. Additionally, it provides a gateway to the formal financial system, encouraging savings and offering a form of self-insurance against minor financial shocks (Ahmad et al., 2020; Demirgüç-Kunt et al., 2018).

The most common FinTech product in the financial industry in Africa is mobile money, which is also thought to be the most significant development for expanding financial inclusion in the developing world. The use of mobile phones in rural regions and their growing penetration are the main factors driving its expansion. By avoiding the frequently time-consuming steps involved in creating a bank account, mobile money streamlines the process of obtaining financial services. Improvements in Point-of-Sale infrastructure, SIM card technology, and mobile phone hardware have all contributed to the broad use of mobile money among underserved and unbanked populace. These significant milestones have created a more conducive ecosystem for mobile money solutions and prompted more cooperation between traditional banks and mobile money providers. The increased accessibility of mobile money point-of-sale systems, combined with its peer-to-peer (P2P) payment functionality, has been instrumental in increasing adoption rates. This functionality enables users to make payments for various everyday expenses—such as utility bills, transportation fares (including ridesharing services like Uber and taxis), airtime, internet data, and personal funds transfers to close relative and associates—thereby meeting a range of financial needs (GSMA, 2013; Masha, 2016; Quartey, 2020).

2.4.2.2 Mobile Banking Services

Mobile banking utilizes mobile technology to provide access to banking services, primarily offered by banks and financial institutions. The framework of established banking laws and regulations governs this extension of traditional banking services via mobile platforms. The

identities of the service providers, the methods for obtaining services, and the many regulatory requirements are the primary features that distinguish mobile banking from mobile money.

However, these distinctions are not always straightforward. Mobile network operators (MNOs), while not providing banking services per se, often manage customer funds within designated bank accounts. Additionally, some banks in specific jurisdictions offer mobile financial services akin to those provided by MNOs.

For example, M-Pesa is offered by Kenyan MNO Safaricom, but other MNOs and banks also provide competitive mobile financial services without requiring formal partnerships under local regulatory policies. Conversely, in countries like Uganda and Ghana, MNOs must partner formally with banks to provide such services (Ahmad et al., 2020; Aron, 2018). This regulatory variability underscores the differing frameworks governing mobile financial services across various regions.

2.4.2.3 Crowdfunding Services

Crowdfunding is a digital, internet-based approach that enables firms or organizations to raise funds through investments or donations from diverse entities. This method gained prominence following the 2008 Global Financial Crisis, addressing the financing barriers faced by start-ups. Crowdfunding operates by pooling small contributions from individuals or institutions to finance projects or individual needs without intermediary financial institutions, facilitated through online platforms. Initially, crowdfunding extended traditional financing methods from family and friends to the online sphere, but it has since evolved to include debt and equity investments, focusing on business owners and micro, small, and medium-sized firms with substantial room for expansion

Since its inception, the global crowdfunding market has experienced rapid growth. In 2012, the market raised approximately \$2.7 billion, with contributions from North America totaling \$1.6 billion, Europe \$945 million, and other regions \$110 million (Massolution, 2013). Between 2009 and 2012, crowdfunding experienced a compound annual growth rate (CAGR) of 63%, with equity-based platforms showing a CAGR of 114%, lending-based platforms 78%, donation-based platforms 43%, and reward-based platforms 524% (World Bank, 2013). The market continued its upward trajectory, raising \$16.2 billion in 2014, an increase of 167% over the previous year, and \$34.4 billion in 2015, marking a 112.3% increase. North America remains the leading region, holding 50.1% of the global market share, followed by Europe at 18.8%, with other regions, including Oceania, South America, and Africa, accounting for 0.5% (Massolution, 2015).

Crowdfunding encompasses four primary models: “donation-based, reward-based, debt-based, and equity-based”. Donation-based crowdfunding involves donors contributing modest amounts to support projects or individuals in need, with no expectation of financial return. Non-profit groups frequently employ this model to finance political, social, environmental, or charitable initiatives. In reward-based crowdfunding, investors contribute to a project in return for a non-cash incentive, like appreciation tokens or previously purchased goods or services. Funders can lend money to people or businesses through debt-based crowdfunding, with the expectation that they would repay the loan plus interest. Equity-based crowdfunding is especially well-suited for funding start-ups and micro, small, and medium-sized businesses since it enables individuals as well as entities to participate in unlisted businesses in return for ownership shares (Jenik et al., 2017; Kirby & Worner, 2014).

Crowdfunding platforms typically enable entrepreneurs to present business pitches or campaigns online, specifying the target amount of funding they seek to raise. In addition to members of the

general public or institutional investors eager to help creative small businesses, funders are frequently selected from the entrepreneur's social network. Although donations still account for the majority of crowdfunding activity in Sub-Saharan Africa (SSA), there has been a noticeable early development of platforms based on equity and debt in nations like Ghana, Kenya, and South Africa. Some crowdfunding sites in Africa are devoted to supporting socially conscious projects.

A burgeoning middle class, expanding access to mobile technology, a high demand for capital, and active financial support from Africans living abroad are all contributing factors to the region's growing interest in crowdfunding. There is a lot of potential for crowdfunding to promote entrepreneurship and assist micro, small, and medium-sized businesses. However, challenges such as regulatory constraints require serious attention and resolution to fully unlock this potential.

2.4.2.4 Cryptocurrency

Cryptocurrency is a type of digital currency that is protected by cryptographic methods that stop counterfeiting and double-spending. Enhancing network security by the application of cryptography is where the term "cryptocurrency" originates (Gandal & Halaburda, 2016; Sovbetov, 2018). Using distributed ledger technology, especially blockchain, several cryptocurrencies operate on decentralized networks that act as public databases for tracking financial transactions. Theoretically, cryptocurrencies are immune to government intervention because they are not issued by a central authority like regular currencies. Peer-to-peer (P2P) Internet technology and cryptographic techniques are the foundation of cryptocurrencies, which are created, shared, and traded solely online. Investors can use online trading platforms to buy and sell cryptocurrencies.

Cryptocurrencies can also be exchanged for fiat money like dollars, pounds, and euros, making them useful for business transactions. Bitcoin, launched in 2009, was the first blockchain-based

cryptocurrency and is still the most widely used one. Today, there are thousands of different cryptocurrencies with various functions and specifications. Notable examples include Ethereum, Ripple XRP, Bitcoin Cash, and Litecoin. According to a 2017 Coinmarketcap report, the dominant cryptocurrencies by market capitalization were Bitcoin, Ethereum, Ripple, Bitcoin Cash, and Litecoin, with Bitcoin being the most prominent. Certain cryptocurrencies are either direct clones or forks of Bitcoin, whereas others have been developed independently. With a total market value of over \$146 billion, more than 18 million Bitcoins had been issued by November 2019, surpassing the GDPs of many countries across the globe.

Furthermore, like conventional shares, cryptocurrencies operate as financial securities. Blockchain start-ups frequently issue digital "tokens" or "new cryptocurrencies" to investors in order to raise money for projects or business endeavors. These investors contribute using well-established cryptocurrencies such as Bitcoin, or fiat currency in exchange for voting rights or ownership stakes in the venture.

This method, also called an initial coin offering (ICO), gives start-ups access to speedier, easier, and less expensive financing options by avoiding the strict legal restrictions that come with regular public offers. Through initial coin offerings, blockchain startups have raised more than US\$1.5 billion since 2017 (Salami, 2019).

Cryptocurrencies hold significant potential to enhance financial inclusion by enabling direct fund transfers between parties without relying on traditional intermediaries such as banks, credit card companies, or central authorities. This feature is particularly advantageous for individuals and entities with restricted access to formal financial institutions, as it allows them to participate in financial transactions more easily. However, because cryptocurrency transactions are semi-anonymous, regulatory challenges arise, as it increases the risk of misuse for unlawful purposes

including tax evasion, money laundering, and illicit financial flows. These concerns are especially relevant in regions such as Africa, where cryptocurrencies have been linked to issues of money laundering and terrorism financing (Salami, 2018).

2.5 Monetary Policy and Financial Development

The theoretical literature presents a variety of mechanisms through which monetary policy influences financial development, a crucial relationship that underpins economic stability and growth. Early contributions by McKinnon (1973) and Shaw (1973) emphasized the significance of monetary stability in promoting financial deepening. In their view, financial repression manifested through high inflation, interest rate controls, and government-directed credit allocation, impedes financial development by distorting savings and investment decisions. Conversely, a stable monetary environment fosters savings, enhances investment, and promotes efficient financial intermediation, thereby facilitating financial sector growth.

Monetary policy and financial development are interrelated pillars that support the broader economic architecture of any country. Central banks, through monetary policy, manage key levers like interest rates, money supply, and credit conditions to achieve macroeconomic goals such as price stability, employment, and economic growth. Financial development, in contrast, refers to the maturation and expansion of financial institutions, markets, and infrastructure that facilitate efficient capital allocation, risk management, and market diversification. The interaction between these two elements is fundamental for the smooth functioning of the economy, as financial development enhances the transmission and effectiveness of monetary policy, while well-calibrated monetary policy supports the development of robust financial systems.

Monetary policy operates through multiple channels to impact financial development, each with distinct effects on various segments of the economy. One traditional channel is the balance sheet channel, as proposed by Bernanke and Gertler (1995) and later expanded by Bernanke, Gertler, and Gilchrist (1996). This channel underscores the idea that the financial health of borrowers, both households and businesses directly influence the lending decisions of financial intermediaries. Monetary policy interventions, such as changes in interest rates, can alter the balance sheet positions of borrowers by affecting asset values, cash flows, and collateral.

While the effectiveness of the channel for the balance sheet is more closely tied to the financial health of borrowers, Bolton et al. (2016) argue that this channel may be even more pronounced when credit markets are more heavily influenced by non-bank financial intermediaries. Non-bank institutions which are less regulated than traditional banks, may be more responsive to changes in monetary conditions. In contrast, traditional banks have strong incentives to maintain long-term relationships with their clients, often mitigating the impact of interest rate fluctuations on lending decisions. This indicates that the structure of the financial system whether dominated by banks or non-bank entities can shape the transmission of monetary policy and, by extension, its impact on financial development.

Monetary policy also affects financial development through its influence on key macroeconomic variables like interest rates, inflation, and credit availability. Low and stable inflation, often an explicit target of central banks, creates an environment conducive to long-term investments in financial assets. High inflation, on the other hand, erodes the value of money, disincentivizes savings, and diminishes the efficiency of financial markets. Bittencourt (2021) finds that high inflation rates are detrimental to the financial system, as they reduce the ability of financial

intermediaries to attract capital and allocate resources effectively. Thus, maintaining a stable inflation rate is essential for supporting financial development.

Monetary policy affects overall lending through the balance sheets of financial intermediaries, often referred to as the bank lending channel. When short-term interest rates are raised by monetary authorities, funding costs for intermediaries increase, while long-term returns remain relatively stable in the short run. This maturity mismatch between the intermediaries' long-term assets (such as loans) and short-term liabilities (like funding) plays a critical role in how monetary policy is transmitted (Bernanke, 2007).

Leverage is a key element in the traditional bank lending channel, as institutions with higher leverage ratios—defined as the ratio of total debt to equity or net worth—are more impacted by monetary policy changes. While prudential regulations typically limit bank leverage, the rise of nonbank financial intermediaries, which may operate with higher leverage, can enhance the transmission of monetary policy through these entities. Unlike commercial banks, nonbanks frequently use mark-to-market valuation, making them more responsive to asset price changes triggered by monetary policy shocks. According to the IMF (2016), factors such as company size, access to international capital markets, and portfolio diversification tend to reduce an intermediary's sensitivity to such shocks.

The extent of monetary policy transmission through financial intermediaries is also influenced by capital adjustment costs and regulatory constraints. For instance, banks operating at the minimum required capital levels may be less inclined to increase lending in response to tighter monetary policy due to the costs associated with raising additional capital (Van den Heuvel, 2002). However, if nonbank lending can easily substitute for bank credit, nonbank intermediaries, which are not subject to the same capital requirements, might expand their share of total credit, thereby

mitigating the dampening effects of capital regulations on monetary policy transmission. Moreover, banks might engage in regulatory arbitrage by moving loans off their balance sheets to avoid capital requirements, potentially reducing the overall impact of the bank capital channel.

Monetary policy also influences the risk-taking behavior of financial intermediaries. Generally, an expansionary monetary policy increases the risk-bearing capacity of intermediaries, thereby boosting lending activity. The effectiveness of this risk-taking channel depends on the distinct business models of banks and nonbanks in response to monetary policy changes (Adrian & Shin, 2011). The IMF (2016) identifies several factors that affect intermediaries' risk-taking behaviors: the use of leverage, yield-seeking tendencies, compensation structures, and internal risk management models. Lower interest rates may encourage yield-seeking behavior, particularly in commercial banks with large fixed-yield obligations, prompting a shift toward higher-risk assets to maintain profitability (Hanson & Stein, 2015). Additionally, factors such as compensation schemes and risk management practices can further incentivize risk-taking, influencing the overall transmission of monetary policy.

Recent theoretical models also account for the growing role of financial technology (FinTech) in mediating the relationship between monetary policy and financial development. FinTech innovations, such as digital payment platforms, mobile banking, and peer-to-peer lending, have expanded access to financial services, particularly in developing countries. These innovations can enhance the transmission of monetary policy by increasing the speed and efficiency with which policy changes are reflected in financial markets (Demirgüç-Kunt et al., 2023).

Empirical research provides mixed evidence on the relationship between monetary policy and financial development, reflecting differences in the effectiveness of monetary policy across countries and regions. Studies examining advanced economies tend to find a positive relationship

between accommodative monetary policies (e.g., low interest rates) and financial market development. In these contexts, expansionary monetary policy encourages borrowing and investment, facilitating the growth of financial markets (Sharma & Dahiya, 2021). However, in emerging economies, monetary policy's effect on financial development is often more complex and contingent upon broader macroeconomic conditions.

Research consistently demonstrates that lower interest rates play a pivotal role in promoting financial development by expanding access to credit. Low interest rates encourage financial market investment in advanced countries, which results in the development of new financial products and the growth of financial institutions. As noted by Asongu and Nwachukwu (2019), periods of reduced interest rates spur market innovation and expansion. For instance, the ultra-low interest rates in the U.S. and Europe following the 2008 Global Financial Crisis led to significant growth in stock markets and a rapid extension of credit to the private sector. This credit expansion supported financial development by enabling businesses and households to access funding for investment and consumption, thereby fostering broader market activity.

The relationship between inflation and financial development is more nuanced. High inflation is typically detrimental to financial development, as it introduces uncertainty and erodes the real value of financial contracts, making long-term financial planning difficult. In contrast, moderate inflation, especially in emerging markets, can sometimes encourage investment in financial assets and foster market development. Imran and Nishat (2022) posit that moderate inflation can create incentives for savers and investors to seek financial instruments as a hedge against rising prices, thereby contributing to market deepening. However, Bittencourt (2021) cautions that prolonged high inflation negatively impacts long-term investment decisions, undermining the financial system's capacity to mobilize savings and efficiently allocate resources.

The correlation between financial development and monetary policy has changed even further with the emergence of FinTech. FinTech platforms, such as digital wallets, mobile money, and cryptocurrency exchanges, have significantly expanded financial inclusion (especially in regions with underdeveloped banking infrastructure). FinTech's ability to facilitate faster and more efficient financial transactions enhances the transmission of monetary policy, particularly in developing economies. Demirgüç-Kunt et al. (2023) posit that digital financial services have improved the reach and impact of monetary policy, allowing for more immediate and widespread changes in financial behavior. Countries like Kenya and India have leveraged mobile banking platforms to increase the unbanked population's ability to obtain financial services which has had positive effects on financial development. For example, the widespread use of mobile money in Kenya through platforms like M-Pesa has not only expanded access to credit but also stimulated entrepreneurship and economic growth.

A key mechanism through which monetary policy influences financial development is the expansion of credit. Increased access to credit facilitates investment, supports entrepreneurship, and stimulates activity in financial markets. Monetary policy that is expansionary, is characterized by lower interest rates and increased credit supply, have been shown to promote financial market growth by providing the liquidity needed for investment in various sectors. Rajan and Subramanian (2020) argue that credit growth, driven by accommodative monetary policies, can spur financial development by deepening markets and promoting the development of fresh and competitive financial products.

However, excessive credit growth can lead to financial instability as seen during the 2008 global financial crisis. Therefore, it is vital to achieve equilibrium between fostering credit expansion and maintaining financial stability to ensure sustainable financial development.

In conclusion, the interaction between monetary policy and financial development is both multifaceted and dynamic. Theoretical perspectives, dating back to McKinnon and Shaw, emphasize the importance of monetary stability for fostering financial sector growth. In practice, monetary policy affects financial development through various channels, including interest rates, inflation control, and credit availability. Additionally, the balance sheet channel and the role of non-bank intermediaries offer deeper insights into how monetary policy influences financial decisions within the broader financial system.

The rise of FinTech has further transformed the landscape, offering new opportunities for monetary policy to influence financial development, particularly in emerging and developing markets. FinTech innovations are enhancing financial inclusion, improving the transmission of monetary policy, and providing more efficient financial services, thereby fostering more robust financial development. As the global financial system continues to evolve, the correlation associated with monetary policy and financial development will remain crucial for promoting economic stability, inclusion, and growth.

2.6 Monetary Policy and FinTech

The theoretical influence of digital finance on monetary policy transmission remains largely unexplored. While existing literature investigates various key channels of monetary policy, such as those discussed by Boivin et al. (2010) and the IMF (2016), few studies specifically address how these channels are altered by the rise of nonbank financial activities. Mylonas et al. (2000) argue that FinTech, as a significant innovation in financial markets, substantially influences the efficacy of monetary policy. They suggest that FinTech enhances the responsiveness of financial instruments and assets to interest rate adjustments, thereby affecting monetary policy transmission. This perspective is supported by Mishra and Pradhan (2008), who contend that financial

innovations, including FinTech, strengthen the role of interest rates in monetary policy transmission. Financial deepening, facilitated by FinTech, makes firms and households more susceptible to fluctuations in interest rates.

Additionally, Hawkins (2001) and Al-Laham et al. (2009) argue that the advent of electronic money, a key FinTech innovation, impacts the efficacy of monetary policy by influencing the velocity of money. They assert that advancements in financial technology and market conditions enhance the short-term effectiveness of monetary policy. In contrast, Fiedler et al. (2017) suggest that Monetary policy is not directly impacted by fintech until digital currencies from non-bank entities compete with traditional currencies.

FinTech can improve monetary policy transmission by increasing competition among banks and expanding the monetary policy's risk-taking channel. Non-bank financial intermediaries may respond more acutely to monetary policy changes compared to traditional banks, potentially making financial markets with substantial non-bank sectors more sensitive to monetary policy shocks (Fiedler et al., 2017). However, a larger non-bank financial sector might also exacerbate existing financial vulnerabilities, potentially weakening the transmission of monetary policy. Furthermore, the rise of digital currencies could limit the flexibility of monetary authorities and reduce the central banks' monopoly over money supply, thereby mitigating potential abuses of monetary power.

The interaction between monetary policy and financial technology, therefore, represents a growing area of interest in the financial and economic literature. FinTech, which includes innovations such as peer-to-peer lending, cryptocurrencies, mobile banking, and digital payments, has transformed the financial landscape, challenged traditional banking systems and reshaped how financial services are delivered. These technological advancements have considerable effects on how

monetary policy is communicated and how effective it is, especially as central banks worldwide adjust to the rapidly evolving financial environment.

The **interest rate channel** remains a central mechanism through which central banks influence economic activity. Central banks have a direct impact on borrowing costs by changing interest rates, which in turn, influence both investment and consumption. The emergence of FinTech platforms, particularly peer-to-peer (P2P) lending and digital lending services, has reshaped the efficiency and accessibility of credit markets. For instance, platforms like Lending Club and Zopa have significantly reduced the reliance on traditional banking institutions by offering alternative, often quicker, methods of accessing credit. These platforms tend to operate with lower transaction costs, thus accelerating the transmission of monetary policy changes such as interest rate adjustments to both consumers and businesses (Thakor, 2021).

However, the rapid expansion of digital lending has introduced complexity into the traditional interest rate channel. FinTech-driven credit allocation creates a more fragmented financial landscape, where central bank interest rate adjustments may not fully capture the dynamics of alternative credit mechanisms. Moreover, some FinTech platforms operate under less stringent regulatory frameworks than traditional banks, which can lead to inconsistencies in how monetary policy impacts credit distribution across the financial system (Boot et al., 2021). This fragmentation poses a challenge to central banks, as it reduces their ability to uniformly influence credit availability through conventional interest rate tools.

By affecting the availability of credit to both consumers and businesses, the credit channel, in addition to the interest rate channel, is essential to enhancing the effects of monetary policy. FinTech innovations, including mobile banking and digital lending, have broadened credit access, particularly in regions underserved by traditional banks. A typical example is mobile money

platform widely adopted and used in West Africa which has enabled millions of previously unbanked individuals to access financial services. This increase in financial inclusion has translated into greater credit availability, enhancing the reach and effectiveness of monetary policy interventions aimed at stimulating economic activity (Demirgüç-Kunt et al., 2023).

In economies with high FinTech penetration, expansionary monetary policies such as interest rate cuts or increased liquidity can be transmitted more effectively to a broader segment of the population. FinTech platforms allow credit to flow more freely and efficiently, especially to underserved markets. This enhances the impact of central bank policies aimed at boosting lending and economic activity. However, the proliferation of alternative credit channels poses a challenge for central banks, as it can dilute their control over credit growth and financial stability. Rapid credit expansion facilitated by digital lending platforms may result in overheating of credit markets, with potential risks of financial instability.

FinTech has also revolutionized **payment systems**, introducing faster, more cost-effective, and more secure methods for transferring funds. Innovations such as digital wallets, blockchain-based payments, and contactless payment systems have simplified transaction processes for consumers and businesses alike. Recognizing these shifts, central banks, such as the People's Bank of China and the European Central Bank, are exploring the development of **Central Bank Digital Currencies (CBDCs)**. CBDCs represent a digital form of fiat money issued by central banks, which aims to maintain control over the monetary system in an era dominated by FinTech innovations. By issuing CBDCs, central banks seek to preserve their role as the primary provider of currency and liquidity, ensuring that they remain integral to the financial system despite the rise of alternative payment systems (Auer & Böhme, 2020).

The rise of FinTech-driven payment systems also impacts the **liquidity management** aspect of monetary policy. Traditional monetary policy tools, such as open market operations, rely on the central bank's ability to control liquidity within the banking system. However, as FinTech platforms offer alternative payment methods often outside the regulated banking system—these tools may become less effective. For instance, the growing use of cryptocurrencies and decentralized finance (DeFi) platforms has the potential to reduce the demand for fiat currency, thereby challenging central banks' ability to manage liquidity and control inflation. The decentralized nature of these platforms allows users to bypass traditional banking infrastructure, rendering Central banks ineffective to oversee and control monetary flows (Chiu & Koepl, 2020).

While FinTech has enhanced access to financial services and the speed of monetary transactions, it also presents significant challenges to the traditional functioning of monetary policy operations. Many FinTech platforms operate outside the regulatory frameworks that govern banks and other financial institutions, creating a regulatory gap that can complicate the ability of central banks to monitor and control financial activities. This poses potential risks to financial stability; particularly as decentralized finance (DeFi) platforms emerge. DeFi enables users to lend, borrow, and trade assets without relying on traditional intermediaries, making it more difficult for central banks to track credit flows and manage systemic risks (Philippon, 2020). To address these challenges, central banks must develop new regulatory frameworks that encompass these digital platforms while still encouraging innovation.

The rapid growth of FinTech in the lending and credit markets, especially through platforms offering digital lending services, has raised concerns about financial stability. These platforms often extend credit without the rigorous risk assessments that traditional banks employ, leading to potential over-lending and the accumulation of systemic risks. The 2008 global financial crisis

highlighted the dangers of unchecked credit expansion, and similar risks may arise in FinTech-driven credit markets. Central banks, therefore, need to closely monitor the growth of digital lending to prevent financial fragility (Boot et al., 2021).

As financial services increasingly move beyond traditional banking institutions, central banks face challenges in effectively implementing monetary policy through conventional tools. For example, if large portions of financial transactions occur on blockchain platforms or through digital currencies, central banks may struggle to manage liquidity and control inflation using tools like interest rate adjustments and open market operations. The proliferation of decentralized financial systems necessitates the “development of new monetary policy tools” that can address the challenges posed by FinTech innovations (Thakor, 2021).

By introducing completely new business models for payments, wealth management, crowdfunding, lending, and capital markets, FinTech is often seen as a “disruptive innovation” that is reshaping financial services. Depending on their particular uses, these innovations might either rival or enhance established financial institutions. (Temelkov, 2018; Lee & Shin, 2018; Puschmann, 2017). The cost-reducing nature of FinTech's business models has raised the standard and accessibility of financial services, especially in underdeveloped markets.

FinTech firms effectively target small and medium-sized enterprises, offering financial services where traditional banks have limited presence (Maier, 2016; Temelkov, 2018).

For instance, FinTech lenders have extended credit to individuals and businesses in economically underserved regions, providing financial inclusion where traditional banks have not reached. Jagtiani and Lemieux (2018) highlight how FinTech lenders can serve customers in regions with limited banking infrastructure or lower economic activity. FinTech firms also enjoy cost

advantages over traditional banks by using advanced technologies to offer customer-centric services and by facing lower compliance costs due to lighter regulations following the Global Financial Crisis (Lee & Shin, 2018; Temelkov, 2018).

The rapid growth of FinTech in the lending and credit markets, especially through platforms offering digital lending services, has raised concerns about financial stability. These platforms often extend credit without the rigorous risk assessments that traditional banks employ, leading to potential over-lending and the accumulation of systemic risks. The 2008 global financial crisis highlighted the dangers of unchecked credit expansion, and similar risks may arise in FinTech-driven credit markets. Central banks, therefore, need to closely monitor the growth of digital lending to prevent financial fragility (Boot et al., 2021).

As financial services increasingly move beyond traditional banking institutions, central banks face challenges in effectively implementing monetary policy through conventional tools. For example, if large portions of financial transactions occur on blockchain platforms or through digital currencies, central banks may struggle to manage liquidity and control inflation using tools of monetary policy. The proliferation of decentralized financial systems necessitates the development of new monetary policy tools that can address the challenges posed by FinTech innovations (Thakor, 2021).

Despite the challenges posed by FinTech, there are also significant avenues for central banks to harness these innovations to enhance the efficacy of monetary policy.

One of the most promising areas for central banks in the evolving financial landscape is the development of Central Bank Digital Currencies (CBDCs). CBDCs represent a digital form of a nation's fiat currency, issued and regulated by the central bank. The introduction of CBDCs could

help central banks maintain control over the monetary system, ensuring their central role within the financial ecosystem amid the rise of FinTech alternatives. CBDCs have the potential to enhance the transmission of monetary policy by facilitating more secure, efficient, and widespread digital payments (Auer & Böhme, 2020).

FinTech innovations, particularly in developing economies, have played a facilitating role in expanding financial inclusion where access to traditional banking services is often limited. Central banks can harness these innovations to improve financial inclusion, which can subsequently enhance monetary policy execution. For example, central banks could collaborate with mobile banking platforms to ensure that policy adjustments such as interest rate changes or liquidity injections, reach populations that have traditionally been underserved by formal financial institutions (Demirgüç-Kunt et al., 2023).

Moreover, FinTech platforms generate vast amounts of real-time data on consumer behavior, credit demand, and payment flows. Central banks can utilize this data to make more informed decisions regarding monetary policy. Real-time insights from digital payment transactions, for instance, could provide central banks with early indicators of shifts in economic activity, enabling them to implement more timely and targeted policy interventions (Carstens, 2021). By leveraging FinTech data, central banks can improve the precision and responsiveness of their monetary policies, adapting to the fast-paced nature of digital finance.

To sum up, the interaction between FinTech and monetary policy differs significantly across regions. In Kenya, the success of M-Pesa has strengthened the transmission of expansionary monetary policies by improving liquidity distribution and enhancing consumer responsiveness to interest rate changes. In China, the People's Bank of China integrates digital payment data from Alipay and WeChat Pay to refine monetary targeting, demonstrating how FinTech can enhance

policy precision. In contrast, Nigeria's unregulated proliferation of mobile lending apps has complicated monetary control, showing that institutional quality determines FinTech's macroeconomic impact.

2.7 FinTech and Financial Development

The introduction of cutting-edge technologies by FinTech has transformed the financial services sector by improving financial services' efficiency and accessibility. This transformative impact has significant implications for financial development, which encompasses the growth and evolution of financial institutions, markets, and infrastructures designed to facilitate efficient resource allocation, risk management, and economic diversification.

The development of FinTech has also greatly improved financial services' efficiency and transparency. Transactions can now be conducted and recorded in new ways that are quicker, less expensive, and more secure due to technologies like distributed ledger systems and blockchain. For instance, cryptocurrencies such as Bitcoin and Ethereum, which provide an alternative to conventional financial systems and allow for safe, transparent transactions without the need for intermediaries, are supported by blockchain technology (Narayan et al., 2018).

Additionally, advanced technologies like artificial intelligence (AI) and big data analytics are improving decision-making processes in financial services. AI-powered algorithms can analyze vast amounts of data to identify creditworthiness and detect fraud, thus reducing risks and improving the reliability of financial transactions (Lee & Shin, 2018). These innovations enhance the efficiency of financial markets by streamlining operations and reducing costs associated with traditional financial intermediaries.

To provide financial inclusion where traditional banks have failed, FinTech lenders, for example, have given credit to individuals and businesses in economically deprived areas. FinTech lenders can help consumers in areas with weaker banking systems or less economic activity (Jagtiani and Lemieux, 2018). By leveraging cutting-edge technologies to provide customer-focused services and by dealing with reduced compliance costs as a result of laxer laws after the Global Financial Crisis, FinTech companies also benefit from lower costs than traditional banks (Lee & Shin, 2018; Temelkov, 2018).

FinTech is essential to advancing global financial and social inclusion because it improves access to economic opportunities and decreases inefficiencies in the financial system's resource allocation (Ding et al., 2018; Salampasis & Mention, 2018). It enables market segments typically ineligible for commercial bank loans to access financial services (Makina, 2019). FinTech also increases credit availability for SMEs, providing an alternative to small banks (Sheng, 2020).

FinTech companies are particularly effective in offering more personalized, convenient, and customer-focused financial services compared to traditional institutions. They leverage advanced technologies such as “big data, artificial intelligence, biometrics, and blockchain” (Ansari & Krop, 2012). This shift has significant implications for the broader financial sector, as digital banking, crowdfunding platforms, and distributed ledger technology reshape the financial services landscape. These innovations are also challenging for macroeconomic policy, as they alter the way financial services are delivered and disrupt traditional regulatory frameworks (Paternoster & Dessimirova, 2017).

FinTech innovations are heterogeneous, encompassing digital payments, digital lending, blockchain and cryptocurrency technologies, robo-advisory services, and InsurTech. Each category has distinct implications for financial stability and monetary policy. Digital payments

expand transaction velocity and financial inclusion; digital lending affects credit allocation; blockchain and cryptoassets challenge regulatory oversight and monetary sovereignty; while InsurTech deepens risk pooling and financial resilience. These distinctions are essential for understanding how FinTech contributes to or threatens financial development in varying macroeconomic contexts.

As FinTech continues to grow, it presents significant challenges to regulators due to its unconventional business models. These models differ from traditional financial services and necessitate adjustments in financial regulation and supervisory frameworks (Bromberg, Godwin, & Ramsay, 2017; Chui, 2017; Temelkov, 2018). For example, digital currencies, such as Bitcoin, introduce additional complexities for monetary policy (Narayan et al., 2018). Financial innovations often lead to increased credit growth, elevating systemic risks and making markets more vulnerable (Chui, 2017). FinTech also presents risks related to fraudulent activities, such as fake startups and scams (Bromberg, Godwin, & Ramsay, 2018).

On the other hand, regulatory technology (Regtech) offers a potential solution to manage the risks introduced by FinTech. Regtech leverages technological advancements to create a safer and more efficient financial services environment, contributing to financial system stability (Anagnostopoulos, 2018). Regtech initiatives can help mitigate risks associated with digital financial services, accelerating the shift toward a new regulatory framework for financial services (Zhou et al., 2018). While FinTech introduces certain risks, it also provides tools that can help mitigate these risks, presenting a trade-off for regulators who must balance the promotion of FinTech innovation with the maintenance of consumer confidence and financial stability (Mahoney, 2019).

2.8 Theoretical Literature

The relationship between monetary policy, FinTech, and financial development can be grounded in several theoretical perspectives that explain the evolving mechanisms through which innovation shapes financial intermediation, stability, and macroeconomic performance. The theories that this study is underpinned are discussed as follow:

Financial Intermediation Theory

The Financial Intermediation Theory (Gurley & Shaw, 1960; Goldsmith, 1969) posits that financial intermediaries play a critical role in mobilizing savings and allocating capital efficiently to productive sectors. Efficient intermediation enhances liquidity creation, reduces transaction costs, and promotes economic growth. In traditional settings, banks and other financial institutions are central to this process, operating as conduits through which monetary policy transmits to the real economy.

However, the emergence of FinTech has transformed the architecture of financial intermediation. Digital platforms now serve as alternative channels for deposit mobilization, credit disbursement, and payments processing. By digitizing financial activities, FinTech enhances access and efficiency but simultaneously disintermediates traditional banking functions, thereby altering the conventional transmission mechanisms of monetary policy. The substitution of traditional intermediaries with digital platforms may weaken central banks' control over liquidity and credit creation, particularly in economies where large volumes of transactions occur outside the formal banking system. Thus, FinTech redefines the intermediation process in ways that can either deepen financial development or complicate monetary control, depending on institutional strength and regulatory oversight.

Stability–Fragility Hypothesis

The Stability–Fragility Hypothesis (Allen & Gale, 2000) provides a dual perspective on financial innovation. It asserts that innovation enhances stability by improving risk diversification and efficiency during normal economic periods but simultaneously increases vulnerability during periods of financial stress. In the context of FinTech, this theory suggests that digital financial innovations such as mobile lending, cryptocurrencies, and decentralized finance can initially strengthen financial systems by enhancing inclusion and liquidity. Yet, during downturns, these same innovations may exacerbate systemic risk through unregulated credit expansion, heightened interconnectedness, and exposure to cyber and operational risks.

FinTech, thus, embodies a paradox: it is both a stabilizing and destabilizing force. When supported by robust prudential and regulatory frameworks, FinTech promotes resilience by enabling financial inclusion and data-driven risk management. However, in economies with weak regulatory institutions common among developing countries, FinTech expansion may amplify fragility by fostering speculative behaviors, market volatility, and contagion effects. This hypothesis is central to this study, as it underscores the need to examine how the interaction between monetary policy and FinTech influences financial stability in both normal and crisis periods.

Innovation-Induced Instability Framework

The Innovation-Induced Instability Framework, advanced by Minsky (1986), argues that financial and technological innovations tend to evolve in cycles that increase systemic leverage and speculative activity. During economic expansions, innovation fuels optimism and risk-taking, which, if unchecked, lead to excessive credit creation and financial bubbles. When conditions reverse, these same innovations amplify downturns through rapid capital outflows and liquidity shortages.

This theory directly relates to the FinTech phenomenon. As digital financial services proliferate ranging from peer-to-peer lending to algorithmic trading new channels of credit and liquidity creation emerge outside the regulatory perimeter. These developments can heighten financial instability, particularly if central banks lack the tools to monitor real-time digital flows. Minsky's framework thus highlights the importance of macroprudential policies and adaptive regulation to ensure that technological innovation supports rather than undermines financial stability.

Integrating the Theoretical Perspectives

Collectively, these theories provide a coherent foundation for analyzing how FinTech interacts with monetary policy to influence financial outcomes. Financial Intermediation Theory explains the efficiency gains and structural changes FinTech brings; the Stability–Fragility Hypothesis cautions against potential systemic risks; and the Innovation-Induced Instability Framework underscores the dynamic, cyclical nature of innovation and crisis.

In emerging economies where financial markets are relatively deep and regulatory structures more advanced, FinTech may reinforce monetary transmission and foster development. In contrast, in developing economies with weaker institutions and informal financial systems, FinTech may disrupt traditional channels, reducing policy effectiveness and amplifying instability. These theoretical perspectives collectively inform this study's empirical framework, which models FinTech as a moderating factor in the relationship between monetary policy and macro-financial outcomes such as financial development, financial stability, and inflation.

2.9 Conceptual Framework of the Study

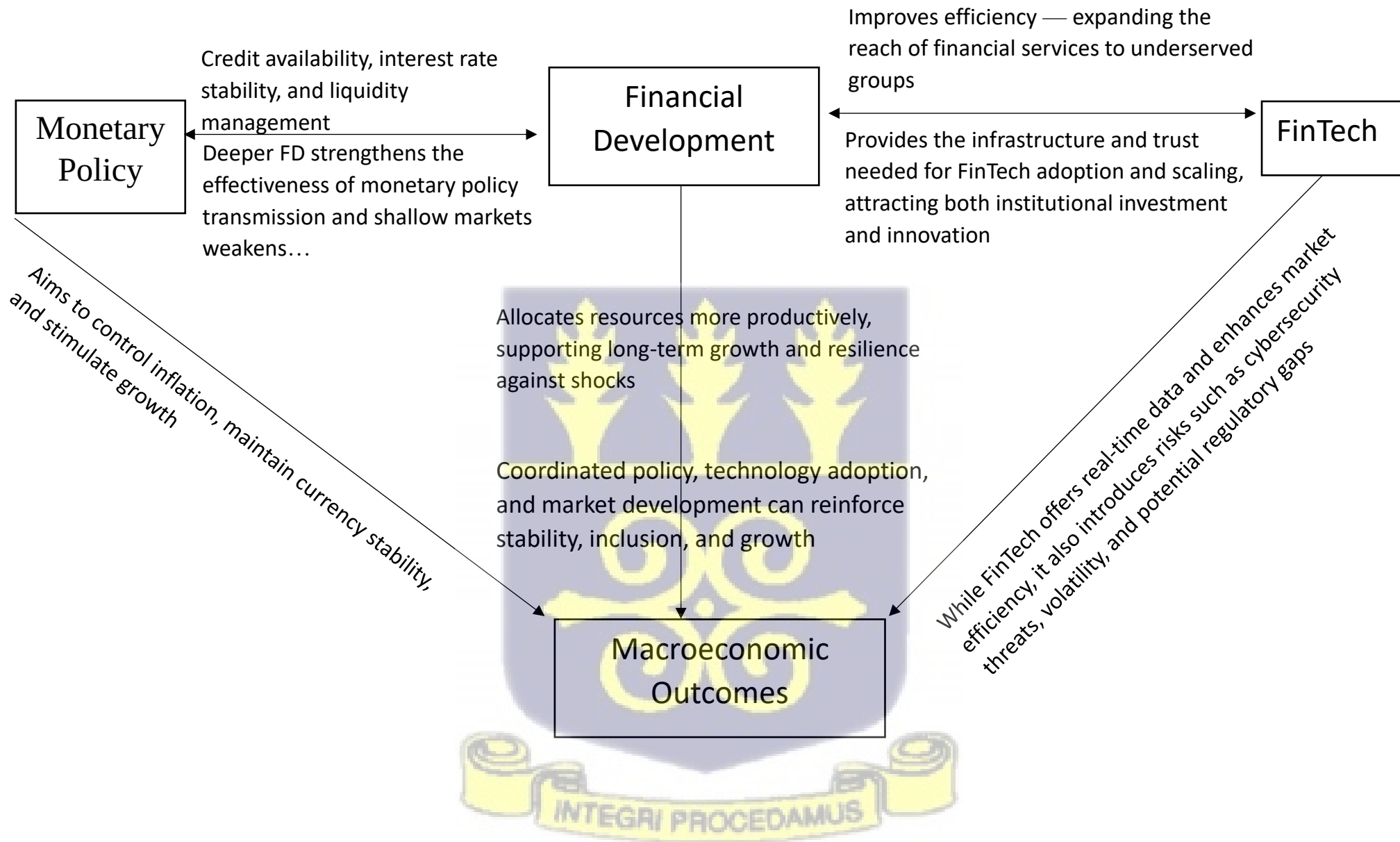
Building on the theoretical foundations outlined above, this study develops a conceptual framework that integrates the interactions between monetary policy, FinTech, and macro-financial performance across emerging and developing economies.

The framework is premised on the view that monetary policy exerts its influence on financial outcomes through traditional transmission mechanisms namely the interest rate channel, credit channel, and exchange rate channel. However, the growing penetration of FinTech modifies these mechanisms by introducing new conduits for credit, payments, and liquidity circulation.

In this conceptualization, FinTech acts as a moderating variable that can either amplify or dampen the impact of monetary policy on financial outcomes, depending on contextual factors such as institutional quality, regulatory effectiveness, and technological readiness.



Figure 2.1: Conceptual Framework



2.10 Conclusion and Policy Implications

The discussion on the stylized facts of monetary policy, FinTech, and financial development reveals the interconnected dynamics between these critical areas. **Monetary policy** plays a central role in managing economic stability and growth, relying on a combination of conventional and unconventional tools to achieve objectives like low inflation, economic growth and full employment. The emergence of **FinTech** has revolutionized the financial landscape, driving greater financial inclusion, innovation, and efficiency through digital solutions, while also presenting new regulatory challenges and risks. Meanwhile, **financial development**—characterized by the expansion and deepening of financial institutions, markets, and infrastructure—remains essential for fostering sustainable economic growth and resilience. The integration of these elements highlights the evolving nature of global finance, underscoring the importance of adaptable policy frameworks and the continuous advancement of financial systems to meet the demands of an increasingly digital and interconnected world.



CHAPTER THREE

MONETARY POLICY, FINANCIAL TECHNOLOGY AND FINANCIAL DEVELOPMENT: EVIDENCE FROM EMERGING AND DEVELOPING COUNTRIES

3.1 Introduction

The Fourth Industrial Revolution has profoundly affected various segments of national economies (Jiao et al., 2021), including the financial and monetary sectors globally (Schwab, 2017). The financial system has experienced a rapid transformation due to cutting-edge technological innovations, significantly altering the operation of the financial sector and reshaping the provision of financial services. Consequently, the efficiency, profitability, and growth of the financial sector are increasingly tied to advancements in information and communication technologies (Su et al., 2020).

A key beneficiary of these innovations within the financial ecosystem is financial technology (FinTech). FinTech refers to the integration of new technologies within the financial services industry, encompassing a “range of digital financial solutions enabled by information technology or the digitization of financial service”’s (Puschman, 2017). These innovations include mobile payments, online lending platforms, blockchain technology, cryptocurrencies, and robo-advisory services (Huang et al., 2022).

To promote financial inclusion, FinTech has been leveraged as a tool to transform the financial development process and reshape the operational structure of financial institutions (Jiang et al., 2022). The adoption of FinTech significantly reduces financial repression and provides underprivileged populations and other financial consumers in developing countries with easier access to financial services. As a result, FinTech has facilitated more efficient resource allocation and contributed to increased gross domestic product (GDP) in many countries (David-West et al.,

2018; Ozili, 2018). For example, FinTech services have created 95 million jobs and increased the GDP of emerging economies by 6%, according to the McKinsey Global Institute (MGI), as cited by David-West et al. (2018).

FinTech's growing influence in the global economy has enhanced access to financial services, thereby promoting financial intermediation (Anarfo et al., 2019). This improved intermediation affects the intertemporal consumption decisions of market participants when there are changes in monetary policy rates, which in turn impacts the overall effectiveness of monetary policy. The increasingly complex financial and economic environment (Nurazira et al., 2022) and the rising demand for financial inclusion and effective monetary policy have made the emergence and adoption of FinTech even more relevant (Lagarde, 2018). As FinTech's role in the global economy expands, it serves as a catalyst for financial development.

Buchak et al. (2018) posit that the shadow banking sector increased its market share from 14% to 38% globally between 2007 and 2015, largely driven by FinTech innovations. Philippon (2016) and Lagarde (2018) further argue that FinTech presents a "brave new world" for monetary policymakers to transform the financial ecosystem, particularly in areas related to financial inclusion and regulatory challenges.

However, the rapid growth and fragmentation of FinTech have posed numerous risks to traditional financial institutions (Buchak et al., 2018). Key risks associated with digital financial transactions include legal and policy incoherence, corporate governance risks, cyber-attacks, monetary policy ineffectiveness, and money laundering (Yan et al., 2021). Among these, the most significant impact of FinTech's evolution on the global financial system is the potential ineffectiveness of monetary policy (Giorgio & Rotondi, 2011). This could lead to financial instability and potentially exacerbate financial exclusion (Jiang et al., 2022).

While research on the impact of FinTech on traditional financial services is growing, there is still limited understanding of how FinTech and monetary policy together influence financial development. Theoretically, the adoption of FinTech could enhance the effectiveness of monetary policy by reducing financial frictions and equalizing interest rates across non-bank entities, thereby fostering a stable and robust financial environment (Stein, 2013; Rajan, 2006). However, the efficacy of monetary policy may be compromised by issues like regulatory arbitrage and heightened competition between FinTech companies and traditional banks, which could impede financial development (Buchak et al., 2018, 2020).

As a result, FinTech's role in shaping monetary policy and the broader process of financial development remains an empirical gap in the literature. Despite numerous studies examining the relationships between these variables (see: Hannig & Jansen, 2010; Ascari et al., 2011; Mehrotra & Yetman, 2014; Lapukeni, 2015; Amatus & Alireza, 2015; Dienillah & Anggraeni, 2016; Ma & Lin, 2016; Anarfo et al., 2019; Tonuchi et al., 2021), there is still limited and often mixed empirical evidence regarding the specific ways in which monetary policy and FinTech independently or jointly affect financial development. This leaves a significant gap in the current literature.

The studies by Evans (2016) and Anarfo et al. (2019) have made strides towards addressing this gap by examining whether financial inclusion facilitated by FinTech improves monetary policy's efficacy and vice versa. However, these studies fall short of specifically investigating the separate or combined effect of monetary policy and FinTech on financial development.

To fill this empirical gap, this paper aims to explore both the independent and joint effects of monetary policy and FinTech on financial development. The importance of this study lies in its contribution to the existing body of literature by offering new insights into how these two factors, individually and together, influence financial development across various countries. In doing so,

it seeks to clarify the complex relationship between monetary policy and FinTech, providing valuable guidance for policymakers and financial regulators.

The rest of the paper is divided into literature review (section 2), methodology (section 3), discussion of empirical results (section 4) and conclusions and recommendations (section 5).

3.2 Literature Review: Theories, Empirics and Hypothesis Development

In recent years, financial systems in many economies have undergone remarkable evolution, accompanied by substantial changes in both corporate practices and policy approaches. While financial development offers numerous economic advantages, the rapid expansion of financial systems often brings about challenges (Levine, 1997, 2005). One of the most critical issues is that financial development directly influences central bank monetary policy and the ways in which its transmitted and communicated. The theories of the different channels through which monetary policy is transmitted—"credit, balance sheet, exchange rate, asset price, and expectations channels", form the basis of this study.

The financial system acts as a conduit monetary transmission mechanism between central bank policy and the actual economy, making it a cornerstone of effective monetary policy. Given that monetary policy significantly shapes the functioning of the financial system, any changes in the system's operating environment are likely to affect the transmission mechanism. Consequently, the efficiency and efficacy of monetary policy are significantly influenced by the financial system's evolution, especially the rate and nature of financial development. Therefore, understanding how changes in the financial system impact monetary policy and vice versa is essential for achieving policy objectives.

For many economies, particularly those undergoing rapid financial development, studying the association between monetary policy and financial development is of both theoretical and practical importance. It helps clarify how financial evolution can shape the success of monetary policy and the realization of its goals.

The theoretical exploration of the relationship between financial development and the effectiveness of monetary policy can be traced back to Gurley and Shaw (1955, 1967). Their pioneering work was followed by further contributions from Taylor (1987), Hendry and Ericsson (1991), Arestis and Howells (1992), Mullineux (1994), and others. Bernanke and Gertler's (1995) credit channel theory has become a more prominent topic in recent literature. This theory highlights that effective monetary policy transmission is often linked to higher levels of financial friction, partly driven by technological innovations. For instance, Kashyap and Stein (2000) find that the impact of the bank lending channel on monetary transmission is more pronounced in banks with extensive digital transaction channels.

Monetary policy influences these financial dynamics in various ways. Bolton et al. (2016) argue that the effects of monetary policy are amplified when the share of non-bank intermediaries is significant, a trend increasingly driven by FinTech adoption. Traditional banks, in contrast, often seek to mitigate the impact of interest rate changes on their lending activities due to their focus on maintaining long-term customer relationships.

The theoretical impact of digital finance on monetary policy transmission and financial development remains underexplored. Empirical studies investigating how FinTech influences the channels of monetary policy transmission and its effects on financial development are limited (World Bank, 2014). The findings from these studies, which examine the interactions between monetary policy and financial development as well as between FinTech and financial

development, have been both mixed and intriguing. Monetary policy affects the risk-taking behavior of financial intermediaries and influences the allocation and accessibility of financial resources. Generally, expansions in monetary policy are associated with an increased risk-bearing capacity among financial intermediaries, leading to higher lending activity. However, the effectiveness of the risk-taking channel can vary based on the differing business models of banks and non-bank intermediaries in response to monetary policy changes (Adrian & Shin, 2011).

Similarly, monetary policy impacts total lending through the financial intermediaries' balance sheets, especially the bank lending channel. An increase in short-term interest rates, driven by monetary policy, raises the cost of credit, while long-term returns on assets may remain relatively stable (Bernanke, 2007). As a result, financial development may suffer if monetary policy is ineffective. Increased financial growth could lessen the effect of monetary policy on inflation and economic output (Ma & Lin, 2016).

FinTech is recognized as a transformative force within the financial services sector, disrupting traditional business models and reshaping the landscape of financial services (Puschman, 2017). These innovations either compete with or complement established financial service providers (Lee & Shin, 2018; Temelkov, 2018). By lowering the costs of financial services, enhancing their accessibility and efficiency, and diversifying the financial market, FinTech contributes to broader financial inclusion. It is particularly effective in entering underserved markets, such as those serving small and medium-sized enterprises, and providing affordable services, which can stimulate economic activity (Maier, 2016; Temelkov, 2018; Makina, 2019; Shen et al., 2020). Thus, FinTech is essential to the advancement of social and financial inclusion globally (Ding et al., 2018; Salampasis & Mention, 2018).

However, FinTech also introduces several challenges for the financial sector and macroeconomic policy (Paternoster & Dessimirova, 2017). The landscape of financial service accessibility is undergoing significant changes. Innovations such as peer-to-peer lending allow individuals to secure funds outside traditional banking channels, mobile payment methods enable transactions via smartphones, and distributed ledger technologies like blockchain offer new ways of conducting transactions and reporting. These advancements can impact the ability of central banks to effectively implement monetary policy aimed at fostering financial development and stability (Narayan et al., 2018). Moreover, the rapid expansion of credit facilitated by financial innovations often lead to increased systemic risk (Chui, 2017). Consequently, FinTech can heighten the susceptibility of financial markets and economic systems to systemic risks, as well as to fraudulent activities and inefficiencies (Bromberg et al., 2018; Zhang et al., 2012).

Based on the above discussion, the paper tests the hypothesis on the independent effect(s) of monetary policy and FinTech on financial development as follows:

H1: Monetary policy and FinTech independently enhance financial development.

The empirical evidence discussed above demonstrates that both monetary policy and FinTech adoption have distinct and varying impacts on financial development. According to Ma and Lin (2016), monetary policy reflects how the financial system adapts to economic conditions, with the extent of this adaptation largely based on the process and degree of financial development. Research by Anarfo et al. (2019), Makina (2019), and Tonuchi et al. (2021) indicates that monetary policy can foster financial development by reducing credit costs and increasing access to funds. This perspective contrasts with findings from Lapukeni (2015) and Evans (2016), who argue that monetary policy can be detrimental to financial development, suggesting that its effectiveness

diminishes in well-developed financial systems. Therefore, they propose that monetary policy and financial development might be mutually exclusive.

Bolton et al. (2016) highlight that FinTech-induced changes in the financial system impact the transmission and implementation of monetary policy. FinTech increases the contestability of financial intermediation activities, such as deposits and loans, which can enhance the ‘pass-through of policy rates to lending conditions and savings rates’. This, in turn, affects investment and access to credit, influencing financial development (Ma & Lin, 2016; Ding et al., 2018). Levine (2005) supports the notion that financial innovations, including those driven by FinTech, promote financial development. However, the role of monetary policy in this development process is also significant, and FinTech activities can facilitate the monetary policy pass-through mechanism.

What remains unexplored in existing research is the empirical investigation of how the interaction between monetary policy and FinTech adoption collectively impacts financial development. This gap in the literature motivates this study, which aims to analyze the combined effects of monetary policy and FinTech on financial development.

H2: Monetary policy and FinTech adoption interactively promote financial development.

3.3 Data Sources, Methodology and Specification Technique

The study utilizes panel data from 82 countries, encompassing emerging, and developing economies, covering the period from 2000 to 2021. In line with the World Bank (2023) income-based categorization, the study distinguishes between emerging and developing economies within the dataset. Emerging economies refer to upper- and middle-income countries with relatively advanced financial infrastructures, diversified industrial bases, and moderate to high integration into global financial markets. Developing economies, conversely, include low- and lower-middle-

income countries with less mature financial institutions, limited capital markets, and high informality. This classification is crucial for ensuring analytical consistency and for examining how the effects of FinTech and monetary policy differ according to financial maturity and institutional capacity. Dummy variables representing these categories are incorporated in the estimation models to control for structural heterogeneity.

Data availability is the key determinant in selecting the countries and time period. Global Financial Development Database, World Bank Financial Development and Structure Database, World Development Indicators, Global Financial Index, and International Financial Statistics (IFS) are among the resources from the World Bank and IMF that are used to obtain the dataset for this study.

To analyze the independent and combined effects of monetary policy and FinTech adoption on financial development, the study employs the two-step Dynamic System GMM estimator (Arellano & Bover, 1995; Blundell & Bond, 1998) to address potential endogeneity and dynamic persistence in financial development and stability indicators. Lagged levels of endogenous regressors are used as instruments for their differenced equations, while lagged differences serve as instruments for level equations.

The choice of GMM is justified by its ability to handle country-specific effects and simultaneity bias common in macro-financial panels. Panel data provide both cross-sectional and time-series variation, enhancing the efficiency of estimates and allowing for robust control of unobservable heterogeneity. The validity of instruments is later tested using the Hansen J-statistic. The empirical models are summarized as follows:

Independent Effects of Monetary policy and FinTech adoption on Financial development

$$FDindex_{it} = \beta_1 FDindex_{it-1} + \alpha_1 MP_{it} + \sum_{p=2}^S \beta_p FinTech_{it} + \sum_{k=1}^N \alpha_k C_{it} + \theta_t + \phi_i + \varepsilon_{it} \dots\dots(1a)$$

The specific model on the independent effect of monetary policy and FinTech adoption on financial development is as follows:

$$FDindex_{it} = \beta_1 FDindex_{it-1} + \beta_2 MP_{it} + \beta_3 AMOB_{it} + \beta_4 RMOB_{it} + \beta_5 MOBA_{it} + \beta_6 MOBT_{it} + \beta_7 BAC_{it} + \beta_8 BAR_{it} + \beta_9 TOP_{it} + \beta_{10} INF_{it} + \beta_{11} POP_{it} + \beta_{12} RGDP_{it} + \theta_t + \phi_i + \varepsilon_{it} \dots\dots(1b)$$

Interaction Effects of Monetary policy and FinTech adoption on Financial Development

$$FDindex_{it} = \beta_1 FDindex_{it-1} + \alpha_1 MP_{it} + \sum_{p=2}^S \beta_p FinTech_{it} + \sum_{i=1}^p \alpha_{2i} (MP_{it} * FinTech_{it}) + \sum_{j=1}^p \alpha_{3i} Controls_{it} + \theta_t + \phi_i + \varepsilon_{it} \dots\dots (1c)$$

The model specification of the interaction effects of equation 1c of the study is as follows:

$$FDindex_{it} = \beta_1 FDindex_{it-1} + \beta_2 MP_{it} + \beta_3 AMOB_{it} + \beta_4 RMOB_{it} + \beta_5 MOBA_{it} + \beta_6 MOBT_{it} + \beta_7 (MP_{it} * AMOB_{it}) + \beta_8 (MP_{it} * RMOB_{it}) + \beta_9 (MP_{it} * MOBA_{it}) + \beta_{10} (MP_{it} * MOBT_{it}) + \beta_{11} BAC_{it} + \beta_{12} BAR_{it} + \beta_{13} TOP_{it} + \beta_{14} INF_{it} + \beta_{15} POP_{it} + \beta_{16} RGDP_{it} + \theta_t + \phi_i + \varepsilon_{it} \dots\dots (1d)$$

In equations 1a to 1d, FDindex is financial development index, MP is monetary policy, AMOB refers to “number of active mobile money accounts per 1,000 adults”, RMOB refers to “number of registered mobile money accounts per 1,000 adults”, MOBA is the “number of mobile money agent outlets per 1,000 adults” and MOBT is value of mobile money transaction (%GDP). BAC represents bank concentration, BAR is bank risk, TOP represents trade openness, INF is inflation and POP is population. θ_t captures time dummies in the equations, ϕ_i captures fixed effects –

country-specific unobservable time-invariant effects in the countries, ε_{it} is the noise error term (idiosyncratic error term) which controls for unit-specific residual in the models for the i^{th} country at period t .

β_0 to β_{16} represent the coefficients of the constant term and the variables in the models. α_1 is the coefficient of monetary policy, α_k represent the parameters of the regression coefficient for the estimated vector C. The equation models are explained by the vector of control variables C.

To capture global and domestic macroeconomic disturbances, two dummy variables were included: one for the Global Financial Crisis (2008–2009) and another for the COVID-19 pandemic (2020–2021), as identified in Laeven and Valencia (2013). These controls help isolate the effects of FinTech and monetary policy during systemic disruptions. In addition, real GDP growth was incorporated as a control for economic size and macroeconomic performance, recognizing that larger and faster-growing economies often exhibit deeper financial systems and stronger monetary transmission mechanisms.

3.3.1 Data, Variables Definitions and Expected Signs

Financial development, the study's dependent variable, is measured using the World Bank's financial development index, which has a range of 0 to 1; higher numbers denote more financial development. Financial development encompasses the enhancement of financial intermediation, diversification, risk management, and the reduction of barriers to the exchange of goods, services, and financial instruments among market participants (Levine, 2005).

Monetary policy is evaluated through the central bank's fixed policy rate, which may be contractionary or expansionary, as a means to regulate the money supply (Abor et al., 2022). We anticipate a positive correlation between financial development and monetary policy.

FinTech is measured along two primary dimensions: demand-side (usage) and supply-side (access) factors (Anarfo et al., 2019). This study reflects these dimensions using mobile money metrics (Jiang et al., 2020; Sakyi-Nyarko et al., 2021). The study uses Mobile-money adoption as the principal proxy for FinTech development due to data availability and its relevance in emerging and developing economies. Mobile money constitutes the most pervasive form of FinTech in these regions, accounting for over 65% of all digital financial transactions in Sub-Saharan Africa and South Asia (World Bank, 2023). Its dominance in the FinTech ecosystem makes it a suitable indicator for assessing how digital finance interacts with monetary variables. The study recognizes that using mobile money as a FinTech proxy is limited. To address this, it complements mobile-money data with additional indicators such as digital credit, ATM coverage, mobile banking and agent density, as some of variables of FinTech and as contained in the robustness analysis (Section 3.4.3).

Four proxies are employed to capture these FinTech dimensions: “(1) the number of registered mobile money accounts per 1,000 adults (access), (2) the number of mobile money agent outlets per 1,000 adults (access), (3) the number of active mobile money accounts per 1,000 adults (usage), and (4) the percentage contribution to GDP from mobile money transactions (usage)”. A positive association is expected between FinTech and financial development.

To control for potential confounding effects, various macroeconomic variables are included in the analysis. Bank concentration is proxied by the number of bank branches, while bank risk is measured by credit risk. The consumer price index's rate of change serves as a proxy for inflation. The yearly population growth rate is used to measure population growth, while the amount of exports and imports as a percentage of GDP is used to measure trade openness (Abor et al., 2022).

Table 3.1: Variable Definitions, Measurements, and Expected Signs

Variable	Description	Measurement	Expected Sign	Source
FINDEX	Financial Development Index	Composite indicator from IMF's Financial Development Database (includes financial institutions and markets)	+	IMF (2023)
FINTECH	FinTech Index	Weighted composite of digital transactions, mobile money accounts, and digital lending volumes	±	World Bank (2023)
MP	Monetary Policy Indicator	Central bank policy rate / M2 growth	±	IMF-IFS (2023)
GDPG	Real GDP Growth	Annual percentage change in real GDP	+	World Bank (2023)
INF	Inflation Rate	Consumer Price Index (CPI, annual %)	–	World Bank (2023)
CRISIS	Crisis Dummy	=1 during Global Financial Crisis (2008–2009) or COVID-19 (2020–2021), 0 otherwise	±	Laeven & Valencia (2013)
C	Control Variables	Trade openness, population growth, institutional quality	±	WDI (2023)



3.4 Empirical Results and Discussion

The findings of the quantitative analysis based on the two hypotheses using the Dynamic System GMM are shown in this section.

The variables' descriptive statistics are shown in Table 3.2 with no outliers, suggesting that the data is normally distributed around the mean. Financial development averaged 0.42, with a standard deviation of 0.49, ranging between 0 and 1. This reflects a moderate level of financial development across the study countries. Monetary policy had a mean of 2.69 and a standard deviation of 6.69, with values ranging from -69.94 to 59.87. This suggests that the central banks in the study countries generally employed an expansionary monetary policy approach.

The average number of active mobile money accounts was 15.16, with a standard deviation of 92.83, ranging from 0 to 1184.86. This indicates that, on average, just over 15 per 1,000 adults had active mobile money accounts during the study period, though this number varied widely. On average, 56.02 percent of the adult population in the sampled countries were registered for mobile money accounts, demonstrating significant financial inclusiveness, though this also varied considerably among countries. The value of mobile money transactions as a percentage of annual GDP averaged 1.46, with a standard deviation of 9.36, underscoring the substantial role of financial inclusion in national economic growth.

Bank concentration and risk had means of 61.27 and 5.30, with standard deviations of 23.74 and 7.24, respectively. This indicates that bank branches and size were widely distributed across the sample countries, averaging more than 60 percent, while credit, operational, market, and liquidity risks were relatively low, indicating a stable financial system during the study period. Inflation and population growth had relatively low rates, averaging 5.53 and 1.03 percent, respectively.

Trade openness averaged 81.87 percent, reflecting the liberalized nature of the economies in the sample.

Several post-estimation diagnostics were conducted to validate model reliability. The Arellano–Bond test for autocorrelation was applied to ensure the absence of second-order serial correlation in the differenced residuals, a key condition for GMM consistency. Additionally, the Hansen J-test for over-identifying restrictions was used to assess the validity of the instruments employed; non-rejection of the null hypothesis indicates instrument exogeneity. To account for potential heteroscedasticity and cross-sectional dependence, robust standard errors were clustered at the country level. The study also verified the absence of multicollinearity and tested for weak instruments to maintain estimator robustness.

Table 3.3 provides the correlation analysis of the explanatory variables. With correlation coefficients below 0.7 and a mean Variance Inflation Factor (VIF) of 6.64, below the threshold of 10, it demonstrates that multicollinearity is not an issue.

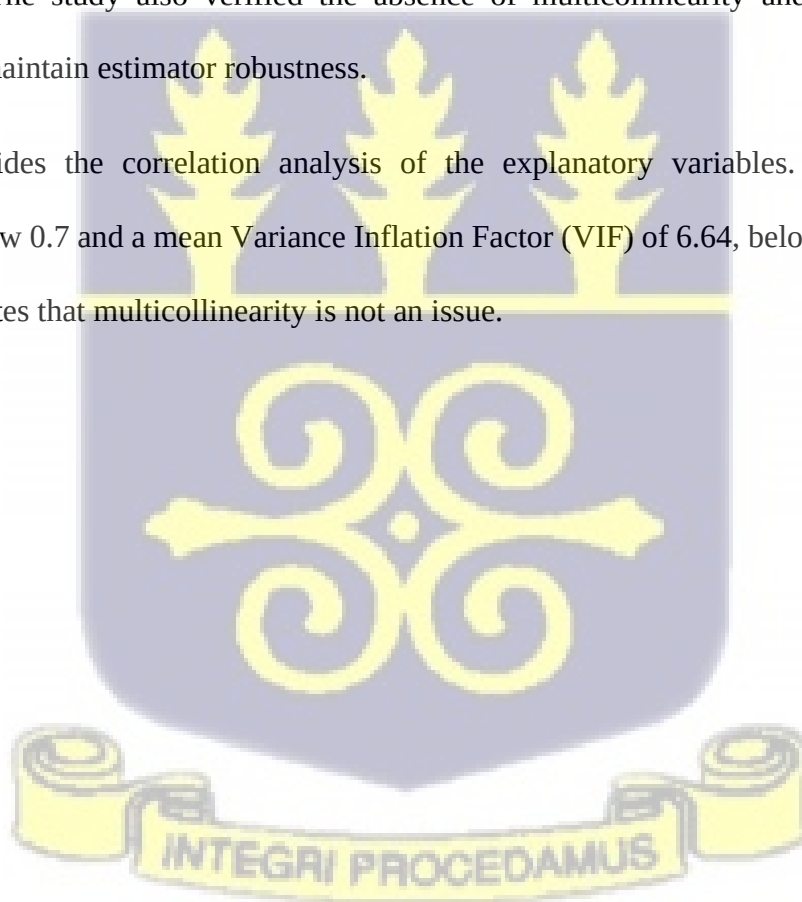


Table 3.2: Summary of Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	P1	P99
Financial Development (lagged)	1617	.421	.494	0	1	0	1
Monetary policy	1620	2.693	6.688	-69.936	59.873	-8.945	32.247
Number of active mobile money accounts	1521	15.16	92.83	0	1184.858	0	598.019
Number of registered mobile money accounts	1607	56.023	256.03	0	2798.884	0	1463.833
Number of Mobile money agent outlets	1573	37.113	226.63	0	3848.921	0	1067.911
Value of Mobile Money transactions	1615	1.463	9.358	0	180.559	0	43.589
Bank concentration	1782	61.27	23.744	0	100	0	100
Bank risk	1782	5.289	7.239	0	74.1	0	34.9
Inflation	1782	5.525	18.216	-8.238	557.202	-1.355	44.964
Population	1782	1.03	1.438	-4.17	18.128	-1.854	5.317
Trade	1782	87.812	62.834	0	437.327	0	353.794

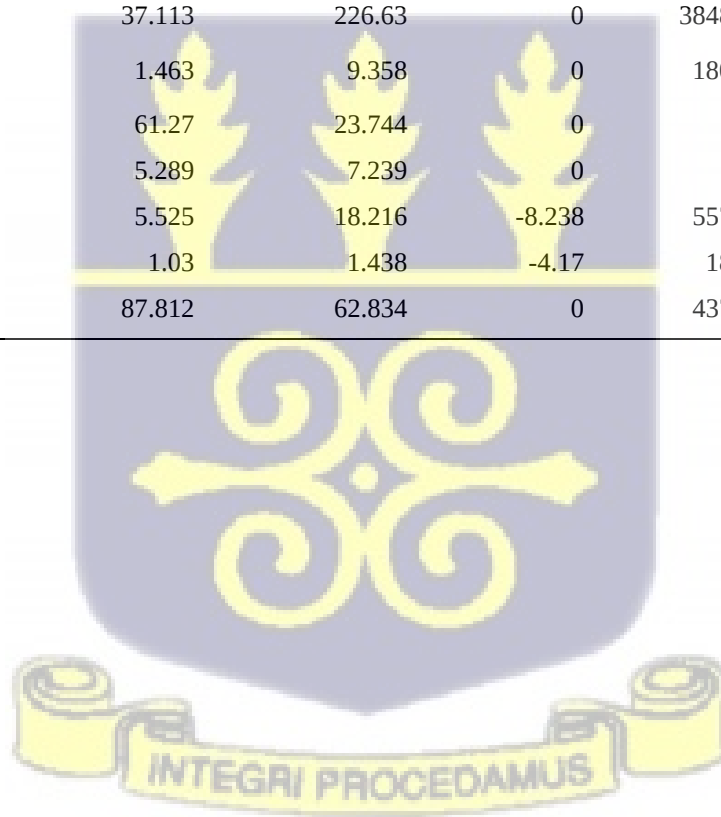


Table 3.3: Pairwise Correlations

Variables	VIF(6.639)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Financial Development(lagged)	1.230	1.000										
(2) Monetary policy	1.059	-0.108	1.000									
(3) Active mobile money accounts	1.575	-0.122	0.067	1.000								
(4) Registered mobile money accounts	1.802	-0.177	0.101	0.451	1.000							
(5) Mobile Money agent outlets	1.594	-0.143	0.041	0.535	0.812	1.000						
(6) Value of Mobile Money transactions	1.003	-0.141	0.062	0.567	0.765	0.751	1.000					
(7) Bank concentration	1.106	0.230	0.017	-0.081	-0.126	-0.093	-0.086	1.000				
(8) Bank risk	1.059	-0.244	0.093	0.122	0.110	0.164	0.123	0.014	1.000			
(9) Inflation	1.059	-0.212	-0.318	0.017	0.018	0.019	0.033	-0.071	0.020	1.000		
(10) Population	1.04	-0.056	0.060	0.065	0.108	0.078	0.089	-0.089	-0.026	0.020	1.000	
(11) Trade	1.104	0.183	-0.143	-0.068	-0.118	-0.077	-0.076	0.219	-0.036	-0.077	-0.070	1.000



3.4.1 Discussion of Regression Results

3.4.1.1 Independent Effects of Monetary policy and FinTech adoption on Financial

Development

Table 3.4 presents results consistent with existing literature. It shows that monetary policy demonstrates a notable degree of stability, as evidenced by the statistical significance of the positive AR (1) term across all equations. The coefficients for monetary policy, reveal a negative relationship with financial development, significant at the 1% level. This implies that expansionary monetary policy, characterized by a reduction in the policy rate, fosters financial development. A lower policy rate increases the money supply through the interest rate transmission mechanism, thereby reducing credit costs in both banking and non-banking sectors. Enhanced access to money and improved availability lead to greater consumer spending, allowing financial institutions to reach more individuals and households, thus promoting financial inclusion and development.

This finding aligns with the conclusions of Lapukeni (2015) and Evans (2016), who identified a negative association between expansionary monetary policy and financial development in Malawi and a one-way relationship from loose monetary policy to financial inclusion in 15 African countries, respectively. The observed effect of increased money supply on financial development suggests that the efficacy of monetary policy diminishes in more developed financial systems, a conclusion consistent with that of Ma and Lin (2016).

Further support for this conclusion is provided by the coefficients for monetary policy- which are not considerably different from one another at the 1% level. Anarfo et al. (2019) argue that there is a positive bidirectional relationship between monetary policy effectiveness (measured by inflation and interest rates) and financial inclusion, a view corroborated by Tonuchi et al. (2021),

who found that monetary policy promotes financial inclusion and development in Nigeria. These findings are in line with this study, possibly due to the focus on developing economies with less sophisticated financial systems. Ultimately, the effectiveness of monetary policy in achieving financial development and its broader economic impacts are heavily influenced by the financial process, with monetary policy serving as a key tool in shaping these outcomes.

FinTech is generally believed to foster financial development due to its extensive reach, simplicity, and cost-effectiveness (Lee & Shin, 2018; Temelkov, 2018). By revolutionizing traditional credit channels, FinTech adoption has enhanced financial access and inclusion across various economies (Tonuchi et al., 2021; Makina, 2019; Temelkov, 2018; Maier, 2016). However, the findings of this study (as presented in Table 3.4), stand in stark contrast to this literature. The proxies used to measure FinTech including coverage (number of registered mobile money accounts per 1,000 adults), usage (number of active mobile money accounts per 1,000 adults), access (number of mobile money agent outlets per 100,000 adults), and volume (value of mobile money transactions as a percentage of GDP) demonstrate a negative and significant relationship with financial development. For instance, an increase in FinTech adoption correlates with a reduction in financial development by up to 0.43% in terms of mobile money transaction value relative to GDP growth. This supports the arguments by Yan et al. (2021) and Jiang et al. (2022), who suggest that the most significant FinTech's effects on the world financial system is the disruption it causes, including financial instability, exclusion, and reduced financial development.

Additionally, the cumulative coefficients of the FinTech variables show a significant negative correlation with financial development, reinforcing the idea that the expansion of FinTech often leads to a decline in financial development. This outcome aligns with the theoretical perspective that increased credit growth and access can heighten systemic risk within the financial sector

(Chui, 2017). The potential for fraud and the presence of dubious startups (Bromberg et al., 2018) introduce frictions that may deter investment and undermine market confidence. Systemic risk and investor risk aversion (as supported by theory) further contribute to the destabilization of financial markets caused by FinTech disruptions. Such market uncertainties and loss of confidence can negatively impact financial system development.

While the empirical results reveal a negative association between FinTech and financial development, this relationship may not necessarily indicate a persistent or structural effect. Instead, it may reflect short-term adjustment frictions that occur as traditional financial institutions and regulatory systems adapt to rapid technological change. In many developing economies, the initial proliferation of FinTech platforms leads to market segmentation, regulatory lag, and data fragmentation, which temporarily undermine financial intermediation efficiency.

In contrast, emerging economies often experience this effect as a transitional phase; over time, technological integration improves credit distribution and market depth as digital channels mature and regulatory oversight strengthens. Thus, the observed negative relationship may capture the disruptive phase of FinTech diffusion rather than a permanent deterrent to financial development. This distinction between short-term disruptions and long-term transformation is consistent with the technology diffusion hypothesis and aligns with findings by Frost (2023) and Demir et al. (2021), who document nonlinear and lagged FinTech effects across markets.

An exception to this pattern is observed in the proxy for the value of mobile money transactions relative to GDP growth, which shows a positive impact on financial development in column 5. This particular proxy, which measures transaction volumes rather than user numbers, might uniquely contribute to financial development as suggested by Ding et al. (2018), who argue that

FinTech reduces inefficiencies in resource allocation and promotes financial and social inclusion, thereby fostering economic development.

The direction of causality between FinTech and financial development may also operate in reverse. Economies with lower levels of financial development may experience more aggressive or unregulated FinTech expansion, as digital platforms step in to fill gaps left by weak formal banking sectors. This phenomenon suggests that limited financial inclusion and underdeveloped financial infrastructures can stimulate FinTech adoption as an alternative mechanism for credit access and transaction facilitation. Such conditions may lead to riskier and less supervised FinTech activity, which, in turn, contributes to volatility and systemic vulnerabilities. To address this possibility, the study's dynamic panel framework (System GMM) incorporates lagged dependent variables and internal instruments to mitigate endogeneity and capture potential feedback effects. However, acknowledging the possibility of bidirectional causation is important for interpreting the findings within a realistic policy context.

The findings can be explained through the stability–fragility hypothesis (Allen & Gale, 2000) and the innovation-induced instability framework (Minsky, 1986). These theories suggest that while financial innovation enhances efficiency and access, it can also generate systemic fragility by outpacing regulatory adaptation. FinTech introduces new liquidity channels and credit products that may heighten cybersecurity vulnerabilities, regulatory arbitrage, and market saturation effects, particularly in economies lacking strong oversight.

The presence of multiple unregulated platforms can fragment financial markets, leading to inefficient capital allocation and higher exposure to shocks. Moreover, excessive digital lending can inflate household indebtedness and create liquidity mismatches that undermine financial stability. Therefore, the observed negative relationship may reflect the unintended consequences

of innovation in the absence of robust prudential regulation, aligning with the arguments of Sahay et al. (2020) and Ozili (2022) regarding FinTech's double-edged impact.

The findings of this study diverge from the consensus that FinTech unequivocally promotes financial development (Beck et al., 2018; Goldstein et al., 2019). Instead, they align with more recent evidence suggesting a nonlinear or conditional relationship. For example, Demirgüç-Kunt et al. (2020) find that digital financial expansion initially increases volatility before improving efficiency as institutions adapt. Similarly, Sahay et al. (2020) emphasize that FinTech's contribution to financial development is contingent upon the regulatory environment and institutional quality. In contrast, studies such as Ozili (2022) and Frost (2023) document cases where digital credit booms led to heightened default risks and instability in African and Asian markets.

This study, therefore, contributes to the ongoing debate by highlighting the context-dependent and transitional nature of FinTech's impact on financial development, offering empirical support for differentiated policy approaches across emerging and developing economies.

Regarding other variables, bank concentration consistently shows positive and statistically significant coefficients across all models (columns 1-9 in Tables 3.4 and 3.5). This indicates that a greater number of bank branches correlates positively with financial system development, as wider bank coverage improves access to financial services. Conversely, the bank risk variable shows a consistently negative coefficient at the 1% significance level across all models, suggesting that higher credit risk within banks adversely affects financial development.

Similarly, macroeconomic variables such as inflation and population growth exhibit noteworthy effects on financial development. Inflation consistently shows negative coefficients across all nine

models, achieving statistical significance. This indicates a negative relationship between inflation and financial development, which is consistent with both economic theory and empirical studies such as those by Lapukeni (2015) and Evans (2016). High inflation diminishes consumer purchasing power and erodes the value of savings, thus deterring individuals from depositing their money into a financial system burdened by inflationary pressures.

Population growth also has a negative influence on financial development, as shown in Tables 3.4 and 3.5; however, the coefficients are not statistically significant, suggesting that its impact may not be as pronounced or consistent.

In contrast, trade openness demonstrates a positive and statistically significant effect on financial development. The coefficient estimates for trade openness are significant at the 10% level in columns 2-5 and at the 1% level in columns 6-9 of Tables 3.4 and 3.5. This suggests that increased openness to international trade tends to enhance the development of a country's financial system. Trade liberalization attracts foreign direct investment and facilitates the entry of new financial institutions and technological advancements into the financial sector. This influx of capital and innovation fosters a competitive financial environment with diverse services, which can reduce credit costs and improve the accessibility and affordability of financial services.

Generally, while FinTech significantly improves access to finance and enhances the efficiency of intermediation, its overall effect on financial development appears negative in the short term as evidenced by the results from models 1-5. This counterintuitive outcome reflects transitional disruptions caused by rapid digital adoption, regulatory gaps, and credit market realignment.

Consistent with the stability–fragility hypothesis, FinTech's benefits to efficiency may coexist with heightened systemic risks, especially in economies with weak supervisory frameworks.

Conversely, the long-run relationship suggests that economies with robust institutional quality and effective monetary-policy coordination experience stronger and more stable financial development outcomes. These results underscore the importance of regulatory adaptation to manage FinTech's dual nature—balancing innovation with prudential control.



Table 1.4: Independent effects of monetary policy and FinTech adoption on financial development: Baseline results

VARIABLES	Model (1) Financial Development	Model (2) Financial Development	Model (3) Financial Development	Model (4) Financial Development	Model (5) Financial Development
Financial Development (lagged)	1.000*** (0.154)	0.989*** (0.168)	0.980*** (0.167)	1.131* (0.573)	0.990*** (0.153)
Monetary policy	-0.00649*** (0.00209)	-0.00685*** (0.00209)	-0.00749*** (0.00212)	-0.00725*** (0.00211)	-0.00626*** (0.00210)
Number of active mobile money accounts	-0.000353** (0.000144)				-0.000701* (0.000369)
Number of registered mobile money accounts		-0.000214*** (3.36e-05)			-4.26e-05 (0.000136)
Number of mobile money agent outlets			-0.000164*** (4.16e-05)		-0.000175 (0.000150)
Value of mobile money transactions				-0.00430*** (0.00103)	0.00729*** (0.00179)
Bank concentration	0.00376*** (0.000555)	0.00382*** (0.000548)	0.00371*** (0.000553)	0.00391*** (0.000548)	0.00379*** (0.000557)
Bank risk	-0.0143*** (0.00180)	-0.0141*** (0.00173)	-0.0143*** (0.00178)	-0.0146*** (0.00178)	-0.0141*** (0.00180)
Inflation	-0.00848** (0.00366)	-0.00848** (0.00365)	-0.00866** (0.00372)	-0.00834** (0.00360)	-0.00847** (0.00366)
Population	-0.00664 (0.00927)	-0.00745 (0.00899)	-0.0126 (0.00902)	-0.00708 (0.00899)	-0.00236 (0.00944)
Trade	0.000288	0.000351*	0.000337*	0.000362*	0.000269

	(0.000194)	(0.000191)	(0.000192)	(0.000190)	(0.000194)
Constant	0.340***	0.324***	0.339***	0.313***	0.338***
	(0.0480)	(0.0473)	(0.0482)	(0.0473)	(0.0483)
Observations	1,316	1,392	1,358	1,397	1,312
Number of country number	76	77	76	76	76
No. of instruments.	10	10	10	10	13
AR (1)	-3.178	-3.148	-3.145	0.358	-3.187
P-value	0.00149	0.000	0.000	0.000	0.953
AR (2)	1.263	1.258	1.259	0.452	1.264
P-value	0.206	0.951	0.001	0.964	0.879
Sargan's Test	0.303	0.347	0.347	0.000231	0.335
P-value	0.960	0.208	0.951	0.988	0.00144
Hansen's Test	0.623	0.769	0.791	0.00205	0.675
P-value	0.891	0.857	0.852	0.721	0.206
F-test	3555	3545	3683	30.02	3574
P-value	0.000	0.00164	0.208	0.651	0.000

Notes: “The dependent variable is financial development, measured by the Financial Development Index. Monetary policy is measured by change in policy rate by the central bank. FinTech is measured in four ways; by Coverage (Number of registered mobile money accounts per 1,000 adults), Usage (Number of active mobile money accounts per 1,000 adults), Access (Number of mobile money agent outlets per 1,000 adults) and volume (percentage contribution to GDP by value of mobile money transaction). Bank concentration is measured by the number of bank branches, Bank risk is measured by credit risk of banks. Inflation is the inflation rate and is measured by the rate of change of the consumer price index. Population is the annual population growth rate and Trade is measured by the sum of exports and imports as a percentage of GDP.

Robust standard errors, derived from t-statistics, are presented in parentheses. Statistical significance is indicated as *** for 1%, ** for 5%, and * for 10%. The AR (1) and AR (2) tests report the p-values for the first-order and second-order autocorrelation, respectively. The Hansen test provides the p-values for the overidentification of instrumental variables”.



3.4.1.2 Interaction Effects of Monetary Policy and FinTech Adoption on Financial Development

This study's second focus is to examine how monetary policy and FinTech interact to affect an economy's financial development. By examining the disruptive effects of FinTech adoption on financial processes and the related frictions within the financial system, this part of the research adds to the body of current knowledge. In particular, it looks into how monetary policy and FinTech factors interact to affect financial development.

The results presented in Table 3.5 reveal that the interaction between monetary policy and FinTech has multifaceted effects on financial development. The nature of this relationship varies depending on whether the FinTech variable is demand-side or supply-side. Nevertheless, the findings consistently show that the interaction between FinTech and monetary policy significantly influences financial development, regardless of the type of FinTech service.

For instance, the interaction between the demand-side FinTech variable—measured as the number of registered mobile money accounts per 1,000 adults and monetary policy exhibits a positive and statistically significant relationship with financial development at the 10% level. This indicates that a reduction in policy rates, coupled with increased demand for FinTech services driven by policy incentives, fosters financial development. The use of FinTech platforms, such as mobile money wallets, extends financial inclusion to previously underserved populations, thereby integrating them into the formal financial system.

Furthermore, the adoption of FinTech services promotes competition among financial institutions, leading to lower transaction costs, enhanced efficiency, and optimal resource allocation within the financial system. These factors are crucial for advancing financial development. These results

align with the findings of previous studies by Lapukeni (2015), Evans (2016), Temelkov (2018), Makina (2019), Tonuchi et al. (2021), and Yan et al. (2021).

In contrast, the impact of FinTech on the supply side represented by the number of mobile money agent outlets per 1,000 adults demonstrates a negative relationship with financial development. When monetary policy interacts with supply-side FinTech variables, it tends to diminish financial development. This occurs because FinTech platforms can introduce market imperfections and systemic risks that hinder the effective transmission of monetary policy. Consequently, the objectives of monetary policy, including financial inclusion, are impeded, countering efforts to foster financial development.

FinTech innovations, such as mobile money, disrupt traditional monetary policy transmission mechanisms, rendering them less effective. This disruption affects key monetary policy goals, such as controlling inflation, stabilizing interest rates, and enhancing financial stability, which are crucial for promoting financial intermediation and inclusiveness. The integration of FinTech platforms with monetary policy shifts can also create liquidity risks for traditional financial institutions. As highlighted in Table 3.3, this situation can lead to financial risks that negatively impact financial development.

Efforts to expand FinTech access while implementing expansionary monetary policies may create frictions that disrupt liquidity in the economy. Expansionary monetary policy aims to inject liquidity through interest rate reductions to stimulate spending and drive economic growth. However, the rise of cashless and digital FinTech services can reduce the amount of currency in circulation, which may in turn lower consumer spending, slow economic growth and hinder financial development. This reduction in currency circulation can lead to higher credit costs, uncontrolled price increases, lower stock market capitalization, and increased financial risks,

particularly in developing markets. Such financial indicators are detrimental to financial development and align with findings by Chui (2017), Bromberg et al. (2018), and Goldstein et al. (2019).

These results suggest that central banks' efforts to promote financial development by lowering policy rates and increasing the number of FinTech outlets or focusing on the supply side may be ineffective. Instead, enhancing the accessibility and ease of adoption of FinTech services alongside expansionary monetary policies, is more likely to foster financial inclusiveness and development. Simply increasing the availability of FinTech services does not guarantee their adoption; thus, it is crucial to make these services more accessible and user-friendly especially for customers in rural areas.

The results are evaluated against the hypotheses formulated. The first hypothesis (H1), which postulates a positive relationship between monetary policy and financial development, is largely supported, indicating that expansionary policy measures tend to enhance financial intermediation and credit availability. However, the second hypothesis (H2), which expects FinTech to foster financial development through inclusion and efficiency, is partially refuted by the empirical results. The negative coefficient on FinTech implies that rapid digitalization may initially erode stability and resource allocation efficiency. The third hypothesis (H3), which posits that the joint interaction between monetary policy and FinTech strengthens financial development, is conditionally supported the interaction term shows a positive but insignificant effect in some models, suggesting that FinTech's moderating role depends on institutional quality and regulatory readiness. These results collectively highlight the importance of context-specific dynamics in understanding how innovation interacts with policy to shape financial outcomes.

Table 3.5: Interaction effects of monetary policy and FinTech adoption on financial development: Baseline results

VARIABLES	Model (6) Financial Development	Model (7) Financial Development	Model (8) Financial Development	Model (9) Financial Development
Financial Development (lagged)	1.002*** (0.154)	0.989*** (0.167)	0.980*** (0.167)	1.229** (0.548)
Monetary policy	-0.00703*** (0.00217)	-0.00759*** (0.00218)	-0.00770*** (0.00218)	-0.00761*** (0.00217)
Number active mobile money accounts	-0.000606*** (0.000221)			
Monetary policy *Number of active mobile money accounts	7.29e-07 (1.28e-05)			
Number of registered mobile money accounts		-0.000378*** (6.26e-05)		
Monetary policy * Number of registered mobile money accounts		9.72e-06* (5.44e-06)		
Number of mobile money agent outlets			-0.000250*** (4.86e-05)	
Monetary policy * Mobile money agent outlets			-1.22e-05* (6.34e-06)	
Value of Mobile Money transactions				-0.00666*** (0.00164)
Monetary policy * Value of Mobile Money transactions				-0.000134 (0.000178)
Bank concentration	0.00378***	0.00383***	0.00373***	0.00392***

	(0.000558)	(0.000551)	(0.000554)	(0.000549)
Bank risk	-0.0143***	-0.0142***	-0.0144***	-0.0146***
	(0.00180)	(0.00175)	(0.00178)	(0.00178)
Inflation	-0.0102**	-0.0103**	-0.0105**	-0.0102**
	(0.00419)	(0.00420)	(0.00426)	(0.00415)
Population	-0.00490	-0.00549	-0.0111	-0.00651
	(0.00934)	(0.00903)	(0.00898)	(0.00913)
Trade	0.000614***	0.000692***	0.000674***	0.000733***
	(0.000189)	(0.000185)	(0.000187)	(0.000184)
Constant	0.480***	0.466***	0.473***	0.454***
	(0.0334)	(0.0333)	(0.0339)	(0.0331)
Observations	1,316	1,392	1,358	1,397
Number of country number	76	77	76	76
No. of instruments.	11	11	11	11
AR (1)	-3.177	-3.150	-3.145	0.336
P-value	0.00149	0.952	0	0.739
AR (2)	1.263	1.258	1.259	0.333
P-value	0.206	0.00163	0.00166	0.737
Sargan's Test	0.294	0.340	0.348	4.28e-05
P-value	0.961	0.862	0.208	0.979
Hansen's Test	0.594	0.747	0.793	0.000681
P-value	0.898	0.208	0.951	0
F-test	3339	3191	3146	18.83
P-value	0.000	0.000	0.851	0.995



3.4.2 Robustness Checks

This section evaluates the robustness of the empirical findings using a Panel Vector Autoregression (PVAR) model. The PVAR approach is employed to address the interdependencies and heterogeneities among countries by jointly modeling multiple variables across various units over time.

To confirm the stability of the baseline results, several robustness checks were performed. First, alternative variable definitions were applied, substituting the FinTech composite index with individual indicators such as mobile money penetration and digital credit volume. Second, estimation was repeated using a Panel Vector Autoregression (PVAR) model to ascertain consistency with the System GMM approach. Third, extreme-value trimming was implemented to mitigate the influence of outliers. Lastly, the inclusion of crisis dummies for the 2008 Global Financial Crisis and the 2020–2021 COVID-19 period tested the sensitivity of the results to exogenous macroeconomic shocks. The findings remained qualitatively consistent across specifications, supporting the reliability of the empirical estimates.

As illustrated in Table 3.6, the independent effects of both monetary policy and FinTech on financial development are found to be negative and statistically significant. This confirms the study's primary conclusion that both monetary policy and FinTech adoption adversely affect financial development, thereby reinforcing the validity and robustness of the findings. Additionally, the results for other estimation coefficients, such as the AR (1) term and control variables, align with previous arguments, further substantiating the analysis.

Table 3.7 reveals that the joint effect of monetary policy and FinTech adoption varies based on whether the FinTech service is demand-side or supply-side. Specifically, when monetary policy interacts with an increase in demand for FinTech services, it significantly enhances financial sector development. Conversely, combining monetary policy with an increase in supply-side FinTech services results in reduced financial development. Therefore, efforts to expand FinTech access should be paired with strong measures to encourage consumer adoption and utilization. The mere availability of FinTech services does not guarantee their use; thus, effective utilization is as important as availability.

Summary statistics, Variance Inflation Factor (VIF), and results from random and fixed effects models, as well as pairwise correlations of the PVAR, are available upon request.



Table 3.6: Dependent effects of Monetary policy and FinTech adoption on financial development: Robustness check results

VARIABLES	Model (10) Financial Development	Model (11) Financial Development	Model (12) Financial Development	Model (13) Financial Development	(14) Financial Development
Financial Development (lagged)	1.000*** (0.154)	0.989*** (0.168)	0.980*** (0.167)	1.131* (0.573)	0.990*** (0.153)
Monetary policy	-0.00649*** (0.00209)	-0.00685*** (0.00209)	-0.00749*** (0.00212)	-0.00725*** (0.00211)	-0.00626*** (0.00210)
Active mobile money accounts	-0.000353** (0.000144)				-0.000701* (0.000369)
Registered mobile money accounts		-0.000214*** (3.36e-05)			-4.26e-05 (0.000136)
Mobile Money Agent outlets			-0.000164*** (4.16e-05)		-0.000175 (0.000150)
Value of Mobile Money transactions				-0.00430*** (0.00103)	0.00729*** (0.00179)
Bank concentration	0.00376*** (0.000555)	0.00382*** (0.000548)	0.00371*** (0.000553)	0.00391*** (0.000548)	0.00379*** (0.000557)
Bank risk	-0.0143*** (0.00180)	-0.0141*** (0.00173)	-0.0143*** (0.00178)	-0.0146*** (0.00178)	-0.0141*** (0.00180)
Inflation	-0.00848** (0.00366)	-0.00848** (0.00365)	-0.00866** (0.00372)	-0.00834** (0.00360)	-0.00847** (0.00366)
Population	-0.00664 (0.00927)	-0.00745 (0.00899)	-0.0126 (0.00902)	-0.00708 (0.00899)	-0.00236 (0.00944)
Trade	0.000288	0.000351*	0.000337*	0.000362*	0.000269

	(0.000194)	(0.000191)	(0.000192)	(0.000190)	(0.000194)
Constant	0.340***	0.324***	0.339***	0.313***	0.338***
	(0.0480)	(0.0473)	(0.0482)	(0.0473)	(0.0483)
Observations	1,316	1,392	1,358	1,397	1,312
Number of countries	76	77	76	76	76
No. of instruments	10	10	10	10	13
AR (1)	-3.178	-3.148	-3.145	0.358	-3.187
P-value	0.00149	0.000	0.000	0.000	0.953
AR (2)	1.263	1.258	1.259	0.452	1.264
P-value	0.206	0.951	0.00166	0.964	0.879
Sargan's Test	0.303	0.347	0.347	0.000231	0.335
P-value	0.960	0.208	0.951	0.988	0.00144
Hansen's Test	0.623	0.769	0.791	0.00205	0.675
P-value	0.891	0.857	0.852	0.721	0.206
F-test	3555	3545	3683	30.02	3574
P-value	0.000	0.00164	0.208	0.651	0.000

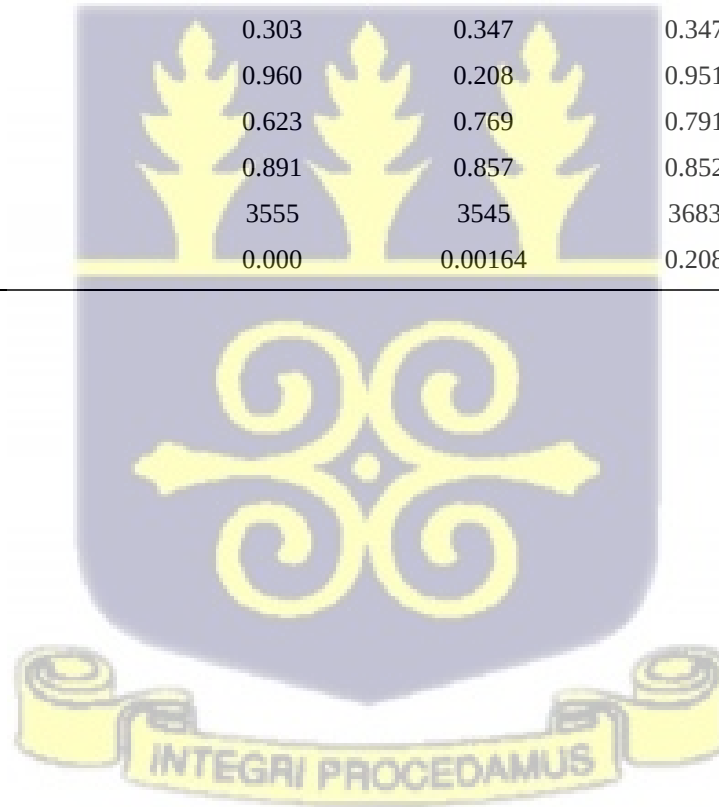
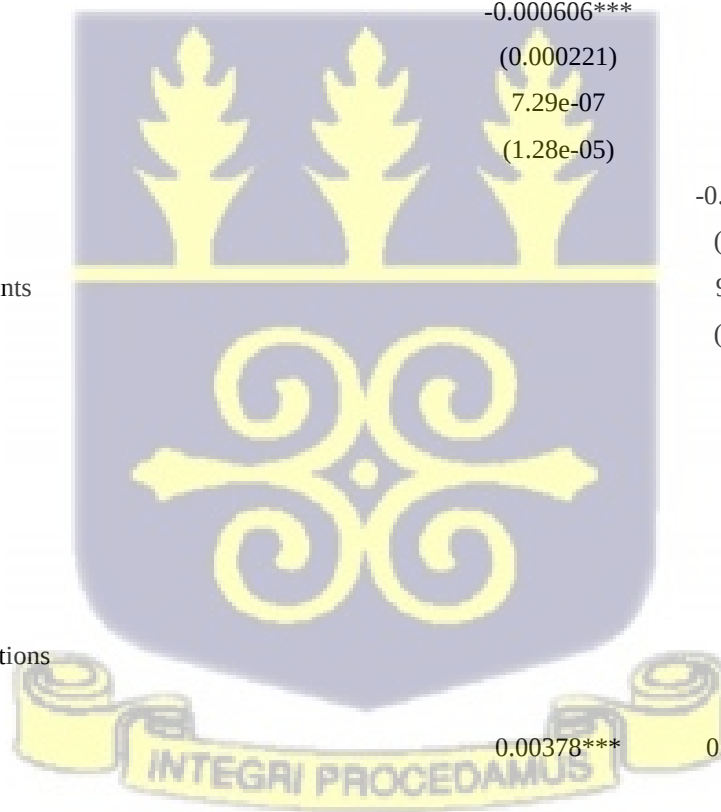
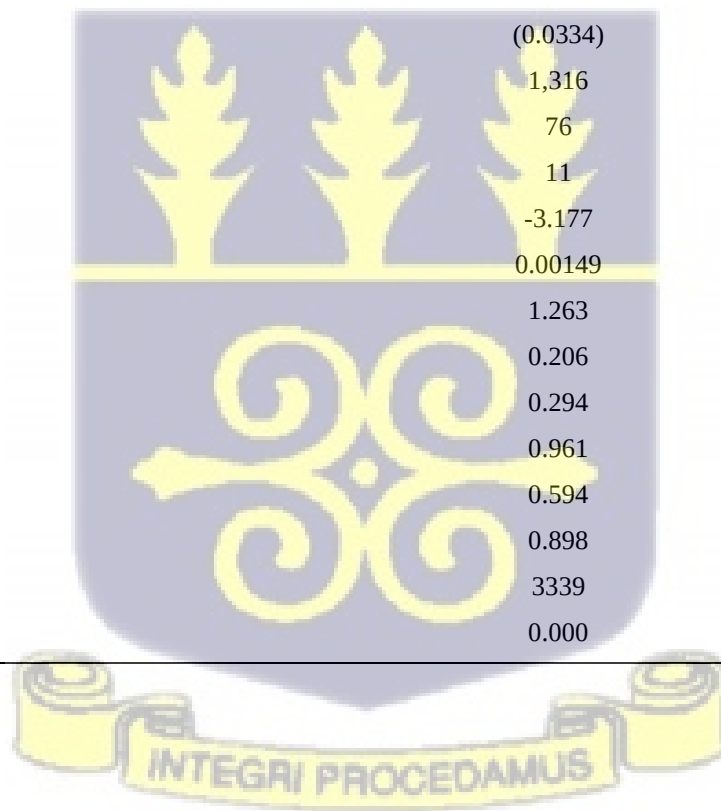


Table 3.7: Interaction effects of Monetary policy and FinTech adoption on financial development: Robustness check results

VARIABLES	Model (15) Financial Development	Model (16) Financial Development	Model (17) Financial Development	Model (18) Financial Development
Financial Development (lagged)	1.002*** (0.154)	0.989*** (0.167)	0.980*** (0.167)	1.229** (0.548)
Monetary policy	-0.00703*** (0.00217)	-0.00759*** (0.00218)	-0.00770*** (0.00218)	-0.00761*** (0.00217)
Active mobile money accounts	-0.000606*** (0.000221)			
Monetary policy * Active mobile money accounts	7.29e-07 (1.28e-05)			
Registered mobile money accounts		-0.000378*** (6.26e-05)		
Monetary policy * Registered mobile money accounts		9.72e-06* (5.44e-06)		
Mobile Money agent outlets			-0.000250*** (4.86e-05)	
Monetary policy * Mobile Money agent outlets			-1.22e-05* (6.34e-06)	
Value of Mobile Money transactions				-0.00666*** (0.00164)
Monetary policy * Value of Mobile Money transactions				-0.000134 (0.000178)
Bank concentration	0.00378***	0.00383***	0.00373***	0.00392***



	(0.000558)	(0.000551)	(0.000554)	(0.000549)
Bank risk	-0.0143***	-0.0142***	-0.0144***	-0.0146***
	(0.00180)	(0.00175)	(0.00178)	(0.00178)
Inflation	-0.0102**	-0.0103**	-0.0105**	-0.0102**
	(0.00419)	(0.00420)	(0.00426)	(0.00415)
Population growth	-0.00490	-0.00549	-0.0111	-0.00651
	(0.00934)	(0.00903)	(0.00898)	(0.00913)
Trade openness	0.000614***	0.000692***	0.000674***	0.000733***
	(0.000189)	(0.000185)	(0.000187)	(0.000184)
Constant	0.480***	0.466***	0.473***	0.454***
	(0.0334)	(0.0333)	(0.0339)	(0.0331)
Observations	1,316	1,392	1,358	1,397
Number of countries	76	77	76	76
No. of instruments	11	11	11	11
AR (1)	-3.177	-3.150	-3.145	0.336
P-value	0.00149	0.952	0.000	0.739
AR (2)	1.263	1.258	1.259	0.333
P-value	0.206	0.00163	0.00166	0.737
Sargan's Test	0.294	0.340	0.348	4.28e-05
P-value	0.961	0.862	0.208	0.979
Hansen's Test	0.594	0.747	0.793	0.000681
P-value	0.898	0.208	0.951	0.000
F-test	3339	3191	3146	18.83
P-value	0.000	0.000	0.851	0.995



3.5 Conclusion and Policy Recommendations

The question of whether FinTech adoption and monetary policy impact financial development and inclusion has recently attracted growing interest from researchers. However, the number of research exploring this empirical question is still limited, and the findings have been mixed and inconsistent. This study adds to the body of knowledge by offering fresh evidence on the relationships among financial development, FinTech, and monetary policy.

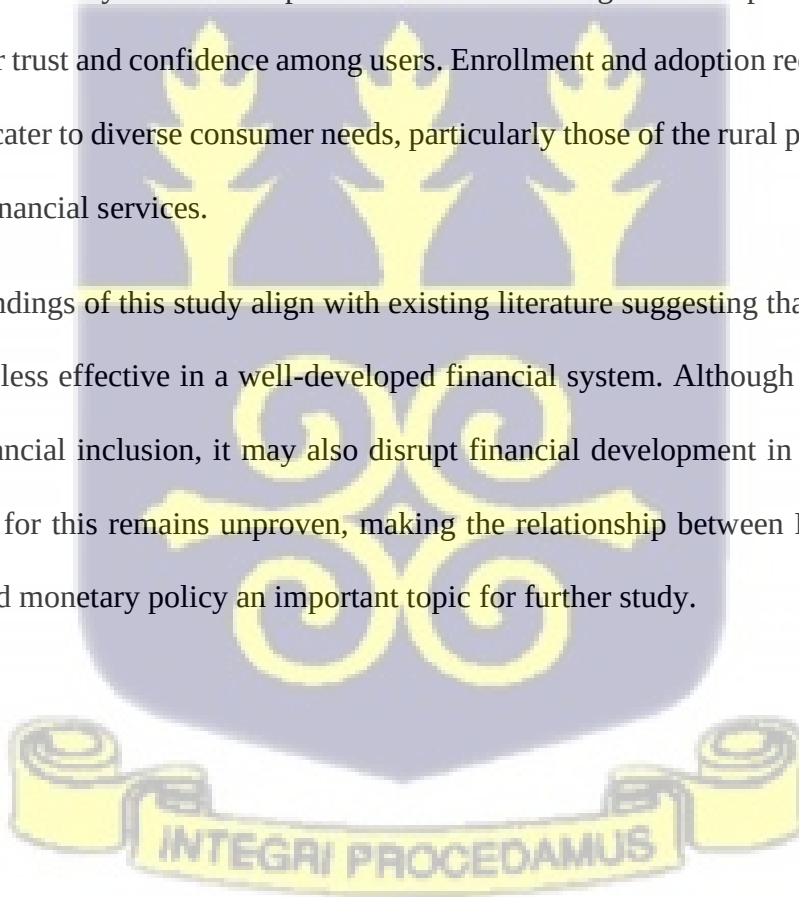
With comparable estimation coefficients across all parameters, the study, which uses panel data from 82 countries between 2000 and 2021, concludes that monetary policy and financial development are often negatively correlated. In particular, every attempt by the central bank to cut the policy rate in order to expand the money supply usually leads to less financial development. Furthermore, FinTech has a detrimental impact on financial development, which lends credence to the claim made in certain research that FinTech disrupts the financial industry.

The combined effects of monetary policy and FinTech on financial development reveal some interesting results. While expanding access to FinTech services (on the supply side) tends to reduce financial development, increased usage of these services (on the demand side) promotes financial development. Thus, a combination of expansionary monetary policy such as lowering policy rates and boosting FinTech usage can significantly enhance financial development. Conversely, merely increasing access to FinTech services and expanding the money supply by reducing policy rates may lead to weaker financial development. To encourage greater usage, access to FinTech should be supported by simpler adoption requirements and more efficient service delivery. Together with a reduced policy rate, these measures can strengthen the financial system.

The findings suggest that policymakers should not rely on either FinTech or monetary policy alone to enhance financial development, as neither is effective in isolation. Instead, the two can complement each other in promoting financial development if policies are designed to increase FinTech demand while adopting a more relaxed monetary policy stance. This approach requires simplifying the adoption process for FinTech, diversifying available products, and improving the robustness of FinTech platforms. Focusing solely on expanding access to FinTech without making these services easier to adopt and more attractive to users will likely fail to develop the financial system.

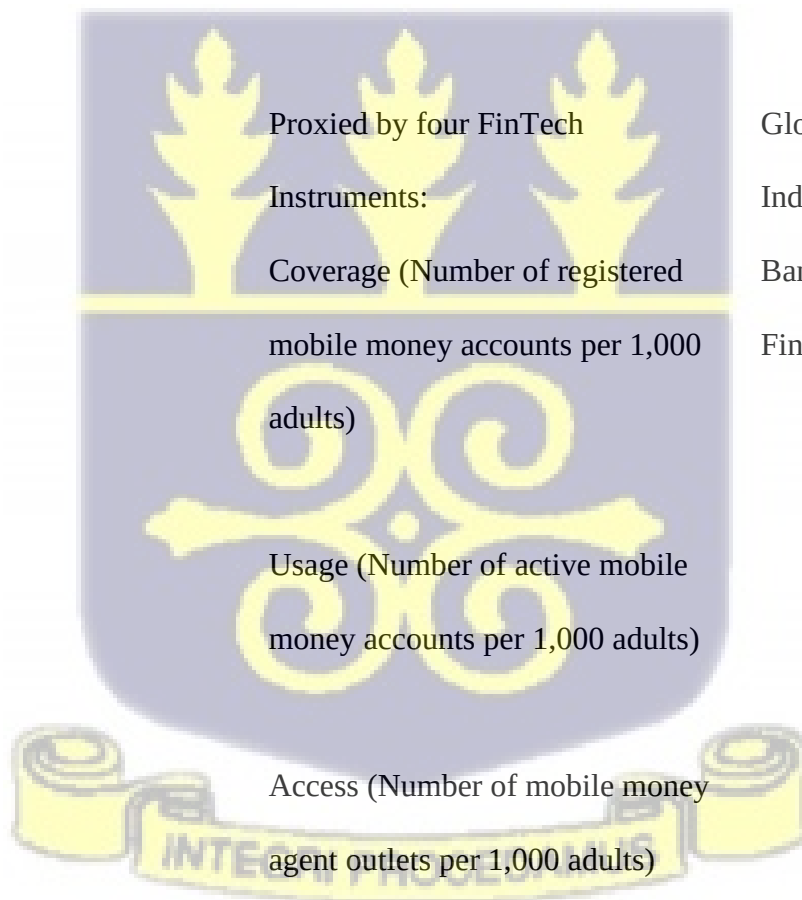
Additionally, the security of FinTech platforms must be strengthened to protect against cyber-attacks and foster trust and confidence among users. Enrollment and adoption requirements should be simplified to cater to diverse consumer needs, particularly those of the rural poor, who are often excluded from financial services.

The empirical findings of this study align with existing literature suggesting that monetary policy changes may be less effective in a well-developed financial system. Although FinTech adoption can enhance financial inclusion, it may also disrupt financial development in the long run. The theoretical basis for this remains unproven, making the relationship between FinTech, financial development, and monetary policy an important topic for further study.



Appendix 1: Variable Description and Source of Data

Variable	Measurement	Data Source
Financial Development	Financial Development Index	International Monetary Fund
Monetary Policy	A shift in the central bank's policy rate: Monetary policy can be either tight (contractionary) or loose (expansionary), with the monetary policy rate serving as a tool.	International Monetary Fund
FinTech	Proxied by four FinTech Instruments: Coverage (Number of registered mobile money accounts per 1,000 adults) Usage (Number of active mobile money accounts per 1,000 adults) Access (Number of mobile money agent outlets per 1,000 adults)	Global Financial Indicators (World Bank) and Global Findex



	Volume of transaction (percentage contribution to GDP by value of mobile money transaction)	
Bank Concentration	Bank concentration is measured by the number of bank branches	World Development Indicators (World Bank)
Bank Risk	Bank risk is measured by credit risk of banks	World Development Indicators (World Bank)
Inflation	The inflation rate, which is determined by the rate at which the consumer price index changes, is a measure of inflation.	World Development Indicators (World Bank)
Population	Population refers to the annual population growth rate	World Development Indicators (World Bank)
Trade	Foreign trade is defined as the total of imports and exports represented as a percentage of GDP	World Development Indicators (World Bank)



Indicators (World
Bank)



CHAPTER FOUR

1 THE EFFECTS OF MONETARY POLICY AND FINANCIAL TECHNOLOGY ON FINANCIAL STABILITY DURING CRISES: EVIDENCE FROM EMERGING AND DEVELOPING COUNTRIES

4.1 Introduction

Economic growth and development are significantly influenced by monetary policy (Sui et al., 2022; Houngb'edji & Bassongui, 2022). It affects the channels of financial process, intermediation and allocation of scarce resources to the real sectors of an economy (Daud et al., 2022; Cheng & Qu, 2020). Hence, monetary policy has a crucial role in the functioning of the financial system and directing the flow of funds into productive investment and promoting aggregate economic activity. Since monetary policy influences the velocity of money and the dissemination of monetary policy choices to the actual economy, it is intimately related to the operation of payment systems. Central banks frequently employ monetary policy to control inflation and economic growth by modifying interest rates. While borrowing and investment are possibly encouraged by lower interest rates, they can also result in asset price bubbles and excessive risk-taking.

The interaction between monetary policy and technological innovations in the financial system has sparked ongoing debate among policymakers and researchers (Oanh et al., 2023; Ding et al., 2018). Recent developments, particularly in financial technology (FinTech), have significantly reduced currency circulation across many economies (Sui et al., 2022; Tobal & Menna, 2020). FinTech's rise has contributed to increased shadow banking (Abor et al., 2018) and a greater emphasis on

1 This chapter has been accepted by the Elgar Companion to Financial Economics for publication as an empirical book chapter in chapter 22 as Monetary Policy, Financial Technology and Financial Crises.

cashless transactions. This is due to FinTech's provision of user-friendly, cost-effective financial products that cater to a broad range of consumers, including those less privileged (Lapukeni, 2015; Evans, 2016; Anarfo et al., 2019; Tonuchi et al., 2021). As the velocity of currency circulation declines due to FinTech's rapid evolution, traditional monetary policy instruments lose their effectiveness (Sui et al., 2022; Tobal & Menna, 2020), potentially disrupting the financial system and causing economic imbalances.

The successful implementation of monetary policy mostly depends on the stability of the financial system, including intermediaries, markets, and infrastructure (Oanh et al., 2023). This stability, in turn, affects the financial system's ability to allocate savings efficiently to investment opportunities, thereby promoting output growth without disruptions (Mishkin, 1999 as cited by Phan et al., 2021). The financial crises of 2007–2008 and the recent COVID-19 pandemic have highlighted the limitations of monetary policy focused solely on price stability, exposing vulnerabilities within the financial system. These crises have led central banks to incorporate financial stability into their mandates alongside price stability, prompting a re-evaluation of monetary policy frameworks (Sui et al., 2022). This shift has also given rise to 'macroprudential policy,' driven by the recognition that safeguarding the soundness of individual institutions alone is insufficient for overall financial stability. Instead, a systemic approach is required, emphasizing institutional resilience through regulatory measures and inclusive finance (Sui et al., 2022).

In response, many countries, particularly emerging economies, have increasingly turned to FinTech to enhance financial inclusion (Xu et al., 2022; Anarfo et al., 2019; Abor et al., 2018). FinTech plays an essential and facilitating role in achieving financial inclusion, stability, and economic growth (Opoku-Afari et al., 2022; Cheng & Qu, 2020). While FinTech's impact on improving credit intermediation is well-documented, its operational models often differ

significantly from traditional financial activities and often fall outside the regulatory framework of central banks. This discrepancy can lead to regulatory arbitrage within the FinTech sector, potentially causing disruptions in the financial system (Ding et al., 2018; Chui, 2017).

Debate continues over whether FinTech's evolution has advanced or impeded the goals of macroprudential policy, which seeks to ensure a stable and resilient financial system. Researchers have provided mixed empirical findings on FinTech's dual role in both enhancing and potentially destabilizing the financial system. For example, Abor et al. (2018) argue that FinTech fosters financial inclusion by providing low-cost transactions and simplified access to financial services for underserved populations. This adoption of FinTech can promote healthy competition, encourage savings, and drive economic growth (Tonuchi et al., 2021; Anarfo et al., 2019; Evans, 2016; Lapukeni, 2015). Additionally, FinTech reduces dependence on informal or unregulated channels (Zhu et al., 2020) and expands financial access, contributing to financial stability (Xu et al., 2022).

Moreover, FinTech enhances competitiveness and participation in emerging markets, which in turn improves the effectiveness and legitimacy of monetary policy (Pazarbasioglu et al., 2020; Feyen et al., 2021; Frost et al., 2021). Increased competition drives efficiency and broadens the range of financial services, reducing the dominance of existing market players and expanding consumer choice (Daud et al., 2022). By altering the financial system's structure, influencing consumption patterns, and affecting inflation dynamics, enhanced financial inclusion through competition can impact the efficiency and effectiveness of monetary policy (Xu et al., 2022).

On the other hand, Chui (2017) contends that the integration of FinTech platforms and their dependence on technology introduce vulnerabilities to operational failures, cyber risks, and disruptions within the financial system. These vulnerabilities can undermine macroprudential

policies designed to maintain overall financial stability. FinTech developments, such as platforms for peer-to-peer lending, crowdfunding services, and mobile payment solutions, can circumvent conventional financial institutions such as payment processors and banks, potentially rendering macroprudential and monetary policies ineffective (Yan et al., 2021; Xu et al., 2022).

The lack of proper oversight and regulation in these areas can threaten the stability of the financial sector. Disintermediation can erode financial stability and disrupt the transmission of monetary policy (Yan et al., 2021). Furthermore, Ding et al. (2018) highlight that FinTech businesses may operate in a regulatory gray area, where emerging business models and regulatory frameworks are inadequately addressed. This regulatory gap allows certain operations to proceed without proper supervision, increasing systemic risk and the possibility of financial distress bubbles, endangering the financial system's stability.

The flow of information is essential for the effective functioning of a financial system, as market participants base their consumption decisions on the evaluation of available options (Phan et al., 2021). Disruptions in information flow, caused by various factors, can exacerbate issues such as moral hazard and adverse selection, ultimately hindering the efficient allocation of funds to economic units. Information asymmetries can erode market confidence and reduce lending, slowing economic activity by complicating the differentiation between good and bad borrowers (Fu et al., 2014; Mishkin, 1999). As a result, credit availability is constricted, affecting operational efficiency and financial stability (Oanh et al., 2023; Bofondi & Gobbi, 2003).

The influx of new entrants in the financial market due to FinTech innovations exacerbates these issues. Financial institutions face challenges in distinguishing reliable borrowers from less creditworthy ones (which threatens operational performance and financial stability) (Oanh et al.,

2023; Sheng, 2020; Paternoster & Dessimirova, 2017). The development of FinTech amidst information asymmetries complicates the efficient operation of financial institutions.

Theoretical frameworks suggest that four key factors disrupt information flow and financial intermediation, leading to instability: high credit costs due to monetary policy tightening, liquidity challenges within the financial sector (e.g., weak balance sheets), deteriorating non-financial balance sheets, and rising uncertainty during disruptions or crises (Oanh et al., 2023; Phan et al., 2021; Mishkin, 1999; Keeley, 1990; Bagehot & Street, 1915).

This study's hypothesis is driven by the increased adoption of FinTech, which has significantly boosted financial inclusion (Abor et al., 2018), and the concurrent disruptions to traditional financial products and services due to fraudulent transactions and cyber-attacks (Ding et al., 2018; Chui, 2017). These disruptions have affected monetary policy transmission channels, as FinTech operations often lack regulation and are less receptive to changes in monetary policy. The recent global uncertainties within the financial system have further impacted credit costs and institutional stability due to information asymmetry, complicating the use of monetary policy tools and the identification of credible financial consumers. This situation causes distortions and crises in the banking sector and broader financial system.

The study argues that the simultaneous application of FinTech and monetary policy to achieve financial stability is counterproductive, given the competition-fragility nexus and information asymmetry theories. This perspective aligns with previous studies, including those by Oanh et al. (2023), Anarfo et al. (2019), Ahamed and Mallick (2019), Gilchrist et al. (2014), and Mishkin (1999).

The study further contends that FinTech is a vital instrument for both preventing and restoring financial stability in economies facing banking crises. Its ability to enhance inclusive finance by offering low transaction costs, broader market reach, and flexible adoption requirements, coupled with its potential for product diversification, increased efficiency, and improved transparency, aligns with the principles of financial intermediation theory, the stability-fragility hypothesis, and the finance-growth theory.

Existing literature indicates that both financial stability and fragility can arise from increased competition driven by FinTech adoption and monetary policy implementation. Theoretical and empirical studies have not yet reached a consensus on this issue. Some argue that FinTech enhances financial stability by fostering innovation, diversifying portfolios, and improving efficiency in the absence of information asymmetries (Daud et al., 2022; Goetz, 2018; Caminal & Matutes, 2002). The stability-fragility theory states that FinTech lowers franchise value, profit margins, and market power—all of which are linked to increased stability (Fu et al., 2014; Kabir & Worthington, 2017; Albaity et al., 2021). Conversely, increased market power or concentration can heighten risk due to greater loan exposure, higher default probabilities, and moral hazard issues exacerbated by monetary policy and FinTech adoption (Caminal & Matutes, 2002; Mishkin, 1999).

Despite the interconnections among these crucial variables—monetary policy, FinTech, and financial stability, there is a lack of empirical research addressing their simultaneous correlations. This gap highlights the need for studies that explore the integrating dynamics on FinTech and monetary policy's moderating influence on financial stability to complement existing literature.

Moreover, conflicting findings in the limited literature may result from variations in research scope, time frames, regional groupings, and development levels. This study focuses on emerging economies with similar levels of financial development, which influences their FinTech adoption

and consumer profiles. This approach aims to provide consistency and validity in analyzing the interaction of FinTech, financial stability, and monetary policy.

To address these research gaps, this study investigates how monetary policy and FinTech impact financial stability in emerging and developing countries during both normal and crisis periods. This exploration is particularly relevant given recent technological advancements and the necessity of increasing capital to promote sustainable development and economic growth, while also considering alternative policy solutions to mitigate financial system fragility.

This research makes four contributions to the empirics. First, it contributes to the body of research that assesses how FinTech and monetary policy affect several facets of the economy, particularly the financial system (see Ahmed et al., 2023; Houngb'edji & Bassongui, 2022; Tonuchi et al., 2021; Anarfo et al., 2019; Gbenou, 2017; Khan, 2011; Granville & Mallick, 2009). For instance, Ahmed et al. (2023), Tonuchi et al. (2021) and Khan (2011) show that monetary policy enhances the financial system's stability and that the effectiveness of the former was a pre-condition in achieving the latter. Similarly, Abor et al. (2018), Evans (2016) and Khan (2011) argue that financial inclusion (FinTech) is an important tool in achieving financial inclusiveness and promoting inclusive economic growth and financial stability. Chui (2017) argues that FinTech can be disruptive to the security of the financial industry because of the dangers of emerging technologies. This argument is validated by the finding of Ding et al. (2018) who show that FinTech is counterproductive to the promotion of financial stability. However, unlike this study, none of the studies examines the unique effect of monetary policy (policy rate) and FinTech (*FinTech index constructed using supply-side and demand -side variables*) regarding the soundness and resilience of the banking industry as a measure for the stability of a financial system.

Second, the study evaluates the interactive effect of monetary policy and FinTech adoption in promoting a sound financial system. Fu et al. (2014) demonstrate that increased concentration causes the financial system to experience shocks and financial bubbles, which in turn causes instability in the banking industry. Hence, competition in the financial sector reduces concentration and diversifies services, increases the efficiency among financial service providers and hence, financial stability. This assertion is supported by Morgan and Pontines (2018) and Ahamed and Mallick (2019) who argue that financial inclusion promotes stability and monetary policy effectiveness serves as the catalyst that facilitates the achievement of stability. These positions in literature make the achievement of financial stability a complex one- FinTech (competition) and monetary policy may hurt or increase financial stability. This literature focuses on the individual roles of monetary policy and FinTech in promoting financial in(stability). None of the studies demonstrates how the interaction between monetary policy and FinTech and their simultaneous implementation affects financial in(stability) in a financial system of an economy. This research closes this gap in the literature and offers fresh suggestions for policy direction to central banks whose mandate in recent times includes the implementation of macroprudential policies aimed at achieving financial stability through the adoption of a policy mix to promote financial inclusion and credit intermediation.

Third, the study adds to the body of knowledge by demonstrating that stability is unaffected by banking crisis within the financial system across countries when FinTech penetration is high in the economy. This is so important and crucial, especially in emerging markets for obvious reasons. Countries have different and unique attributes of their financial sector including levels of inclusion, regulatory frameworks, size of financial markets, levels of liberalization of the financial system and competition, taste of market participants, among others- such that the level of financial

innovations can serve as a net absorber to maintain financial stability in the midst of a distressed banking environment. This study that uses a cross-country data gives a broader analysis of the banking crisis- financial stability relationship using the moderating effect of FinTech adoption which has permeated most economies of the world. Besides, the estimates are more precise due to the increase in observations as a result of the pooled sample. This differs from the limited literature that focuses on single or fewer country level data with possible non-precision of estimates which limits the currency to generalize the findings. Last, we further demonstrate that financial stability is inherent in monetary policy and FinTech with banking crisis having no significant influence on financial in(stability). There is no evidence that shows that FinTech adoption negates the impact of banking crisis on financial instability. This study provides the first evidence that shows that financial stability is enhanced during a banking crisis when the adoption of FinTech is greater in an economy. Similarly, the study adds to the limited strand of the literature that suggests that monetary policy is crucial in enhancing financial stability when there is a banking crisis. The use of monetary policy and the application of its tools to keep the financial system stable during banking crisis has been confirmed by this study.

The remainder of the study is organized as follows. Section 2 discusses extant literature; section 3 describes the data and methodology used. Section 4 presents descriptive statistics, and discussion of the results, while Section 5 summarizes the main conclusions.

4. 2 Literature Review

Theoretically, sudden changes in the financial system's structure and operations can cause significant disruptions and uncertainties due to increased information asymmetry. This opacity in market activities can undermine the effectiveness of regulatory measures such as monetary policy (Phan et al., 2021; Mishkin, 1999). Increased uncertainty and disruption elevate credit risk for

financial intermediaries, making it difficult for surplus units to differentiate between reliable and unreliable borrowers. This, in turn, reduces the flow of funds to essential sectors, leading to decreased investment and a contraction in economic activity. Consequently, financial stability diminishes following prolonged credit risk, reduced fund flow, and declining economic activities. Disruptions such as those caused by FinTech innovations, can thus trigger market reactions and uncertainties. Minsky (1970) suggests that cash flow shortfalls due to income declines or management errors can destabilize a financial system, especially during periods of uncertainty and crisis. These factors highlight that both monetary policy and FinTech play crucial roles in determining financial stability.

Several theoretical studies support these perspectives. For example, George (1970) argues that information asymmetry and abrupt changes in financial structure lead to tighter credit conditions, which can impair the operational efficiency of financial institutions and compromise financial stability. The proliferation of new players and the launch of several financial services and products, characteristic of FinTech, represent such disruptions. These changes can hinder surplus units' ability to distinguish between reliable and unreliable borrowers and diminish the effectiveness of monetary policy transmission. Consequently, this causes distortions in the credit intermediation process and the broader financial landscape, leading to herd behavior that threatens the performance of financial institutions and overall financial stability.

Additionally, Bagehot and Street (1915) argue that high levels of financial exclusion can contribute to income inequality, long-term economic imbalances, and slow economic growth. This suggests that the evolution of FinTech, which promotes financial inclusion, has the potential to improve income equality, support macroeconomic stability, and accelerate economic growth. These factors have both direct and indirect implications for monetary policy and the financial system, indicating

that FinTech and financial stability are crucial for the effectiveness of monetary policy and overall economic growth.

A review of empirical studies over time reveals a complex and often contentious relationship between monetary policy and financial stability. Research into this dynamic relationship has produced varied outcomes and conclusions. The money supply, exchange rates, stock markets, and credit market are just a few of the channels that monetary policy can affect financial stability.

Borio and Lowe (2004) analyzed the interactions between monetary policy and financial stability in four advanced economies—Australia, Japan, the USA, and Germany, using a modified Taylor rule. They found that, except for the United States, there were generally adverse and reverse causality outcomes between monetary policy and financial stability. Using macroeconomic data from 1995 to 2004 and data from the German banking industry, De Graeve et al. (2008) contend that there is a ‘trade-off between monetary and financial stability’, pointing out that an unanticipated tightening of monetary policy raises the risk of financial distress.

Granville and Mallick (2009) suggest that effective monetary policy is crucial for long-term financial stability, emphasizing that managing interest rates to ensure price stability is necessary for a stable financial system. Albulescu et al. (2013) find that instability in the financial and banking systems negatively impacts interest rate settings, and vice versa. Peek et al. (2016) investigate the connection between monetary policy and financial stability in the United States and come to the conclusion that monetary policy decisions should take financial stability into account.

Tobal and Menna (2020) argue that "leaning against the wind" with monetary policy can reduce the likelihood of a financial crisis. They note that while financial conditions in emerging markets are more influenced by capital flows than in advanced economies, monetary policy in these

markets can positively affect financial stability during crises. More recently, Gross and Zahner (2021) used Bayesian model averaging to analyze the European Central Bank's monetary policy before and during the Global Financial Crisis. They found that inflation became the primary factor influencing monetary policy post-crisis, whereas pre-crisis decisions were more driven by economic activity metrics.

Bernanke and Blinder (1988) suggest that tightening monetary policy leads to a decrease in deposits, prompting banks to reduce loan supply. Nier and Zicchino (2008) found that changes in monetary policy are associated with corresponding increases or decreases in loans, based on research of over 600 banks in 32 countries. Conversely, Disyatat (2011) argues that focusing solely on policy-induced changes in deposits is misguided. He suggests that financial stability should be reframed to emphasize the soundness of banks' balance sheets and their risk perceptions. This aligns with Kashyap and Stein's (1995) findings that smaller banks reduce lending more significantly than larger banks when monetary policy tightens in the USA.

The literature on financial inclusion and stability is limited and the results are conflicting and ambiguous. Research indicates that FinTech can impact financial stability both positively and negatively. For instance, Morgan and Pontines (2018) suggest a relationship between financial stability and inclusive finance, while other studies (Sahay et al., 2015; Morgan & Pontines, 2018) have identified a link between financial inclusion and instability.

Khan (2011) posits that increasing financial inclusion through innovative products and services can enhance financial stability in three primary ways: (i) including low-income individuals expands banks' deposit bases, reducing their reliance on volatile funding sources; (ii) lending to small businesses diversifies bank assets, lowering overall portfolio risk by decreasing the relative

proportion of any single borrower; and (iii) digital innovations in financial inclusion improve the transmission effectiveness of monetary policy, which may support financial stability.

However, Khan (2011) also argues that increasing financial inclusion can be detrimental to financial stability. Specifically, (i) expanding credit to small borrowers may increase banks' reputational risk and lead to financial distress; (ii) lowering loan requirements and lending to a larger number of borrowers might reduce asset quality; and (iii) inadequate regulation of financial institutions could result in increased group lending, undermining market regulation and contributing to financial instability. This highlights how efforts to boost financial inclusion can lead to subprime lending and, ultimately, undermine financial stability.

Paternoster and Dessimirova (2017) contend that the banking sector and macroeconomic policy face a number of difficulties as a result of the growth of FinTech which includes 'digital banking, crowdfunding platforms, distributed ledger technology, and electronic money'. For example, peer-to-peer lending allows individuals to secure funds outside traditional banking channels, digital payment systems via smartphones enable seamless transactions and technologies like blockchain simplify transaction reporting and execution. These innovations can hinder central banks' ability to effectively implement monetary policies aimed at maintaining financial stability (Sheng, 2020). Financial innovations such as Bitcoin might further complicate monetary policy by contributing to increased credit growth and systemic risk (Narayan et al., 2018). Consequently, FinTech can heighten market and economic vulnerabilities to systemic risk (Chui, 2017). Bromberg et al. (2018) reinforce this by highlighting concerns about scams and fraudulent startups in the FinTech sector, which erode confidence in the financial system (Temelkov, 2018) and have reputational implications for financial stability (Khan, 2011).

Overall, the literature suggests that FinTech and monetary policy can both enhance and disrupt financial inclusion and intermediation within the financial system. While these studies emphasize the significance of FinTech and monetary policy in financial stability, none have thoroughly examined the interplay between these factors and their collective impact on financial stability. This study addresses this gap by demonstrating that monetary policy and FinTech can influence financial stability, providing insights across emerging markets and during banking crises.

4.2.1 Hypothesis Development

Based on the theoretical framework outlined in Chapter 2, the study proposes the following hypotheses:

H1: Monetary policy has a stabilizing effect on the financial system in both emerging and developing economies.

H2: FinTech adoption enhances financial stability through increased efficiency and diversification of financial intermediation.

H3: The interaction between monetary policy and FinTech strengthens financial stability under normal conditions but may amplify volatility during crises.

H4: The impact of monetary policy and FinTech on financial stability differs significantly between crisis and non-crisis periods.

These hypotheses reflect the dual role of FinTech as both a stabilizing innovation and a potential source of fragility when regulatory and institutional responses lag technological advancement.

4.3 Methodology and Data Source

The study employs panel data of 82 countries across the world from emerging and developing economies over the period 2000 to 2021. The categorization of countries for the study is determined by the limited empirical evidence available on emerging economies as far as the moderating effects of FinTech with monetary policy are concerned on financial stability to guide policy decisions (Abor et al., 2018; Anarfo et al., 2019; Anarfo et al., 2020; Tounchi et al., 2021). The main factors influencing the research period are the availability of data and the requirement to include various historical periods that have recently seen economic upheaval. Global Financial Development and Structure Database, World Bank Global Financial Development Database, World Development Indicators, Global Financial Index, and International Financial Statistics (IFS) are among the World Bank and IMF datasets used for the study.

This study employs the Dynamic Systemic GMM estimations technique to specify two equations to investigate the independent and joint effects of monetary policy and FinTech adoption on financial stability. The endogenous problem (endogeneity) of the lagging term of the dependent variable related to dynamic panel regressions is resolved by the system-GMM estimator of Arellano and Bond (1991) and Blundell and Bond (1998). This helps address the problem of omitted variable bias and measurement errors that may arise in the model. Again, the GMM is seen to be more reliable than other alternative methods when it comes to addressing a variety of econometric issues including identification, autocorrelation and heteroscedasticity, and enabling the incorporation of both individual-specific and time-specific effects while addressing endogeneity and serial correlation issues (see: Hansen, 1982; Newey & West, 1987; White, 1984). The endogeneity problem has been addressed in recent researches by applying a number of GMM techniques (see: Trinh et al., 2022; Daud et al., 2022; Ahmed et al., 2023, Oanh et al., 2023).

The empirical models can be summarized as follows:

Independent Effect

$$\begin{aligned} Stability_{jt} = & \beta_1 Stability_{jt-1} + \beta_2 MP_{jt} + \beta_3 FinTech_{jt} + \beta_4 BAC_{jt} + \beta_5 NPL_{jt} + \beta_6 INF_{jt} \\ & + \beta_7 ER_{jt} + \beta_8 GDPPCI_{jt} + \beta_9 CRISIS_{jt} + \theta_t + \phi_j + \varepsilon_{jt} \end{aligned}$$

Interaction Effect

$$\begin{aligned} Stability_{jt} = & \beta_1 Stability_{jt-1} + \beta_2 MP_{jt} + \beta_3 FinTech_{jt} + \beta_4 (MP_{jt} * FinTech_{jt}) + \beta_5 BAC_{jt} \\ & + \beta_6 NPL_{jt} + \beta_7 INF_{jt} + \beta_8 ER_{jt} + \beta_9 GDPPCI_{jt} + \beta_{10} CRISIS_{jt} + \theta_t + \phi_j + \varepsilon_{jt} \end{aligned}$$

where MP is monetary policy rate, FinTech is an index of FinTech constructed by the authors using the Principal Component Analysis of FinTech variables, BAC is bank concentration, NPL is non-performing loans, INF is inflation rate, ER denotes real exchange rate, GDPPCI is Goss Domestic Product per capita income and CRISIS is a dummy of financial (banking) crisis defined as 1 during periods of crisis and 0 otherwise. Stability measures financial stability using the bank Z-score. θ_t captures time dummies in the equations, ϕ_j captures fixed effects – country-specific unobservable time-invariant effects in the countries. The noise error term (idiosyncratic error term) for the jth country at period t is ε_{jt} , which accounts for unit-specific residuals in the models.

4.3.1 Variables, Measurement and A priori Expectations

The dependent variable is financial stability. Based on the theories discussed above and following the work of Boyd and Runkle (1993); Beck, et al. (2007); Demirgüç-Kunt et al. (2008); Laeven and Levine (2009); Čihák and Hesse (2010), Daud et al. (2022), Anarfo et al. (2022), we adopt the z-score measure of financial stability due to its ability to take into account profitability, leverage, liquidity, solvency and activity ratios of specific individual financial institutions such as banks.

These financial measures are important factors that determine the performance and financial efficiency of a financial institution (Beck et al., 2007; Čihák & Hesse, 2010; Daud et al., 2022).

The policy rate of Central banks is used to proxy monetary policy (Abor et al., 2022; Anarfo et al., 2022). The FinTech index which is calculated using principal component analysis (PCA) of proxy variables related to FinTech and financial inclusion, is used to measure FinTech (Daud et al., 2022; Oanh et al., 2023) to deal with possible multicollinearity, missing values, categorical data and imprecise measurements. A single variable cannot adequately measure FinTech or financial inclusion (Oanh et al., 2023). Consequently, different variables of FinTech are used to compute the index based on the IMF 2004 classification of FinTech variables of financial utilization index (demand-side variables) and financial access index (supply-side variables).

These variables of FinTech and financial inclusion cover both the supply (access) and demand (usage) of FinTech services. These include access to ATM platforms, number of people with access to internet per 1,000 adults, number of registered mobile money accounts per 1,000 adults, number of mobile money agent outlets per 1,000 adults on the supply side, and number of active mobile money accounts per 1,000 adults, percentage contribution to GDP by the value of mobile money transactions and number of mobile money transactions on the demand side (Abor et al., 2018; Anarfo et al., 2022). Both monetary policy and FinTech are expected to have positive and significant relationships with financial stability independently and when interacted with monetary policy. Control variables are included to increase the explanation level of the model. The control variables include bank concentration proxied by number of bank branches; non-performing loans measured by loan recovery rate. The consumer price index rate is used to measure inflation. Exchange rate measures the real effective exchange rate, and GDPPCI measures the country's GDP

per capita income. It is expected that all the control variables except exchange rate and financial stability and GDP per capita income will be inversely correlated, consistent with literature.

The study defines financial crises following the classification by Laeven and Valencia (2013), where a systemic banking crisis occurs when significant financial institutions fail, bank runs arise, or large-scale government interventions are required to stabilize the system. Two major crisis periods are incorporated in this study:

1. Global Financial Crisis (2007–2008) – marked by global credit market disruptions, liquidity shortages, and declining asset values.

2. COVID-19 Pandemic (2020–2021) – characterized by economic shutdowns, heightened financial uncertainty, credit market disruptions, and fiscal-monetary policy interventions such as liquidity injections. Thus, the CRISIS variable comprises ‘(i) notable indications of financial distress in the banking system such as huge bank runs, losses, and/or liquidations; and (ii) significant banking policy intervention measures in reaction to notable losses in the banking system’. A binary variable **CRISIS** equals 1 for these years and 0 otherwise. To assess differential effects, the study introduces interaction terms between monetary policy and FinTech during CRISIS to capture how the impact of monetary policy and FinTech changes under crisis conditions. The inclusion of these terms ensures the model reflects the study’s central objective of examining FinTech and monetary policy effects on financial stability during crises

4.4 Empirical Results

4.4.1 Descriptive Statistics

Table 4.1 presents the descriptive statistics for the variables studied, indicating deviations from the mean for each. A high degree of financial stability was found in the countries under investigation, as shown by the Bank Z score, which had an average of 13.91, a standard deviation of 7.234, and

values ranging from 2.17 to 47.57. Values for monetary policy ranged from 1.46 to 70.0, with a mean of 7.90 and a standard deviation of 7.21. This implies that during the research period, the central banks of study countries used both expansionary and contractionary monetary policies to control the money supply.

FinTech adoption averaged -0.26, with values ranging from -0.84 to 2.79, indicating relatively low levels of FinTech adoption across the countries studied. Bank concentration and non-performing loans had means of 70.91 and 4.25, with standard deviations of 18.70 and 3.41, respectively. This indicates that bank branches and sizes had broad coverage, averaging over 70 percent across the sample countries, while the loan default rate remained below 5%. This suggests a stable and sound financial environment in the countries during the review period. Additionally, macroeconomic variables such as inflation and GDP per capita had averages of 853.9 and 5.90 percent, respectively.

Table 4.2 details the correlations among the explanatory variables, showing no issues of multicollinearity. The correlation coefficients are all below 0.7, and the mean Variance Inflation Factor (VIF) is 2.724, shows that multicollinearity is not an issue.

Table 4.1: Summary of Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	P1	P99	Skew.	Kurt.
Bank Z-score (lagged)	659	13.911	7.234	2.176	47.573	3.071	37.863	1.00	4.372
Monetary policy	315	7.899	7.211	1.460	70	1.5	28	3.172	21.671
FinTech	268	-0.259	0.77	-0.842	2.786	-0.818	2.539	2.09	6.615
Bank Concentration	571	70.91	18.691	17.164	100	23.024	100	-0.21	2.451
Non-performing Loans	729	4.254	3.406	-0.212	45.3	0.596	19.30	6.127	55.762
Inflation	841	29.9	26.938	17.711	56.47	23.35	160.71	7.815	65.804
Exchange Rate	912	34.722	47.57	0.00	142.626	0.00	126.844	0.696	1.604

GDPPCI	1007	5.896	2.838	0.00	9.896	0.00	9.626	-1.303	3.421
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Table 4.2: Pairwise Correlations

Variables	VIF (2.724)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank Z-score(lagged)		1.000							
Monetary Policy	2.259	0.026 (0.685)	1.000						
FinTech	2.898	-0.042 (0.625)	0.082 (0.506)	1.000					
Bank Concentration	2.858	-0.087 (0.037)	-0.169 (0.012)	0.072 (0.420)	1.000				
Non-performing Loans	1.344	-0.156 (0.001)	-0.076 (0.253)	-0.156 (0.031)	-0.025 (0.625)	1.000			
Inflation	2.849	-0.146 (0.000)	0.174 (0.002)	0.038 (0.586)	-0.134 (0.001)	-0.031 (0.455)	1.000		
Exchange rate	4.424	-0.160 (0.000)	0.317 (0.000)	0.051 (0.424)	-0.210 (0.000)	0.207 (0.000)	-0.109 (0.003)	1.000	
GDPPCI	2.434	-0.130 (0.001)	-0.096 (0.096)	-0.172 (0.005)	-0.041 (0.334)	0.028 (0.468)	0.060 (0.089)	0.042 (0.204)	1.000

4.4.2 Effects of Monetary Policy and FinTech on Financial Stability without Crisis

Table 4.3 presents the baseline results regarding the individual and interactive effects of monetary policy and FinTech on financial stability. The findings align with existing literature, demonstrating a high degree of consistency for monetary policy, as evidenced by the statistical significance of a positive AR (1) term across all models.

The results presented in Table 4.3 show that, monetary policy is positively correlated with financial stability (with significance at the 1% level). This indicates that higher policy rates, through a tighter monetary policy, enhance financial stability. A tighter monetary policy helps mitigate the formation of asset bubbles by increasing borrowing costs, which makes speculative investments

in real estate or stocks assets more expensive. This reduction in speculative behavior can prevent the development of unsustainable asset price bubbles that may lead to financial crashes if they burst. These results support the conclusions of Ahmed et al. (2023) and Tonuchi et al. (2021), who argue that monetary policy strengthens financial stability.

Additionally, tight monetary policy helps limit excessive credit growth and reduces systemic risk by curbing financial risk-taking during economic booms. By discouraging excessive leverage and speculative activities, it minimizes the potential for financial shocks and contagion across institutions. This policy also fosters prudent lending and borrowing practices and mitigates moral hazard among financial institutions. Higher interest rates lead to stricter lending standards and more thorough credit risk assessments, decreasing the likelihood of over-lending and loan defaults. This finding corroborates the work of Lapukeni (2015), Evans (2016), Ma and Lin (2016), and Gyeke-Dako et al. (2022).

Monetary policy decisions in general have a signaling effect on the financial market and how market participants react to them through the various channels of transmission. Hence, tight monetary policy decisions can signal a monetary authority's commitment to financial stability and responsible economic management. This enhances long-term confidence among market participants such as investors, borrowers, and lenders, as they believe that the monetary authorities will take necessary measures to prevent financial excesses and maintain a stable economic environment. These results are consistent with Houngb'edji and Bassongui (2022) and Gbenou, (2017).

Similarly, Table 4.3 shows that FinTech has a positive association with financial stability. This association is significant at the 1% level. In other words, an increased adoption of financial solutions enabled by FinTech innovations improves the soundness and stability of the financial

system in an economy. This suggests that market participants' and other financial intermediaries' conduct is influenced by high levels of financial technology adoption, which may have an impact on the overall stability of the financial system. Underprivileged groups that were previously shut out of the official financial system can now access financial services due to the expansion of financial services by FinTech.

The inclusion of larger economic units into the financial intermediation process decreases inefficiencies in the financial system's resource allocation and expands economic opportunities that support social development and financial access. Peer-to-peer lending platforms, digital wallets, and mobile banking, for example, facilitate access to banking services for those living in distant or underbanked areas. Increased financial inclusion promotes economic stability by reducing income inequality, enabling more households and businesses entities to save, invest, and take part in the formal financial system. Again, FinTech applications often include user-friendly interfaces that prioritize customer needs and educational components that can enhance financial literacy. This focus encourages better financial decision-making among market participants, reducing the likelihood of excessive debt accumulation and financial distress. Market players and financial consumers are less likely to make poor financial choices that could cause instability when they have a greater understanding of financial products and services.

To this end, an increase in access to financial services by a significant portion of the market enabled by FinTech coupled with the right information to make informed decisions, enhances their resilience to withstand financial shocks and thereby increases their capacity and ability to manage financial risks, both of which have a positive effect towards the stability of the entire financial system and the economy as a whole. This reduces credit risk, bankruptcy as well as systemic risk of financial institutions which could spread to other parts of the whole financial system and

possibly cause financial instability in the economy. This result contradicts the finding by Oanh et al. (2023) who argue that financial inclusion reduces the stability of the financial ecosystem in least developed countries.

However, the finding affirms the argument by Morgan and Pontines (2018) and Sahay et al. (2015) that financial innovations have a correlation with financial stability and the latter is improved when the former is promoted. FinTech diversifies a financial ecosystem and makes it more resilient to shocks. FinTech solutions often have leaner structures and may be less interconnected with traditional financial institutions, reducing the systemic risk posed by large, interconnected banks. Enhanced risk assessment, fraud prevention, and payment systems can help mitigate the effects of economic upheavals and downturns. During times of economic stress, FinTech innovations can help maintain access to financial services and reduce the severity of financial crises. Additionally, FinTech streamlines payment systems and settlement processes by introducing faster, more efficient, and cheaper methods of transferring money domestically and internationally. These systems and processes, including real-time payment platforms, reduce the risk of payment delays and errors. Faster and more reliable payment systems reduce the cost of financial intermediation, contributing to the seamless operation of financial markets and the larger economy by lowering interest rates for borrowers and increasing returns for savers, reducing liquidity and operational risks and ultimately financial instability. It is the case that FinTech solutions employ sophisticated algorithms and AI-driven fraud detection tools to identify and thwart fraudulent activities swiftly. By minimizing financial fraud, FinTech helps safeguard both the financial system's integrity and its customers. Reduced fraud-related losses for both financial institutions and consumers lead to improved risk management of financial service providers, reduced systemic risk and increased confidence in the financial system, which are fundamental aspects of financial stability. These

findings align with the conclusions by Anarfo et al. (2022), Abor et al. (2018), Dienillah et al. (2018), Ding et al. (2018), Hannig and Jansen (2010). The finding, however, contradicts the results by Bromberg et al. (2018) and Chui (2017). Equally important is the fact FinTech innovations such as distributed ledger technology (blockchain), can enhance the transparency and traceability of financial transactions. This transparency reduces counterparty risks and enhances overall systemic stability, as regulators and market participants have improved visibility into financial activities.

The empirical findings suggest that financial stability is significantly improved when monetary policy and FinTech combine (see Table 3). The findings imply that an economy's financial stability is improved when monetary policy and FinTech mutually work together. Therefore, the stability of the financial system is supported by monetary policy as well as increased access to and use of FinTech services. The implication is that the combination of monetary policy measures and the adoption of FinTech innovations has mutually reinforcing positive effects on the stability of the financial system. In other words, when monetary policy and FinTech initiatives work together, they have a more significant and favorable impact on promoting financial stability in the economy than either one would have individually. The interaction and simultaneous implementation of monetary policy and FinTech can promote financial stability by improving data analysis, strengthening risk management, enhancing payment system resilience, fostering competition and innovation and increasing financial inclusion. This collaboration has the potential to make the financial system more robust and resilient to economic shocks as discussed below.

FinTech promotes financial inclusion by expanding access to financial services. As more individuals and businesses gain access to the financial system, they become less vulnerable to financial shocks, which can help stabilize the overall economy. Stability and resilience to financial shocks are enhanced by a more inclusive financial system. The impact of the interest rate change

policy on households' intertemporal consumption decisions is much diminished when non-inclusive households are involved. However, as participation in the formal financial environment improves, the transmission of monetary policy actions to the broader economy improves. Digital payment systems, for example, can make it easier for central banks to implement changes in interest rates and quantitative easing measures, ensuring that these actions affect the financial system more immediately and directly. This result is consistent with Temelkov (2018), Makina (2019) and Tonuchi et al. (2021), Ahmed et al. (2023).

The finding further indicates that FinTech innovations enhance competition and efficiency in financial markets by improving price discovery, lowering transaction costs, and boosting market liquidity through diversification. By introducing competition into traditional financial sectors, FinTech encourages banks and financial institutions to adopt more efficient, customer-oriented, and resilient practices. Consequently, this may result in a more stable financial system overall. FinTech platforms provide firms with access to alternate sources of capital, such as crowdfunding and peer-to-peer lending mechanisms, thereby diversifying funding options and reducing reliance on traditional banking channels. This reduced concentration risk contributes to greater financial stability. Generally, more efficient markets are less susceptible to sudden fluctuations. These findings align with the competition-stability nexus discussed in the literature, as supported by Oanh et al. (2023), Sui et al. (2022), and Phan et al. (2021).

FinTech firms play a pivotal role in the financial ecosystem by collecting extensive real-time data, which provides central banks with more detailed and current economic insights. This enhanced data enables central banks to make better-informed decisions when developing and implementing monetary policy, ultimately supporting stronger financial stability measures. The digitalization of financial services and payment systems facilitates the swift and efficient transmission of changes

in interest rates and credit conditions to both businesses and consumers, aiding central banks in achieving their financial stability objectives more effectively. This efficiency is supported by the research of Ahmed et al. (2023), Anarfo et al. (2019), Maier (2016), and Evans (2016). Additionally, FinTech solutions such as regulatory technology improve the monitoring and reporting of compliance, enhancing the effectiveness of regulation and supervision and reducing the risk of financial instability. The use of advanced analytics by FinTech platforms allows for real-time assessment of credit risk and tracking of financial market developments, aligning with the findings of Opoku-Afari et al. (2022). This technology helps central banks identify and manage systemic risks more effectively, thereby lowering the probability of financial crises, a view that challenges the perspectives of Chui (2017) and Bromberg et al. (2018).

To fully capitalize on the inevitable financial evolution of the 21st century while managing associated risks, it is crucial for policymakers, central banks, and FinTech firms to work together and adapt to the changing financial landscape. This collaboration should aim to achieve key objectives such as financial inclusiveness, efficiency, resilience, and inclusive economic growth. Policy development and execution must consider the synergistic effects of FinTech and central bank monetary policies, particularly in emerging economies striving for a stable financial system and sustainable economic growth. Leveraging the rapid evolution and development in FinTech can enhance the implementation of monetary policies designed to foster financial stability, inclusive finance, and a robust macroeconomic environment.

Table 4.3: Independent and Interaction effects of monetary policy and FinTech on financial stability (without crisis)

	Independent Effect (Model 1)	Interaction Effect (Model 2)
Variables	Financial stability	Financial stability

Bank Z-score (lagged)	0.634** (0.238)	0.590* (0.291)
Monetary Policy	0.216*** (0.0690)	0.337*** (0.0920)
FinTech	2.374*** (0.707)	0.359** (0.177)
Monetary Policy*FinTech		0.0935** (0.0454)
Bank Concentration	-0.0895*** (0.0245)	-0.0560*** (0.0203)
Non-performing Loans	-0.306* (0.152)	-0.563*** (0.0673)
Inflation	-0.0862** (0.0319)	-0.0323*** (0.0115)
Exchange Rate	0.0205 (0.0191)	0.0103 (0.0107)
GDPPCI	4.610*** (0.394)	2.593*** (0.839)
Constant	-4.435 (3.582)	4.109 (5.904)
Observations	322	322
Number of country code	30	30
No. of Instruments	13	14
Arellano-Bond test for AR (1)	-1.854	0.444
P-value	0.0637	0.00190
Arellano-Bond test for AR (2)	0.440	-1.049
P-value	0.660	0.378
Sargan test (overidentification test of all instruments)	1.072	26.20
P-value	0.300	0.294
Hansen's Test	8.994	9.665
P-value	0.438	1.14e-09
F-test	164	6.722
P-value	0.00	0.000589
R-squared	0.840	

Notes: “The dependent variable is financial stability, measured by the bank z-score. Monetary policy is measured by policy rate by the central bank. FinTech is measured by FinTech index, computed using the principal component analysis (PCA) of proxy

variables of FinTech. Bank concentration is proxied by number of bank branches; non-performing loans measured by loan recovery rate. Inflation is measured by the rate of the consumer price index. The exchange rate is represented by the real effective exchange rate, while GDPPCI refers to the GDP per capita of a country. Robust standard errors, indicated by t-statistics, are presented in parentheses. Statistical significance levels are denoted as *** for 1%, ** for 5%, and * for 10%. The AR (1) and AR (2) tests provide the p-values for the first-order and second-order autocorrelation tests, respectively. Hansen test reports the p-values associated with the overidentification of instrumental variables”.

4.4.3 Effects of Monetary Policy and FinTech on Financial Stability during Crisis

This study seeks to further explore how financial stability is influenced by both monetary policy and FinTech, as well as their combined impact during banking crises. The findings presented in Table 4.4 indicate that monetary policy significantly affects financial stability, with statistical significance at the 1% level. This suggests that financial stability is improved during banking crises when central banks implement tight or contractionary monetary policies. These policies, which are marked by less money supply expansion and higher interest rates, are designed to curb inflation and prevent excessive credit expansion.

Maintaining price stability during a banking crisis is crucial, as high inflation can reduce the actual value of assets and deposits, thereby worsening the crisis. By using tight monetary policy to control inflation and credit growth through interest rate hikes, central banks help protect the purchasing power of individuals and businesses, stabilizing the financial system. Tight monetary policy is often complemented by a focus on fiscal discipline, which is essential during a banking crisis when government support for troubled banks can strain public finances. Responsible fiscal policies encouraged by tight monetary policy can contribute to long-term financial stability.

The empirical results align with those of Ma and Lin (2016) and are corroborated by Oanh et al. (2023). Furthermore, tight monetary conditions typically lead to more cautious lending and investment practices by financial institutions. Managing liquidity becomes critical during a banking crisis, and tight monetary policy helps control liquidity by making borrowing more costly and less attractive. This discourages excessive lending and speculative behavior, which can trigger

further financial instability. By curbing liquidity, tight monetary policy promotes prudent lending practices, reduces risky assets on banks' balance sheets, and improves the rate of non-performing loans and investment returns. This reduction in systemic risk is supported by findings from Ahmed et al. (2023), Ma and Lin (2016), and Valencia (2014).

A crucial element of maintaining financial stability during a banking crisis is restoring confidence in the banking system. Tight monetary policy is so pivotal in this by demonstrating the central bank's commitment to addressing underlying issues such as inflation, speculative behavior, and excessive risk-taking. When combined with other measures, such as regulatory interventions and recapitalization efforts, tight monetary policy can help rebuild trust in the financial system. This increased confidence bolsters market sentiment, prevents the formation of speculative bubbles, and reduces panic and uncertainty. These observations are supported by Ahmed et al. (2023), Gyeke-Dako et al. (2022), and Ma and Lin (2016). Notably, these findings affirm the positive association between monetary policy and financial stability discussed in Table 4.3.

Similarly, the impact of FinTech on financial stability remains beneficial during crises, as shown in Table 4.4. FinTech continues to play a significant role in promoting financial stability in emerging economies facing financial distress. This suggests that FinTech can be a valuable tool for restoring stability during banking crises. FinTech influences financial stability in several ways: it diversifies financing sources for businesses and individuals, promotes financial inclusion, and provides alternative financing options when traditional lending is constrained. Furthermore, FinTech services often use cloud-based infrastructure, which can offer greater resilience during crises that disrupt traditional financial systems, ensuring continuity of financial services. Digital payments and transfers reduce reliance on physical bank branches and cash transactions, mitigating

the impact of cash shortages often seen during financial crises, as observed during the COVID-19 restrictions. This aligns with findings from Oanh et al. (2023).

However, when a significant portion of the populace does not have access to financial services, they might be less prepared to handle financial risks and more susceptible to financial shocks, which could result in increased rates of default, bankruptcy, and delinquency. This susceptibility raises the possibility of financial instability and can have repercussions across the economy.

This perspective is supported by Chui (2017) and Bromberg et al. (2018), who argue that FinTech can heighten susceptibility to credit and systemic risks.

However, the relationship between monetary policy and and FinTech negatively impacts financial stability during banking crises, with the relationship being statistically significant at the 5% level. This finding suggests that employing FinTech alongside expansionary monetary policy measures to enhance financial stability is counterproductive in times of crisis. The simultaneous use of FinTech and monetary policy tools to increase the money supply can lead to financial friction and instability. During banking crises, traditional banks may experience liquidity and solvency issues, resulting in diminished trust in the banking system. FinTech platforms, especially those involved in digital asset trading or peer-to-peer lending, may not respond to central bank interest rate adjustments as traditional institutions do, making them alternative options for borrowers and investors seeking safer or more profitable opportunities. The accessibility and potentially higher returns offered by FinTech platforms can draw investors away from traditional banks. Conversely, if FinTech platforms offer low interest rates despite central bank tightening, it could lead to excessive borrowing and risk-taking, potentially resulting in financial instability if borrowers struggle with repayment. These disconnects can undermine the efficiency and efficacy of monetary policy in achieving stability and distort the broader lending environment. As funds shift from

traditional banks to FinTech platforms, it can further weaken banks already in distress, potentially leading to bank runs or insolvencies and exacerbating the crisis. This aligns with the conclusions of Ahmed et al. (2023), Gyeke-Dako et al. (2022), Makina (2019), Temelkov (2018), Ding et al. (2018), Maier (2016), Evans (2016), Ma and Lin (2016), and Lapukeni (2015).

Related to this is the issue of market volatility introduced by FinTech innovations in the financial landscape. Technologies such as digital currencies and online trading platforms can bring new sources of market volatility. These markets often operate independently of central bank policies and may not follow traditional prudential standards, making them susceptible to speculative trading and sentiment-driven price swings. During a banking crisis, volatility in FinTech-related assets can result in sudden and unpredictable changes in investor wealth. This can intensify panic and uncertainty, prompting individuals and institutions to rapidly liquidate their FinTech holdings, which can destabilize the broader financial system. Additionally, FinTech innovations can complicate the effectiveness of monetary policy during a banking crisis. Central banks may struggle to assess the impact of their policy measures on the rapidly evolving FinTech sector. This uncertainty can create confusion among investors and consumers about the capacity of the central bank to handle the crisis effectively, further contributing to financial instability. These findings are supported by the work of Bolton et al. (2016), Buchak et al. (2018), Anarfo et al. (2019), Yan et al. (2021), Gyeke-Dako et al. (2022), and Ahmed et al. (2023).

Countries with advanced financial technology and greater financial inclusion often experience more interconnected financial systems, which can heighten their susceptibility to risks and shocks. This increased interconnectedness may exacerbate crises and undermine efforts to stabilize the financial system. FinTech adoption can introduce market imperfections and systemic risks, complicating the effectiveness of monetary policy transmission and hindering the achievement of

monetary policy goals, particularly those related to financial stability. Additionally, the growth of FinTech alongside shifts in monetary policy may create liquidity risks for traditional financial institutions, potentially leading to financial instability. These findings align with the perspectives of Hesse and Cihak (2007), Chui (2017), Bromberg et al. (2018), Xu et al. (2019), and Oanh et al. (2023). In light of these challenges, employing tight monetary policy alongside FinTech innovations might be a more effective strategy for achieving financial resilience and stability during banking crises.

To sum up the discussion on both time dimensions of crisis and non-crisis periods, the empirical findings show that monetary policy maintains a stabilizing influence on the financial system under both normal and crisis conditions, though the magnitude of the effect weakens during crises. Conversely, FinTech exhibits a dual impact - while it enhances stability through improved efficiency in normal periods, its effect turns negative during crises due to increased systemic risks, digital credit defaults, and liquidity mismatches. The positive coefficient of the $MP \times FINTECH$ interaction term during crises suggests that effective monetary policy can partially offset FinTech-induced instability.

These findings validate H3 and H4, confirming that FinTech's role in financial stability is context-dependent and moderated by macroeconomic shocks and institutional readiness.

These results align with the stability–fragility hypothesis (Allen & Gale, 2000), which posits that innovation can enhance efficiency but also increase systemic risk under stress. They also corroborate findings by Sahay et al. (2020) and Frost (2023) that the relationship between FinTech and stability is nonlinear and sensitive to regulatory quality. The crisis-period destabilization observed here supports the notion that without strong prudential oversight, rapid FinTech adoption can amplify credit risks and market volatility.

Table 4.4: Independent and Interaction effects of Monetary policy and FinTech on financial stability during banking crisis

VARIABLES	Independent Effect (Model 3)	Interactive Effect (Model 4)
	Financial stability	Financial stability
Bank z-score (lagged)	0.634** (0.238)	0.590* (0.291)
Monetary policy	0.216*** (0.0690)	0.283*** (0.0947)
FinTech	2.374*** (0.707)	0.655*** (0.163)
Monetary policy *FinTech		-0.0547** (0.0587)
Bank concentration	-0.0895*** (0.0245)	-0.0476* (0.0243)
Non-performing Loans	-0.306* (0.152)	-0.506*** (0.0733)
Inflation	-0.0862** (0.0319)	-0.0252* (0.0139)
Exchange rate	0.0205 (0.0191)	0.0221* (0.0113)
GDPPCI	4.610*** (0.394)	1.414* (0.765)
Banking crisis dummy*Fintech	-0.0105** (0.00427)	2.587*** (0.890)
Constant	-4.435 (3.582)	10.25* (5.542)
Observations	322	322
Number of country code	30	30
No. of instruments.	13	14
AR1	-1.854	0.444
P-value	0.0637	0.00190
AR2	0.440	-1.049
P-value	0.660	0.378
Sargan's Test	1.072	26.20
P-value	0.300	0.294
Hansen's Test	8.994	9.665

P-value	0.438	1.14e-09
F-test	164	6.722
P-value	0	0.000589
R-squared	0.840	



4.5 Conclusion and Policy Implications

This study investigates the relationship between monetary policy, FinTech, and financial stability across 82 emerging and developing economies, utilizing Dynamic System GMM and annual data spanning from 2000 to 2021. A FinTech index is created through principal component analysis to evaluate the impact of monetary policy and FinTech on financial stability, particularly during banking crises. The results indicate that monetary policy positively influences financial stability. FinTech also contributes to enhanced financial stability (both in normal conditions and during crises). Moreover, the interaction between monetary policy and FinTech improves the efficiency and resilience of the financial system, thereby supporting financial stability. However, the study finds that while tight monetary policy can bolster financial stability during periods of financial distress and banking crises, the combination of monetary policy and FinTech can create friction and exacerbate stress factors in the financial system. This interaction may further strain liquidity and systemic stability within financial institutions, leading to increased instability in the financial environment.

The results of this study offer several key policy implications for monetary authorities, financial institutions, and governments aiming to achieve and maintain financial stability, especially in light of recent global financial upheavals and the rapid evolution of FinTech.

First, expanding FinTech adoption in emerging countries can enhance financial stability by increasing access to financial services for underserved populations, including low-income and rural communities. This broader access can mitigate the effects of financial distress and strengthen the overall resilience and recovery capacity of the financial system.

Second, policymakers should ensure that efforts to promote FinTech are supported by sound macroeconomic policies. Specifically, monetary policy should focus on tightening the money supply to improve market credit conditions. This approach helps stabilize the financial system, fosters financial inclusion through better intermediation, and ultimately supports financial stability.

Third, emerging and developing countries' governments ought to implement FinTech and tight monetary policy measures separately, even during banking crises, to maintain overall financial stability. These countries, often vulnerable to shocks, should identify and eliminate obstacles in order to minimize financial exclusion faced by underserved populations and small businesses. This can be achieved through targeted FinTech interventions, such as investing in underprivileged areas' cloud infrastructure, promoting financial literacy, and promoting financial inclusion for underserved populations, such as low-income people and women.

More so, policymakers must avoid using both FinTech and monetary policy tools simultaneously during financial crises, as this can undermine stability. Instead, policies should be designed to enhance either monetary policy transmission or FinTech effectiveness, but not both at the same time.

Future research should investigate the causal relationship between monetary policy and FinTech and their combined effects on financial stability (using a range of measures). This study primarily employs the Z-score measure of financial stability, which may not capture all aspects of the financial system, thus representing a limitation.

Appendix 2: Variable Description and Source of Data

Variable	Measurement	Data Source
Financial Stability	Bank Z-score	International Monetary Fund
Monetary Policy	A shift in the central bank's policy rate: Monetary policy can be either tight (contractionary) or loose (expansionary), with the monetary policy rate serving as a tool.	International Monetary Fund
FinTech	 Findex computed using PCA of proxied FinTech variables: percentage contribution to GDP by value of mobile money transactions, access to ATM platforms, number of people with access to internet per 1,000 adults, number of registered mobile money accounts per 1,000 adults, number of mobile money agent outlets per 1,000 adults, number of active mobile money accounts per 1,000 adults	Global Financial Indicators (World Bank) and Global Findex

Bank Concentration	Bank concentration is measured by the number of bank branches	World Development Indicators (World Bank)
Non-performing loans	Percent of loan recovery on gross loans	World Development Indicators (World Bank)
Inflation	The rate of change of the consumer price index is used to measure inflation	World Development Indicators (World Bank)
Gross Domestic Product Per Capita	GDP per capita income of the country	World Development Indicators (World Bank)
Exchange rate	Real effective exchange rate	World Development Indicators (World Bank)



CHAPTER FIVE

THE EFFECTS OF MONETARY POLICY AND FINANCIAL TECHNOLOGY ON INFLATION: EVIDENCE FROM EMERGING AND DEVELOPING COUNTRIES

5.1 Introduction

The confluence of monetary policy and financial technology (FinTech) has become increasingly prominent in the global economic landscape, offering both unprecedented opportunities and challenges. As economies embrace digitization and FinTech innovations, the traditional mechanisms through which monetary policy operates are undergoing significant transformations (Oanh et al., 2023). The dynamic interplay between monetary policy and FinTech and its potential implications on inflation in economies, especially emerging and developing ones, has gained attention from both researchers and policymakers.

Monetary policy, traditionally governed by central banks, is a crucial tool for influencing economic stability and growth (Trinh et al., 2022). Through mechanisms such as interest rate adjustments, open market operations, reserve requirements and quantitative easing in recent times, central banks control the money supply, stabilize prices, and foster employment (Anarfo et al., 2022). However, the rise of FinTech introduces a disruptive force that alters the transmission channels of monetary policy thereby making the achievement of price stability a complex one in recent times.

FinTech, encompassing a diverse range of technological innovations in financial services, has revolutionized how individuals and businesses access, manage, and transfer funds (Daud et al., 2022; Zhu et al., 2020). From mobile banking to blockchain-based cryptocurrencies, FinTech has created new avenues for financial transactions, challenging the traditional banking infrastructure. The seamless integration of technology into financial activities has the potential to reshape the velocity of money, alter the demand for traditional banking services (Xu et al, 2022), and influence

the ‘effectiveness of conventional monetary policy tools’. The adoption of FinTech instruments is mostly out of reach and control by central banks due to their nature of operations (Bolton et al., 2016). Financial intermediation that facilitates the direction of funds into real productive sectors of the economy becomes weakened and less controlled by the central bank. This diminishes the potency of monetary policy in its quest to achieve price stability and boost economic growth and development.

One potential consequence of the synergy between monetary policy and FinTech is the impact on inflation dynamics. Traditionally, central banks sought to control inflation by adjusting interest rates to influence spending and investment. However, the digitization of financial transactions through FinTech could alter the transmission mechanisms of monetary policy, leading to unintended consequences on inflation (Daud et al., 2022). For instance, the rapid adoption of digital payment systems and decentralized cryptocurrencies may alter the velocity of money, making it more difficult for central banks to accurately gauge and control the money supply. Additionally, the increased availability of alternative financing mechanisms through FinTech platforms may circumvent traditional banking channels, affecting the efficacy of traditional monetary policy tools in influencing credit creation and money supply.

In an era of economic and financial upheavals, characterized by rapid financial innovations and an increased demand for financial inclusion, price stability and inflationary control are proving to be extremely delicate and practically complex to deal with (Zhu et al., 2020). Economic theory and prior empirical research have highlighted the key causes of price instability and the primary determinants of inflationary pressures within an economy. Key among these causes include money supply and economic growth (Bruno & Easterly, 1998; Pollin & Zhu, 2005), increased wages (Eftekhari Mahabadi & Kiaee, 2015), exchange rate volatility (Kandil & Morsy, 2009), financial

instability and global economic uncertainties (Barro, 1997) among others. The study on the causes of inflation remains an important macroeconomic issue among policymakers and the academic community across the globe. To this end, understanding the factors that influence inflation in an era of financial innovations and digitalization would help policymakers map out strategies that help to achieve price stability.

While theoretical and empirical studies have identified various factors contributing to inflation, the findings remain inconclusive. Notably, none of these studies have explored the role of the financial revolution in the age of financial technology. Theoretically, two dominant schools of thought—Keynesian and Monetarist, offer differing explanations and policy prescriptions for inflation.

Monetarist theory asserts that inflation occurs when the growth of the money supply surpasses the increase in goods and services production leading to an imbalance where the money supply grows faster than economic output (Barro, 1997). In contrast, Keynesian theory highlights the short-run inflexibility of prices and wages, which may not adjust promptly to shifts in demand. Keynesians classify inflation into two types: ‘demand-pull and cost-push’.

Demand-pull inflation arises when aggregate demand for goods and services exceeds aggregate supply. This imbalance can result from factors such as increased government spending, heightened household consumption, or economic inflows like trade surpluses or capital investments. Conversely, cost-push inflation is driven by rising production costs, including higher wages or increased raw material prices, which force producers to raise prices to maintain profitability.

Additionally, some researchers argue that inflation can also be influenced by structural factors within the economy, such as market inefficiencies or the behavior of market participants, which can disrupt the balance between supply and demand.

In recent times, there has been a global trend of financial digitalization that has revolutionized the financial system and is being used as a tool to solving financial sector challenges such as financial exclusion and improving macroeconomic aggregates, especially in emerging and developing economies. Financial technology has ensured the competitiveness of financial service providers and increased financial inclusion in most countries. Several studies have explored the impact of the financial revolution on financial markets and the broader macroeconomic environment across different countries. For example, Abor et al. (2018) highlight that FinTech fosters financial inclusion by providing underserved populations with access to financial services through affordable transactions and simplified adoption processes.

The use and adoption of FinTech products can therefore promote healthy competition, encourage savings and propel economic growth and stabilize the economy (Tonuchi et al., 2021; Anarfo et al., 2019; Evans, 2016; Lapukeni, 2015), reduce reliance on informal and unregulated channels (Zhu et al., 2020), and expand financial reach to help maintain financial inclusiveness (Xu et al., 2022). Increased competition promotes efficiency and results in a range of financial services by reducing the market strength of incumbents and providing optional consumer choices (Daud et al., 2022). By changing the structure of the financial system, influencing consumption trends, and affecting inflation dynamics, increased financial inclusion through competition has an impact on monetary policy effectiveness (Xu et al., 2022).

This paper is inspired by the growing body of empirical research examining the connection between FinTech and macroeconomic indicators. Despite this progress, the effect of monetary

policy and FinTech on inflation remains underexplored. To the best of our knowledge, this study represents one of the first attempts in recent times to provide both theoretical and empirical insights into the relationship between these factors, using FinTech and monetary policy as exogenous variables to analyze their impact on inflation in emerging and developing countries. The study focuses on emerging and developing countries because FinTech has drastically reshaped their financial systems (Daud et al., 2022); and increased financial access exponentially (Tonuchi et al., 2021; Abor et al., 2018, Romdhane et al., 2021).

While monetary policy traditionally aims to control inflation through interest rate adjustments and money supply management, the rapid expansion of FinTech has introduced new channels that influence inflationary dynamics. Digital payment platforms, mobile lending, and online investment tools affect money velocity, credit creation, and price responsiveness. Consequently, the interaction between **FinTech adoption** and **monetary policy** becomes critical in understanding how technological innovation modifies inflation outcomes. The focus of this chapter, therefore, is not merely to reaffirm monetary policy's role but to examine how **FinTech moderates its effectiveness** in managing inflation across emerging and developing economies.

This paper makes a twofold contribution. First, it extends the existing literature by examining both demand- and supply-side factors of FinTech in relation to macroeconomic indicators, particularly inflation. While traditional determinants of inflation have been widely studied, recent research has begun to investigate the influence of FinTech on inflation dynamics. For instance, Kammoun et al. (2020) analyzed the impact of FinTech on economic performance in the politically unstable Middle East and North Africa (MENA) region during the years 2011, 2014, and 2017. Their empirical findings indicate that FinTech lending activities are associated with a rise in inflation,

indicating that the expansion of digital financial services may exacerbate inflationary pressures in volatile political environments.

Further, Xiang, Huang, and Cheng (2019) argue that FinTech significantly influences a country's inflation by directly shaping consumer behavior, particularly in countries like China and Malaysia. They attribute this effect to the enhanced convenience of financial transactions, such as online payments, account balance checks, and funds transfers, which facilitate greater consumption and, consequently, inflation. This perspective is echoed by Taherdoost (2018), who highlights the role of FinTech in streamlining financial interactions and increasing the velocity of money circulation.

Simpasa and Gurara (2012) provide an early examination of mobile money's potential impact on inflation, emphasizing that the increased speed of money circulation could amplify inflationary pressures. They contend that the rapid growth of mobile money systems may complicate the execution of effective monetary policy by increasing the velocity of money in the economy. Collectively, these studies underscore the complex relationship between FinTech innovations and inflation, suggesting that while digital financial services can foster economic inclusion and efficiency, they also pose new challenges for inflation control and monetary policy formulation.

The focus of this paper delves further to unravel which side of FinTech – usage (demand side) and access (supply-side), influences inflation in an economy. The second contribution of this paper lies in the findings of how the interaction of monetary policy and the various sides of FinTech jointly influence inflation in an economy. No studies have shown how the interaction of FinTech, both supply and demand side variables, with monetary policy affects inflationary pressures. This study provides an empirical explanation of the implications of the rapid provision and adoption of FinTech instruments combined with the implementation of monetary policy decisions by central banks.

The paper finds that demand-side variables of FinTech have a positive association with inflation while supply-side factors that are geared towards expanding access to financial services exhibit an inverse relationship with inflation. Monetary policy, on the other hand, has an inverse relationship with inflation as espoused in theory and in other empirical research. The interaction of demand-side FinTech variables with monetary policy, however, has a negative effect on price stability.

The remainder of the paper is structured as follows: Section 2 reviews the existing literature, while Section 3 outlines the data and methodology employed. Section 4 provides descriptive statistics and discusses the findings, and Section 5 concludes with a summary of the key recommendations.

5.2 Literature Review

A comprehensive review of the literature on inflation determinants highlights both demand-side and supply-side factors as primary influences. Demand-side factors, such as economic growth, are noted by Bruno and Easterly (1998), Pollin and Zhu (2005), Eftekhari Mahabadi and Kiaee (2015), and Nigussie et al. (2019), who argue that rapid economic expansion can lead to demand-pull inflation as aggregate demand outpaces supply capacity. Additionally, the role of money supply has been emphasized as a critical factor influencing inflation. Mohanty and Klau (2001) and Kandil and Morsy (2009) indicate that increases in money supply often lead to higher inflation, consistent with monetarist theories which posit a direct relationship between monetary expansion and price levels.

On the supply side, wage levels, import prices, and oil prices are considered significant contributors to cost-push inflation. Mohanty and Klau (2001) and Eftekhari Mahabadi and Kiaee (2015) argue that rising wages can increase production costs, ultimately driving up consumer

prices. Similarly, fluctuations in import and oil prices impact production and transportation costs, thereby influencing inflationary pressures within an economy.

Government expenditure and exchange rate dynamics also play a role in shaping inflation. Research by Mohanty and Klau (2001), Kandil and Morsy (2009), and Eftekhari Mahabadi and Kiaee (2015) suggests that higher government spending can boost aggregate demand, contributing to inflationary pressures, particularly if the spending is debt-financed. Furthermore, exchange rate movements can affect inflation by altering the cost of imports; depreciation, for instance, can increase the price of imported goods, feeding into domestic inflation.

Numerous empirical investigations have been conducted to assess the influence of monetary policy on the management of inflation. Buitert and Miller (1991) explored the dynamics between ‘real exchange rate overshooting and the costs associated with reducing inflation’. They found that while inflation may adjust gradually, shifts in the price level driven by exchange rate fluctuations can have a rapid effect in mitigating core inflation. This highlights the potential for exchange rate interventions to influence inflationary pressures even when direct inflation adjustments are sluggish.

Building on these themes, Chaudhary and Ahmad (1995) concluded that the long-term relationship between inflation and key macroeconomic indicators, including money supply and government budget overruns, in the context of Pakistan. Their analysis employed co-integration methods alongside the monetarist and quantity theory perspectives on inflation, as well as unit root tests to examine the stability of these relationships. Their findings indicated that domestic budget financing particularly through the banking system has inflationary effects over the long term. This result underscores the critical role of government financing mechanisms in shaping inflationary trends and supports a strong positive association between money supply and inflation. By

confirming that inflation and monetary growth are interlinked over time, their research contributes to the broader understanding of inflationary dynamics in economies where fiscal and monetary policies intersect significantly.

Akcay et al. (1996) analyzed the existence of a stable long-term relationship between budget deficits, money growth, and inflation using annual data from Turkey, and their findings were supportive of such a link. Employing co-integration vectors, they concluded that the budget deficit exerts a significant influence on inflation, which cannot be disregarded under the assumption of long-term monetary neutrality. Conversely, their application of an unrestricted VAR model to quarterly data from the post-bond financing period revealed a weaker correlation between inflation and the other variables, suggesting that this relationship may vary based on data frequency and financing methods. Kilindo (1997) examined how money supply, inflation, and fiscal activities relate to Tanzania's economy. The results demonstrate a robust correlation between Tanzania's money supply, fiscal operation, and inflation. Using an adaptive learning methodology, the study finds that robust anti-inflation measures can reduce inflation persistence under specific conditions. In their model of inflation dynamics in South Africa, Akinboade et al. (2004) connect domestic inflation to structural factors within the money market, labor market, and foreign exchange market. Their findings reveal a positive relationship between labor costs, the broad money supply, and domestic inflation, with escalating labor costs playing a significant role in fueling inflation over time. They suggest that while an expanding broad money supply ultimately contributes to higher domestic inflation, a rise in nominal interest rates can also influence this dynamic, though initially having minimal impact, will moderately reduce inflation over time. Their analysis also reveals a long-term correlation between inflation and money growth, highlighting the sustained influence of monetary expansion on inflationary trends.

Chinaemerem and Akujuobi (2012) explored the potential for a stable and predictable relationship between inflation and monetary policy instruments in Ghana and Nigeria. Their model's findings suggest that inflation in both countries exhibits significant inertia, with monetary innovations showing limited and statistically insignificant influence on price determination compared to price shocks. Through vector autoregressive (VAR) models incorporating various financial indicators such as money supply, price levels, nominal exchange rates, and interest rates, they demonstrate that monetary policy tools like interest rates and exchange rates exert minimal impact on prices in the medium term. Instead, price fluctuations are predominantly driven by their own inherent shocks. This suggests that there is a weak and unpredictable short-term policy relationship between monetary policy instruments and inflation.

McCallum and Nelson (2010) investigated if there was a strong argument to alter the methodology of policy research and the relationship between inflation and monetary aggregates. They contend that a model economy can only support the monetarist claim if it exhibits the long-run "neutrality of money" feature. This viewpoint is in opposition to Friedman's claim that, if the monetary authority were to execute an exogenous adjustment in the nominal money supply, the price level would eventually shift proportionately, with no long-term impact on real variables. As a result, they contradict the widely held belief in the literature that has been voiced by both opponents and supporters of using money in monetary policy analysis—that money dynamics play a central role in shaping inflationary pressures and ensuring price stability within an economy. Forecasting inflation has grown increasingly complex in emerging and developing markets, where financial activities and monetary policy decisions have been reshaped by the influence of FinTech. Researchers have explored the impact of FinTech on inflation alongside traditional drivers of inflation. Kammoun et al. (2020) investigated the influence of FinTech on economic performance

during periods of political instability in the Middle East and North Africa (MENA) region, focusing on the years 2011, 2014, and 2017. Their empirical analysis reveals that FinTech lending activities contribute to rising inflation. While greater access to credit can stimulate economic activity, it also poses risks of overborrowing and excessive credit expansion, potentially fueling inflationary pressures if not managed properly. Xiang et al. (2019) argue that FinTech has an impact on inflation since it directly affects consumer choice.

FinTech innovations play a key role in enhancing financial inclusion by granting previously underserved populations access to banking services. This expanded access often stimulates economic activity and may contribute to inflationary pressures as increased money circulation drives demand. Features like seamless fund transfers, real-time communication, account balance checks, and convenient transactions further facilitate this process (Taherdoost, 2018).

Similarly, Simpasa and Gurara (2012) were among the first to investigate the potential impact of mobile money on inflation. They argue that the rapid expansion of money supply facilitated by mobile money could amplify inflation and complicate the implementation of monetary policy. The widespread adoption of digital payment systems affects the velocity of money, which in turn influences inflation dynamics and challenges central banks in their efforts to maintain price stability.

Conversely, Agarwal (2014) found that innovations like Bitcoin might help reduce the cost at which governments generate revenue during inflationary periods. These digital currencies have the potential to create equilibrium where they exert a stabilizing effect on consumer prices. Supporting these insights, Mumtaz and Zachary (2020) confirm the broader implications of digital money on inflation and economic stability. In emerging countries, fluctuations in foreign exchange rates can significantly influence inflation. FinTech innovations, particularly those related to cross-

border payments and currency exchange, can affect foreign exchange dynamics. For instance, digital currencies and blockchain technology may offer alternatives to traditional fiat currencies, potentially impacting exchange rate stability and inflationary pressures. Narayan and Sahminan (2018) analyzed the impact of FinTech on inflation rates and the exchange rate of the Indonesian rupiah against the US dollar. Their findings suggest that FinTech contributes to reducing inflation and enhances the value of the rupiah relative to the US dollar.

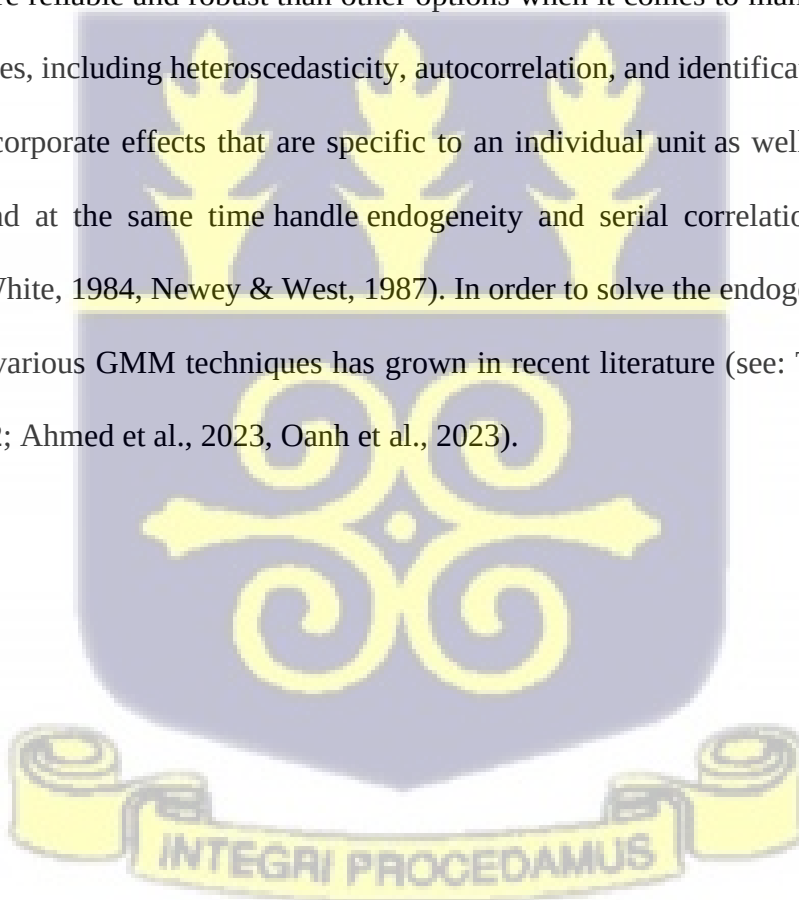
FinTech lending platforms, including peer-to-peer lending, have the potential to broaden access to credit for individuals and businesses that previously struggled to secure financing through traditional methods. Jagtiani (2018) examined the impact of FinTech lending on consumer credit accessibility using data from U.S. banks with assets exceeding \$50 billion as well as ‘account-level data from Lending Club’. The study found that ‘Lending Club’s consumer lending activities’ have significantly impacted areas that are typically underserved by traditional banks such as regions with high banking concentration and areas with fewer bank branches per capita. The research concluded that in economically weaker regions, the share of loans from ‘Lending Club’ is increasing which may contribute to rising inflationary pressures.

5.3 Methodology and Data Source

The study uses panel data from 82 countries, representing emerging and developing economies, covering the period from 2000 to 2021. The selection of these countries is driven by the limited empirical research on the moderating effects of FinTech and monetary policy on price stability in these economies, which is crucial for informing policy decisions (Anarfo et al., 2019; Anarfo et al., 2020; Tounchi et al., 2021). The study period is based on the availability of data. The dataset is sourced from the World Bank and IMF, including the World Development Indicators, the World Bank Financial Development and Structure Database, the World Bank Global Financial

Development Database, the Global Financial Index, and the International Financial Statistics (IFS).

The Dynamic Systemic GMM estimation method is employed to formulate two equations that explore the separate and combined impacts on inflation resulting from monetary policy and FinTech adoption. In dynamic panel regressions, the endogenous problem (endogeneity) of the lagged term of the dependent variable is solved by the system-GMM estimator of Arellano and Bond (1991) and Blundell and Bond (1998). This aids in addressing the issue of measurement errors and bias from missing variables that could occur in the model. Once more, the GMM is proven to be more reliable and robust than other options when it comes to managing a variety of econometric issues, including heteroscedasticity, autocorrelation, and identification. It also makes it possible to incorporate effects that are specific to an individual unit as well as those that are time-specific, and at the same time handle endogeneity and serial correlation problems (see: Hansen, 1982; White, 1984, Newey & West, 1987). In order to solve the endogeneity problem(s), the adoption of various GMM techniques has grown in recent literature (see: Trinh et al., 2022; Daud et al., 2022; Ahmed et al., 2023, Oanh et al., 2023).



The empirical models are summarized as follows:

Independent Effect of Monetary Policy and FinTech on Inflation

$$Inf_{jt} = \beta_1 Inf_{jt-1} + \beta_2 MP_{jt} + \sum_{p=2}^s \beta_p FinTech_{jt} + \sum_{k=1}^N \alpha_k C_{jt} + \theta_t + \phi_j + \varepsilon_{jt}$$

The specific model on the independent effect of monetary policy and FinTech adoption on inflation is as follows:

$$\begin{aligned} Inf_{jt} = & \beta_1 Inf_{jt-1} + \beta_2 MP_{jt} + \beta_3 VMOBT_{jt} + \beta_4 RMOB_{jt} + \beta_5 MOBB_{jt} + \beta_6 MOBA_{jt} \\ & + \beta_7 NMOBT_{jt} + \beta_8 ATM_{jt} + \beta_9 ATMKM_{jt} + \beta_{10} BAC_{jt} + \beta_{11} BMO_{jt} \\ & + \beta_{12} TOP_{jt} + \beta_{13} BZSCORE_{jt} + \beta_{14} POP_{jt} + \beta_{15} GDP_{jt} + \beta_{16} NPL_{jt} + \beta_{17} ER_{jt} \\ & + \beta_{18} FDI_{jt} + \theta_t + \phi_j + \varepsilon_{jt} \end{aligned}$$

Interaction Effect of Monetary Policy and FinTech on Inflation

The general equation is as follows:

$$\begin{aligned} Inf_{jt} = & \beta_1 Inf_{jt-1} + \beta_2 MP_{jt} + \sum_{p=2}^s \beta_p FinTech_{jt} + \sum_{j=1}^p \alpha_{2j} (MP_{jt} * FinTech_{it}) \\ & + \sum_{j=1}^p \alpha_{3j} Controls_{it} + \theta_t + \phi_j + \varepsilon_{jt} \end{aligned}$$

The specific model is as specified below:

$$\begin{aligned}
 Inf_{jt} = & \beta_1 Inf_{jt-1} + \beta_2 MP_{jt} + \beta_3 VMOBT_{jt} + \beta_4 RMOB_{jt} + \beta_5 MOBB_{jt} + \beta_6 MOBA_{jt} \\
 & + \beta_7 NMOBT_{jt} + \beta_8 ATM_{jt} + \beta_9 ATMKM_{jt} + \beta_{10}(MP_{jt} * VMOBT_{jt}) \\
 & + \beta_{11}(MP_{jt} * RMOB_{jt}) + \beta_{12}(MP_{jt} * MOBB_{jt}) + \beta_{13}(MP_{jt} * MOBA_{jt}) \\
 & + \beta_{14}(MP_{jt} * NMOBT_{jt}) + \beta_{15}(MP_{jt} * ATM_{jt}) + \beta_{16}(MP_{jt} * ATMKM_{jt}) \\
 & + \beta_{17}BAC_{jt} + \beta_{18}BMO_{jt} + \beta_{19}TOP_{jt} + \beta_{20}BZSCORE_{jt} + \beta_{21}POP_{jt} \\
 & + \beta_{22}GDP_{jt} + \beta_{23}NPL_{jt} + \beta_{24}ER_{jt} + \beta_{25}FDI_{jt} + \theta_t + \phi_j + \varepsilon_{jt}
 \end{aligned}$$

5.3.1 Variables, Measurement and a priori Expectations

Based on the theories discussed and following the work of Anarfo et al. (2020, 2019) and Tounchi et al. (2021), the consumer price index is used to represent inflation as the dependent variable.

Monetary policy is measured by the policy rate set by the central bank (Abor et al., 2022; Anarfo et al., 2022). FinTech variables used in this study cover both supply (access) and demand (usage) in line with the IMF 2004 classification of FinTech services of financial utilization. These include access to ATM platforms per 100,000 adults (Oanh et al., 2023), number of ATMs over 1000km² (Oanh et al., 2023), ‘number of registered mobile money accounts per 1,000 adults, and number of mobile money agent outlets per 1,000 adults’ (Tonuchi et al., 2021) on the supply side; and ‘number of mobile banking transactions per 1,000 adults, percent contribution to GDP by value of mobile money transactions, and number of mobile money transactions per 1,000 adults’, on the demand side (Abor et al., 2018; Anarfo et al., 2022). Monetary policy and FinTech are expected to have inverse and positive significant relationships respectively with inflation independently and interactively. Control variables are included to further enhance the explanatory and fitness level of the model. The control variables are mainly economic indicators and traditional determinants of

macroeconomic stability, especially inflation. These include bank concentration proxied by a number of bank branches; non-performing loans measured by loan recovery rate. The study uses the bank Z-score to assess the stability of financial institutions. The exchange rate is represented by the ‘nominal effective exchange rate’ which reflects the ‘value of a currency relative to a weighted average of multiple foreign currencies’. This rate is adjusted by dividing it by a price deflator or cost index to provide a more accurate measure of the currency’s real value. Broad money is measured by the sum of currency outside of banks, demand deposits excluding those of the central government, time, savings, and foreign currency deposits from resident sectors (excluding the central government), as well as bank and traveler’s checks, and other securities like certificates of deposit and commercial paper. Foreign direct investment is measured by net inflows into the reporting economy. Other variables include GDP, measured by the percentage growth rate of GDP at market prices based on constant local currency; trade openness, calculated as the sum of exports and imports as a percentage of GDP; and population, which is represented by the annual population growth rate. It is expected that all the control variables will have an inverse relationship with inflation.

Table 5.1: Variable Description and Measurement

Variable Description	Measurement	Data Source
Inflation	Annual consumer price index	World Bank
Monetary Policy	Policy Rate by central banks	World Bank
Access to ATM platforms	Access to ATM platforms per 100,000 adults	World Bank
Number of ATM centres	Number of ATMs over 1000km ²	World Bank
Number of Mobile Money accounts	Number of registered mobile money accounts per 1,000 adults	World Bank

Number of Mobile Money agents	Number of mobile money agent outlets per 1,000 adults	World Bank
Number of mobile money transactions	number of mobile money transactions per 1,000 adults	World Bank
Number of Mobile Banking transactions	Number of mobile banking transactions per 1,000 adults	World Bank
Value of mobile money transactions	Percent contribution to GDP by volume of mobile money transactions	World Bank
Bank Concentration	Number of commercial Bank branches	World Bank
Non-performing Loans	Loan recovery rate	World Bank
Bank Z-Score	Stability of Financial Institutions	World Bank
Exchange rate	Nominal effective exchange rate	IMF
Broad Money	Sum of currency outside banks	IMF and World bank
FDI	Net inflows in reporting economy.	IMF
GDP	Gross domestic product measured in real terms	IMF
Trade Openness	Sum of exports and imports as a percentage of GDP	World Bank
Population	Annual population growth rate	World Bank

5.4 Discussion of Empirical Results

5.4.1 Descriptive Statistics

Table 5.2 presents the descriptive statistics of the variables. Generally, all the variables deviated from the mean. Inflation recorded an average of 0.079 above the mean, with a standard deviation

of 0.404 ranging between -0.239 and 9.21, implying a low level of consumer price hikes of goods and services in the study countries. Monetary policy recorded a mean (standard deviation) of 0.039 (0.061), ranging between -0.005 and 1.286. This means that central banks of the study countries generally adopted both contractionary and expansionary approaches of monetary policy to control money supply over the study period. FinTech adoption was averagely moderate indicating a fairly financial inclusiveness in the countries over the study period. The financial system was fairly sound and stable in the countries of study during the period under review whereas the circulation of money was relatively high. Macro-economic variables such as GDP and exchange rate averaged 3.2 and 0.13 per cent, respectively. Table 5.3 reports on the correlation between explanatory variables. The explanatory variables do not contain the problem of multicollinearity as confirmed by the mean VIF of 3.371.

Table 5.2: Summary of Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Inflation (lagged)	1782	0.079	0.404	-0.239	9.21	-0.024	0.657	16.199	300.724
Value of mobile money transactions/GDP	1782	0.026	1.182	-4.094	1.987	-4.094	1.987	-1.776	8.686
Number of ATMs over 1000km2	1782	1.31	3.004	-1.93	12.101	0.000	11.175	2.123	6.021
Number of registered mobile money A/Cs	346	0.238	0.257	-0.047	1.169	-0.009	0.744	0.614	2.092
Number of mobile banking transactions	934	2.279	19.832	-101.218	70.643	-64.069	47.159	-1.01	6.825
Number of ATM Platforms per 100,000 adults	1782	-0.048	1.708	-26.603	2.121	-7.077	1.469	-10.791	133.64
Number of mobile money agent outlets	1782	246.752	1956.159	-890.582	30519.547	-272.422	7992.094	10.784	133.761
Number of mobile money transactions	1782	-13800	130000	-2130000	180000	-378000	71327.219	-11.573	153.951
Monetary policy	1782	0.039	0.061	-0.005	1.286	0.000	0.188	8.585	140.537
GDP	1782	3.205	4.525	-40.563	31.087	-9.773	13.722	-1.507	16.293
FDI	1782	0.056	0.204	-0.575	4.499	-0.056	0.579	13.194	226.767
Exchange rate	1782	0.131	0.152	-0.22	0.369	0.001	0.369	0.771	1.826
NPL	1694	0.054	0.099	-1.022	0.93	-0.092	0.363	-1.656	37.391
Bank concentration	1761	58.18	27.238	1.00	166.472	1.000	99.973	-0.344	3.011
Broad money	1782	0.139	0.386	-1.47	7.213	-0.059	1.212	10.189	138.95
Trade openness	1760	0.749	0.625	0.011	4.373	0.032	3.493	2.091	9.363
Z- score	1760	0.139	0.114	-0.107	1.512	0.012	0.552	3.42	29.15

Table 5.3: Pairwise Correlations and Variance Inflation Factor

Variables	VIF (3.371)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Value of mobile money transactions/GDP	1.599	1.000														
Number of ATMs over 1000km ²	4.265	0.324	1.000													
Number of registered mobile money accounts	14.452	-0.048	0.464	1.000												
Number of mobile banking transactions	2.136	0.151	0.178	0.264	1.000											
Number of ATM Platforms per 100,000 adults	1.208	0.005	0.037	0.229	0.013	1.000										
Number of mobile money agent outlets	1.431	0.057	-0.010	0.035	0.047	0.004	1.000									
Number of mobile money agent outlets	1.662	0.001	0.112	0.230	0.010	-0.002	-0.959	1.000								
Monetary policy	12.779	0.028	-0.023	0.901	0.094	-0.029	-0.076	0.075	1.000							
GDP	1.692	-0.039	0.015	0.078	-0.019	-0.002	-0.052	0.048	0.011	1.000						
FDI	1.607	-0.139	-0.052	-0.053	-0.046	0.000	-0.017	-0.033	0.050	0.014	1.000					
Exchange rate	2.465	0.102	0.287	0.227	0.037	0.064	0.012	-0.013	-0.060	0.134	-0.100	1.000				
NPL	2.063	-0.156	0.095	0.167	0.141	0.000	0.240	-0.232	-0.002	-0.049	0.046	-0.003	1.000			
Bank concentration	1.428	-0.054	-0.131	-0.200	-0.054	-0.015	-0.071	-0.040	-0.024	0.000	0.083	-0.188	-0.038	1.000		

Broad money	1.918	0.035	0.038	-0.110	0.002	-0.019	0.003	0.005	0.014	0.014	-0.045	0.058	-0.034	-0.045	1.000
Trade openness	1.593	-0.148	-0.102	-0.082	-0.058	0.010	-0.043	0.000	-0.087	0.060	0.231	-0.188	-0.036	0.093	-0.069
Z-score	1.637	-0.007	-0.023	-0.095	0.096	0.058	-0.012	0.032	-0.018	0.122	0.028	-0.133	-0.025	0.088	0.036



5.4.2 Independent Effects of Monetary Policy and FinTech on Inflation

The empirical results presented in Table 5.4 show that monetary policy has a significant impact on reducing inflation levels in emerging and developing countries at the 1 percent level. This finding suggests that expansionary monetary policy contributes to higher inflationary pressures, indicating an inverse relationship between monetary policy and inflation dynamics. In other words, changes in monetary policy directly affect inflation levels within the economy. Central banks use interest rate adjustments to influence aggregate demand. When interest rates are lowered, borrowing becomes more affordable, leading to increased demand, investment and consumption. An increase in aggregate demand can stimulate higher levels of economic activity and, in turn, upward pressure on prices. On the other hand, when there are interest rate hikes through policy tightening, borrowing becomes more expensive, which tends to dampen investment and consumption, thereby reducing aggregate demand and potentially slowing down inflationary pressures. Evidence provided by Tonuchi et al. (2021) and Abor et al. (2018) affirms the findings of this study.

Another channel through which monetary policy impacts inflation is by influencing the money supply in the economy. This is achieved through the central bank's open market operations, which adjust the amount of money circulating in the economy. When the money supply increases, it boosts spending and investment, leading to higher aggregate demand and potentially driving inflationary pressures. Conversely, a decrease in the money supply dampens spending and investment, thereby curbing inflationary pressures. Furthermore, changes in monetary policy can also impact exchange rates particularly in economies with flexible exchange rate regimes. A decline in the value of the home currency brought on by expansionary monetary policy or lower interest rates, can result in higher import prices. The rising price of imported products and services

contributes to inflationary pressures. On the other hand, a stronger domestic currency can reduce import prices, helping to alleviate inflationary pressures.

Finally, central banks frequently take into account the output gap—the differential between actual and potential output, into consideration when determining monetary policy in an economy. When the economy operates above its potential (a positive output gap), demand outpaces supply, putting upward pressure on prices. In such cases, central banks may adopt contractionary monetary policies to slow down the economy and curb inflation. Conversely, when there is a negative output gap, expansionary policies may be used to stimulate economic activity.

FinTech is proxied by access and utilization variables, which have varied outcomes with inflation as shown in Table 5.4. First, access to financial services through the provision and creation of FinTech innovations and platforms such as ATM centres, mobile banking outlets among others have an inverse significant relationship with inflation at 10 per cent level. Thus, the creation and setting up of FinTech platforms lead to an improved access to financial services and have a reducing effect on inflation. FinTech plays a pivotal role in promoting financial inclusion by extending access to underserved populations with reduced costs, including those in rural areas or with limited access to traditional banking services. Through its role in facilitating access and acting as a gateway to the formal financial system, FinTech creates equitable opportunities for individuals and small businesses to participate fully in economic activities. This involvement not only supports the accumulation of savings but also enhances self-insurance capacities, enabling resilience against adverse economic shocks and promoting investment in productive assets. This is mainly due to the fact that financial innovations provide a wide range of portfolio choices of monetary and nonmonetary assets and liabilities to all manner of market participants. As such, economic activity becomes more inclusive and diversified, supports asset building (savings); reducing income

inequality and enhancing overall economic stability. Moreover, greater financial inclusion helps to reduce reliance on informal and often more costly financial services, which can contribute to inflationary pressures in the economy. Empirical evidence provided by Abor et al. (2018), Evans (2016), Anarfo et al. (2022) is consistent with this finding.

Again, the operational nature of FinTech promotes competition in financial markets by eliminating barriers to entry and expanding the range of financial service providers. Increased competition fosters innovation, drives down costs, and enhances price transparency, leading to more competitive interest rates, rigid requirements, and loan terms. As market participants benefit from a wider array of choices and better pricing information, financial intermediaries are incentivized to operate more efficiently and offer competitive rates, reducing the cost of borrowing and spending. This competitive pressure can exert downward pressure on prices, contributing to a moderation in inflationary trends.

Similarly, FinTech innovations such as “mobile banking, digital payments, and online lending platforms” streamline financial transactions, reduce transaction costs and increase the efficiency of monetary exchanges. As individuals and businesses gain easier access to credit, savings, and investment opportunities, they are better informed to manage their finances and allocate resources more efficiently. This increased efficiency in financial transactions and market information, the absence of which, leads to speculative behaviours of financial consumers and, hence, trigger inflation, can contribute to overall economic productivity, potentially leading to lower production costs and mitigating inflationary pressures. The findings of this paper confirm the arguments made by Agarwal (2014), Narayan and Sahminan (2018) and Jagtiani (2018) and affirmed by Mumtaz and Zachary (2020).

Access to financial services through FinTech can also improve the effectiveness of monetary policy transmission mechanisms. By providing real-time data on financial transactions and consumer behavior, FinTech platforms offer central banks and policymakers valuable insights into economic trends and inflationary pressures. This enhanced visibility enables more precise monetary policy adjustments, such as interest rate changes or liquidity injections, to stabilize prices and manage inflation expectations effectively.

Further, utilization of FinTech innovations increases inflationary pressure. The empirical results show that the adoption and usage of FinTech innovations to access financial services have a positive association with inflation dynamics. This implies that demand for financial service using FinTech innovations is a catalyst to fueling inflationary pressures in the economy. This finding is dependent on a number of variables and can be explained by many intricate dynamics within the macroeconomic environment. FinTech expands access to credit, enabling deficit agents to borrow funds more easily through online lending platforms, peer-to-peer lending, mobile and digital banking services. As demand for credit increases, fueled by easy access to financing options, financial consumers may increase their spending on durable goods, investments, and consumption. This surge in demand can lead to higher levels of the economy's aggregate demand, potentially outpacing the ability of the economy to produce products and services.

This phenomenon exerts upward pressure on general prices of goods and services and contribute to demand-pull inflation. Furthermore, FinTech innovations promote inclusive finance and, therefore, facilitate greater participation in financial markets, including investment in stocks, bonds, cryptocurrencies, and other assets. As more individuals and institutional investors engage in asset trading and speculation, the demand for financial assets increases, leading to asset price inflation. Rising asset prices can spill over into the broader economy, as increased wealth

encourages higher levels of spending and investment, thereby driving up prices for goods and services. Consequently, speculative bubbles fueled by excessive demand for financial assets distorts asset prices and contribute to inflationary pressures in the economy. This finding agrees with the conclusions arrived at by Kammoun et al. (2020), Xiang et al. (2019), Taherdoost (2018) and Simpasa and Gurara (2012). However, the evidence provided by Mawejje and Lakuma (2017) contradicts this finding.

FinTech platforms leverage on behavioral economic principles to encourage spending, saving, and investment behaviors among consumers and other market players. Techniques such as gamification, behavioral nudges, and personalized recommendations influence consumer decision-making and consumption patterns which could potentially result in higher demand for goods and services. Moreover, the seamless integration of financial services into digital platforms and mobile applications creates a "cashless society" culture, where transactions are carried out electronically and come in handy, speed up money velocity, facilitate impulse purchases and increase overall consumption levels. In a similar vein, the surge in demand for financial services occasioned by FinTech has implications for monetary policy. Central banks may respond to increased inflationary pressures by tightening monetary policy, raising interest rates, or implementing liquidity-draining measures to curb excessive credit growth and contain inflation expectations. However, if FinTech-driven demand for financial services is fueled by factors such as technological innovation, financial inclusion and productivity gains as have been the goals in developing and emerging economies, policymakers may face challenges in accurately assessing the underlying inflationary pressures and calibrating appropriate policy responses. This lapse in policy response tends to cause credibility problems for the central bank and, hence, increase speculative behaviour among market players and reduce confidence in monetary authorities which can fuel inflation in an economy.

Findings by Anarfo et al. (2022, 2020) and Abor et al. (2022) are consistent with the results of this study.



Table 5.4: Independent effects of monetary policy and FinTech on Inflation

VARIABLES	Model (1) Inflation	Model (2) Inflation	Model (3) Inflation	Model (4) Inflation	Model (5) Inflation	Model (6) Inflation	Model (7) Inflation
Inflation _{t-1}	-0.0102** (0.00418)	-0.0103** (0.00420)	-0.0102** (0.00418)	-0.0103** (0.00420)	-0.0105** (0.00427)	-0.0102** (0.00415)	-0.0103** (0.00419)
Value of mobile money transactions per GDP	0.0200*** (0.00698)						
Number of mobile money transactions		0.0165*** (0.00284)					
Number of ATMs over 1000km ²			-0.163* (0.0961)				
Number of mobile banking transactions				0.000299* (0.000627)			
Number of ATM Platforms per 100,000 adults					-0.000550* (0.00470)		
Number of mobile money agent outlets						-5.48e-06* (4.23e-06)	
Number of Registered mobile money accounts							7.14e-08 (6.35e-08)
Monetary policy	-0.588*** (0.0770)	-0.609*** (0.0765)	-1.552*** (0.382)	-1.101*** (0.153)	-0.588*** (0.0772)	-0.593*** (0.0772)	-0.592*** (0.0772)
GDP	-0.0388*** (0.00196)	-0.0387*** (0.00194)	-0.0801*** (0.00475)	-0.0566*** (0.00267)	-0.0392*** (0.00196)	-0.0392*** (0.00196)	-0.0392*** (0.00196)
Population	-0.583	-1.048*	-5.918***	-2.881***	-0.624	-0.685	-0.679

	(0.600)	(0.600)	(1.890)	(0.998)	(0.602)	(0.603)	(0.603)
FDI	-0.00324	-0.0102	-0.441	0.0266	-0.0141	-0.0150	-0.0130
	(0.0404)	(0.0399)	(0.465)	(0.343)	(0.0403)	(0.0403)	(0.0403)
Exchange Rate	0.198***	0.115*	0.660***	0.236***	0.213***	0.215***	0.215***
	(0.0602)	(0.0619)	(0.180)	(0.0901)	(0.0603)	(0.0601)	(0.0601)
Non-performing Loans	0.0570	-0.0301	0.00251	-0.145	0.0183	0.0448	0.0403
	(0.0845)	(0.0832)	(0.181)	(0.101)	(0.0836)	(0.0860)	(0.0858)
Bank concentration	0.000216	0.000287	-0.000457	0.000514	0.000197	0.000172	0.000185
	(0.000314)	(0.000312)	(0.000974)	(0.000486)	(0.000315)	(0.000316)	(0.000315)
Broad money	0.186***	0.178***	1.859***	1.049***	0.188***	0.189***	0.188***
	(0.0256)	(0.0255)	(0.187)	(0.0735)	(0.0257)	(0.0256)	(0.0257)
Trade openness	-0.00961	-0.0110	-0.0799	-0.0339	-0.0141	-0.0146	-0.0140
	(0.0137)	(0.0135)	(0.0623)	(0.0245)	(0.0136)	(0.0136)	(0.0136)
Z-score	0.114	0.113	1.105***	0.463***	0.126	0.128	0.125
	(0.0897)	(0.0890)	(0.248)	(0.145)	(0.0900)	(0.0898)	(0.0898)
Constant	0.142***	0.138***	0.120	0.142***	0.148***	0.150***	0.149***
	(0.0292)	(0.0290)	(0.109)	(0.0456)	(0.0292)	(0.0292)	(0.0292)
Observations	1,316	1,392	1,316	1,392	1,358	1,397	1,312
Number of countries	45	46	46	47	46	45	46
No. of instruments.	9	8	10	10	13	9	8
AR (1)	-1.374	-1.765	-3.178	-3.148	-3.187	-1.374	-1.765
P-value	0	0	0.00149	0	0.953	0	0
AR (2)	1.038	0.511	1.263	1.258	1.264	1.038	0.511
P-value	0.299	0.609	0.206	0.951	0.879	0.299	0.609
Sargan's Test	0.0192	0.00118	0.303	0.347	0.335	0.0192	0.00118
P-value	0.990	0.444	0.960	0.208	0.00144	0.990	0.444
Hansen's Test	0.757	0.142	0.623	0.769	0.675	0.757	0.142
P-value	0.685	0.931	0.891	0.857	0.206	0.685	0.931
F-test	1415	2721	3555	3545	3574	1415	2721
P-value	0.000	0.000	0.000	0.00164	0.000	0.000	0.000
R-squared	0.253	0.264	0.751	0.510	0.249	0.250	0.249

Notes: “The consumer price index, which measures inflation, is the dependent variable. The policy rate measures monetary policy. The FinTech variables of use and access are used to measure FinTech. The number of bank branches serves as a proxy for bank concentration, whereas the loan recovery rate is used to measure non-performing loans. Z-score evaluates the stability of financial institutions, while exchange rate measures the actual effective exchange rate. Broad money measures the total amount of currency outside of banks, trade openness measures the total amount of imports and exports as a percentage of GDP, and population represents the annual population growth rate. GDP is measured as the percentage growth rate of GDP at market prices. Parentheses include robust standard errors from t-statistics. At 1%, 5%, and 10%, they are ***, **, and * significant, respectively. The Hansen test displays the p-values of the overidentification of instrumental variables, while the AR (1) and AR (2) tests display the p-values of the first- and second-order autocorrelation tests, respectively”.



5.4.3 Interactive Effects of Monetary Policy and FinTech on Inflation

Empirical results in Table 5.5 present the findings of the outcome of an interaction between monetary policy and the access and utilization sides of FinTech variables on inflation in the economy. The results, however, depart from that of the independent effects of each of the variables as discussed in section 5.4.2. First, the implementation of monetary policy tools aimed at inflationary control achieves better outcomes when the demand for FinTech innovations increases in the consumption of financial services and products by market participants. This finding implies that the combined use of tight monetary policy and high adoption of FinTech services to consume financial services is efficacious in inflationary control and targeting. FinTech innovations streamline financial transactions, making them faster, cheaper, and more accessible. This increased efficiency leads to productivity gains across the economy, allowing businesses to operate more efficiently and reduce costs. Tight monetary policy which contracts the money supply, can work in tandem with FinTech adoptions to further enhance efficiency. As businesses face higher borrowing costs and reduced access to credit due to tight monetary policy, they are incentivized to seek out cost-saving measures, which FinTech offers. The adoption and use of FinTech solutions for financial management and transaction processing leads to further reductions in production costs, lower prices for goods and services and contribute to overall price stability. Moreover, by facilitating faster and more efficient payment processing, FinTech innovations improve the velocity of money, which have deflationary effects by increasing the effectiveness of monetary policy in stimulating economic activity. This agrees with the conclusion by Bolton et al. (2016) and Chen et al. (2017).

Again, the use of FinTech innovations improves the transmission mechanisms of monetary policy. Central banks utilize monetary policy tools, such as adjusting interest rates and conducting open

market operations, to influence borrowing costs and economic activity. FinTech platforms can facilitate faster and more efficient transmission of monetary policy changes to financial markets and the broader economy. Real-time data analytics and digital communication channels enable central banks to monitor economic developments more closely and respond swiftly to changes in inflationary pressures. This enhanced transmission mechanism ensures that monetary policy measures have a more immediate and impactful effect on inflation, helping to achieve price stability. This finding aligns with the conclusion of Beck and Demirgüç-Kunt (2008) who found that countries with higher levels of financial inclusion typically have monetary policy frameworks that are more efficient at containing inflation.

Furthermore, FinTech innovations generate vast amounts of data on financial transactions, consumer behaviour, and economic activity. Central banks can leverage on this data to gauge and inform their decision-making process and implement more targeted and effective tight monetary policy measures. This is in line with the findings of Bolton et al. (2016). Sophisticated machine learning and data analytics methods enable central banks to develop more accurate inflation forecasts and identify areas of the economy where inflationary pressures are most acute. This data-driven approach to policy making ensures that tight monetary policy measures are implemented in a timely and precise manner, maximizing their effectiveness in reducing inflation. Additionally, by providing central banks with real-time data on economic activity and inflation trends, FinTech innovations help central banks manage inflation expectations more effectively. Clear and transparent communication about monetary policy objectives and inflation targets can anchor inflation expectations and prevent inflationary spirals driven by changes in expectations.

It is important to note that FinTech innovations can improve financial stability and financial institutions' as well as consumers risk management procedures. This reduces the likelihood of

inflationary pressures stemming from financial market disruptions. By providing more accurate and timely data on financial transactions and market conditions, FinTech platforms enable financial institutions and regulators to detect new hazards and take preventative action to lessen them. Improved risk management practices strengthen the resilience and robustness of the financial system, reducing the frequency and severity of financial crises that can lead to inflationary pressures. FinTech innovations promote price transparency by providing consumers with easy access to information about prices and product offerings. Greater price transparency leads to more informed consumer choices and more efficient allocation of resources to productive sectors to produce goods and services that match demands in the market. Moreover, access to FinTech platforms enables consumers to compare prices more easily, putting downward pressure on prices and contributing to inflation moderation.

The second strand of the interactive effects of monetary policy and FinTech on inflationary dynamics focuses on the access and or supply part of FinTech. Thus, how does an increased supply or creation of FinTech channels and its interactions with monetary policy changes affect inflation? What is the impact on inflation when access to FinTech is expanded and monetary policy is changed simultaneously? The results in Table 4 indicate that there is a positive relationship between increased FinTech services and increased monetary policy on inflation. In other words, inflation hikes when monetary authorities pursue tight monetary policies, on one hand, and attempt to implement measures that increase access to financial services through the use of FinTech. This finding is explained by several economic intuitions.

Aggregate demand for goods and services is stimulated through the inclusion of many underprivileged financial consumers in the formal financial system, providing them with access to credit, savings, and investment opportunities. Businesses and individuals' borrowing and spending

capacities rise in tandem with their access to financial services. This boosts the economy's overall demand. To mitigate inflationary pressures, a restrictive monetary policy is usually implemented, which is characterized by higher interest rates or a decreased money supply. However, increased financial inclusion can offset the restrictive effects of tight monetary policy by stimulating demand, potentially leading to inflationary pressures. Conventional monetary policy tools, such as changes in interest rates, would therefore, have limited effectiveness when financial intermediation increasingly occurs through FinTech channels and patronized by many financial consumers. As a result, even when central banks implement tight monetary policy measures, FinTech platforms offer alternative sources of financing that bypass the intended impact of monetary policy. This creates difficulties in controlling borrowing costs and aggregate demand, hence, exacerbating inflationary pressures in the short to medium term. This argument is demonstrated in Behn et al. (2016) and Chen et al. (2017) and supported by the findings of Boot et al. (2021), Bartlett et al. (2022) and Buchak et al. (2022) who suggest that the impact of FinTech is more significant when monetary policy is tightened than when it is loosened thereby causing slippages in inflationary control.

Tight monetary policy constrains access to credit by raising borrowing costs and tightening lending standards. However, increased financial inclusion efforts such as FinTech proliferation, lead to the expansion of credit availability through alternative channels, such as FinTech platforms which are seamless and usually out of the regulatory control of the central banks. This is supported by the findings of Hachem and Song (2021) and Allen et al. (2020). FinTech innovations, are therefore, less sensitive to changes in policy rates aimed at controlling inflation. Due to competition, FinTech services are cheaper, efficient, reliable and easily accessible. Credit is, therefore, expanded through less expensive transactions and flexible procedures thereby speeding the velocity of money in the

economy and rendering the effectiveness of policies geared towards constraining credit accessibility and availability which have been theoretically and empirically proven to stimulate demand and cause inflation in the economy.

Similarly, financial inclusion efforts, coupled with tight monetary policy, can also drive asset price inflation. As financial services become more accessible to consumers as well as businesses and their quest for higher returns on their investments, the demand for assets like stocks, bonds, and real estate increases. Tight monetary policy measures, which involve raising interest rates, can make traditional interest-bearing investment instruments less attractive, leading investors to allocate more capital to riskier assets. The price of assets rises as a result of this increasing demand leading to asset price inflation and potentially spurring inflationary pressures in the broader economy.

Lastly, the combination of increased financial inclusion through easy access to FinTech platforms and tight monetary policy can also influence inflation expectations and central bank credibility. When market players perceive that monetary policy is ineffective in controlling inflation or that central banks are unable to respond to inflationary pressures exacerbated by financial inclusion efforts, it can lead to upward revisions in inflation expectations. Higher inflation expectations can become self-fulfilling, as individuals and businesses adjust their behaviour in anticipation of future price hikes, leading to actual inflation. Additionally, if central banks are perceived as being unable or unwilling to respond to inflationary pressures due to counter-policy mixes such as implementing tight monetary policy and at the same time embarking on measures that increase access to financial services or weaken the effectiveness of the policy measures, it leads to credibility crisis, erodes confidence and thwarts their ability to maintain price stability, further fueling inflation.

Table 5.5: Interactive effects of monetary policy and FinTech on Inflation

VARIABLES	Model (1) Inflation	Model (2) Inflation	Model (3) Inflation	Model (4) Inflation	Model (5) Inflation	Model (6) Inflation	Model (7) Inflation
Inflation _{t-1}	-0.0102** (0.00419)	-0.0103** (0.00420)	-0.0102** (0.00419)	-0.0103** (0.00420)	-0.0105** (0.00426)	-0.0102** (0.00415)	-0.0105** (0.00426)
Value of mobile money transactions per GDP	0.0630*** (0.00719)						
Monetary policy	-0.492*** (0.0728)	-0.210*** (0.0727)	-1.866*** (0.414)	-1.183*** (0.152)	-0.588*** (0.0772)	-0.591*** (0.0774)	-0.592*** (0.0774)
Value of mobile money transactions per GDP * monetary policy	-1.305*** (0.0886)						
GDP	-0.0353*** (0.00186)	-0.0312*** (0.00181)	-0.0780*** (0.00485)	-0.0545*** (0.00269)	-0.0391*** (0.00196)	-0.0392*** (0.00196)	-0.0392*** (0.00196)
Population	-0.142 (0.566)	-0.417 (0.547)	-5.588*** (1.890)	-2.597*** (0.991)	-0.630 (0.602)	-0.684 (0.603)	-0.679 (0.603)
FDI	-0.00380 (0.0380)	-0.00528 (0.0363)	-0.380 (0.464)	-0.0367 (0.340)	-0.0141 (0.0403)	-0.0150 (0.0403)	-0.0130 (0.0403)
Exchange Rate	0.182*** (0.0567)	0.206*** (0.0565)	0.625*** (0.180)	0.264*** (0.0894)	0.214*** (0.0604)	0.214*** (0.0601)	0.215*** (0.0602)
Non-performing Loans	0.00782 (0.0796)	-0.0266 (0.0756)	0.0124 (0.181)	-0.171* (0.100)	0.0174 (0.0837)	0.0444 (0.0860)	0.0404 (0.0858)
Bank Concentration	0.000233 (0.000296)	0.000263 (0.000284)	-0.000373 (0.000971)	0.000552 (0.000481)	0.000203 (0.000316)	0.000171 (0.000316)	0.000185 (0.000315)
Broad money	0.164*** (0.0242)	0.141*** (0.0232)	1.867*** (0.186)	1.031*** (0.0729)	0.188*** (0.0257)	0.188*** (0.0257)	0.188*** (0.0257)
Trade openness	-0.00575 (0.0129)	-0.0118 (0.0123)	-0.0676 (0.0623)	-0.0340 (0.0243)	-0.0139 (0.0137)	-0.0146 (0.0136)	-0.0140 (0.0136)
Z-score	0.132 (0.0845)	0.135* (0.0809)	1.033*** (0.250)	0.482*** (0.143)	0.126 (0.0901)	0.128 (0.0899)	0.125 (0.0898)

Number of mobile money transactions	0.0325*** (0.00276)						
Number of mobile money transactions * Monetary Policy	-0.597*** (0.0317)						
Number of ATMs over 1000km2				-0.270** (0.111)			
Number of ATMs over 1000km2 # Monetary policy				3.154* (1.647)			
Number of mobile banking transactions				0.00127* (0.000659)			
Number of mobile banking transactions * Monetary policy				-0.0398*** (0.00913)			
Number of ATM platforms per 100,000 adults					-0.000957* (0.00503)		
Number of ATM platforms * Monetary policy					0.0136 (0.0606)		
Number of mobile money agent outlets						-5.56e-06* (4.23e-06)	
Number of mobile money agent outlets * Monetary policy						-2.21e-05* (6.60e-05)	
Number of Registered mobile money accounts							7.13e-08 (6.36e-08)
Number of Registered mobile money accounts*monetary policy							-4.03e-08 (9.72e-07)
Constant	0.124*** (0.0275)	0.0952*** (0.0264)	0.119 (0.109)	0.135*** (0.0451)	0.147*** (0.0294)	0.150*** (0.0292)	0.149*** (0.0292)
Observations	1,694	1,694	338	909	1,694	1,694	1,694
Number of countries	45	46	45	46	46	45	46
No. of instruments.	9	8	9	8	8	9	8
AB1	-1.690	-1.693	-1.690	-1.693	-1.693	-1.690	-1.693
P-value	0	0	0	0	0	0	0

AB2	0.601	0.563	0.601	0.563	0.601	0.563
P-value	0.548	0.807	0.548	0.807	0.548	0.807
Sargan's Test	0.000648	3.52e-06	0.000648	3.52e-06	0.000648	3.52e-06
P-value	0.980	0.999	0.980	0.999	0.980	0.999
Hansen's Test	0.0677	0.000653	0.0677	0.000653	0.0677	0.000653
P-value	0.795	0.980	0.795	0.980	0.795	0.980
F-test	2482	2498	2482	2498	2482	2498
P-value	0.000	0.000	0.000	0.000	0.000	0.000



5.5. Conclusion and Policy Recommendations

This paper provides an overview analysis of the effects of FinTech solutions and technologies and monetary policy changes on inflation. It has been have argued that monetary policy and FinTech innovations are intricate tools that affect inflation. The structure of financial intermediation is anchored on these two in recent times such that the effect of the former is incomplete without the interplay of the latter.

Therefore, the interaction between monetary policy and FinTech innovations presents a complex yet promising avenue for understanding inflation dynamics. While monetary policy traditionally plays a pivotal role in influencing inflation through interest rate adjustments and money supply management, the rise of FinTech introduces new dynamics. FinTech innovations, such as digital payments and online lending platforms, enhance financial inclusion, efficiency, and data analytics, potentially impacting inflation through channels such as credit expansion, asset price inflation, and monetary policy transmission challenges. However, FinTech also offers opportunities to improve price transparency, enhance monetary policy effectiveness, and manage inflation expectations. Understanding and navigating this intricate relationship is crucial for policymakers in ensuring price stability while fostering innovation and inclusive economic growth.

The relationship between the use of FinTech and inflation appears multifaceted, with potential positive and inverse associations. On one side, increased utilization of FinTech platforms stimulates inflationary pressures through avenues such as facilitated credit expansion, asset price inflation, and changes in monetary policy transmission. Conversely, enhanced access to FinTech platforms exerts downward pressure on inflation through improved efficiency in financial transactions, increased financial inclusion, and enhanced monetary policy effectiveness.

Understanding these dual dynamics is crucial for policymakers in navigating the evolving landscape of financial technology and its impact on inflation.

On the other hand, the examination of the interplay between monetary policy and FinTech reveals nuanced implications for inflation dynamics. The combination of monetary policy and FinTech utilization exerts a negative effect on inflation, as FinTech innovations may amplify the changes in monetary policy transmission and contribute to credit expansion and the risk of asset price inflation. Conversely, the interaction between access to FinTech and monetary policy suggests a positive impact on inflation, driven by enhanced financial inclusion, efficiency gains, and improved monetary policy effectiveness. These findings underscore the importance of understanding the multifaceted relationship between monetary policy and FinTech in shaping inflationary pressures.

Policymakers should carefully calibrate monetary policy measures to account for the evolving landscape of financial technology, leveraging FinTech's potential to promote price stability while fostering innovation and inclusive economic growth. Balancing the benefits and risks of FinTech integration within monetary policy frameworks is crucial for achieving sustainable economic outcomes in the digital era. By leveraging FinTech innovations effectively and complementing them with appropriate monetary policy measures, economies can harness the benefits of financial inclusion and technological advancements to mitigate macroeconomic volatilities.

Based on the empirical findings, several targeted recommendations are proposed:

For Emerging Economies, Central banks should leverage FinTech data analytics (digital payments, transaction patterns) to enhance real-time monetary policy calibration. Strengthening

cybersecurity frameworks will sustain public trust and limit inflationary pressures arising from digital currency use.

For Developing Economies, Regulatory authorities should prioritize establishing digital financial oversight frameworks, consumer protection measures, and data transparency to prevent liquidity oversupply through unregulated FinTech credit.

For Both Groups, collaboration between FinTech firms and central banks should be institutionalized through regulatory sandboxes to test digital products' macroeconomic effects before market introduction.

This paper does not take into account the time dynamics of how the impacts of these findings would have behaved in the long-run. Future research considering the short-run and long-run outcomes of the findings is highly recommended.



CHAPTER SIX

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Introduction

In the previous chapters, this study elicits on the debate on how financial technology could facilitate the financial process and system to affect financial development, stability and inflationary pressures in an economy. The study also argues that monetary policy is cardinal in the financial intermediation process and influences price dynamics and resilience of the financial system. The study concludes that monetary policy and financial technology are key instruments in the achievement and sustenance of financial inclusion and development, financial and price stability given the right mix of policy interventions in the macro ecosystem. This chapter provides the summary of the findings and conclusions of the papers in section 6.2. It also details the contribution this thesis makes in section 6.3 and provides the direction for future research in section 6.4.

6.2 Summary of the Findings and Conclusion

This thesis analyses the role of monetary policy and financial technology in enhancing financial development in developing and emerging countries. The thesis is partitioned into three empirical research papers. The first paper examines how monetary policy and FinTech independently and interactively affect financial development in an economy. The second paper evaluates how monetary policy and FinTech independently and interactively influence financial stability, one side and the effect of their influence on financial stability during crises on another side in emerging and developing countries. The third paper looks at how monetary policy and FinTech independently and collectively affect inflation in emerging and developing countries using the various components of FinTech (supply-side and demand-side). Using various estimation techniques, the

studies provide empirical findings, of which various conclusions and policy implications can be drawn from.

6.2.1 Monetary Policy, Financial Technology and Financial Development

The central theme of this paper is that monetary policy and financial technology influence financial development in an economy. Again, the paper contends that the combination of monetary policy and financial technology facilitates financial development. The paper draws inspiration from the Credit channel theory put forth by Bernanke and Gertler (1995) and the Financial Intermediation theory proposed by Diamond (1984). The key finding from various researches is that strong transmission mechanisms of monetary policy are typically associated with higher levels of financial frictions partly occasioned by technological innovations, hence, monetary policy and financial technology reduce financial development.

The paper employs the Dynamic Systemic GMM estimations technique to investigate the independent and joint effects of monetary policy and FinTech adoption on financial development. The paper uses panel data from 82 countries from emerging and developing countries across the world. The paper finds that there is a negative relationship between expansionary monetary policy (reduced policy rate) and financial development in emerging and developing countries. Similarly, FinTech has an inverse relationship with financial development. The interaction of monetary policy and FinTech has an adverse effect on the efficiency and robustness of the financial system, and hence, impedes financial development.

6.2.2 Monetary Policy, Financial Technology and Financial Stability

This paper investigates the effects of monetary policy and financial technology (FinTech) on financial stability in emerging and developing countries. The theoretical foundation of the paper

is built on the financial intermediation theory, stability-fragility hypothesis and finance-growth theory. The study uses panel data from 82 emerging and developing countries over the period of 2000-2021. The study employs the Dynamic System General Moments Method in the analysis. The empirical findings indicate that financial stability is positively affected by monetary policy. Similarly, FinTech also enhances financial stability. Additionally, the interaction between monetary policy and FinTech plays a positive moderating role in promoting the efficiency and robustness of the financial system, hence, financial stability in emerging and developing countries. The paper further finds a positive moderating role that tight monetary policy and FinTech independently play in enhancing financial stability during financial distress and crisis periods. However, their interaction in times of banking crisis adversely affects the financial system and further deepens the precarious liquidity and systemic conditions of financial institutions.

6.2.3 Effects of Monetary Policy and Financial Technology on Inflation

This study examines how financial technology and monetary policy affect inflation in developing and emerging countries. This paper relies on the Keynesian and monetarist theories, financial intermediation theory and the stability-fragility hypothesis as its theoretical framework. The study uses panel data of 80 over the period, 2000-2021. The Dynamic System General Moments Method is employed in the analysis. The empirical findings indicate that inflation is negatively influenced by monetary policy. Similarly, increased access to financial services through FinTech has a reducing effect on inflation through improved efficiency in financial transactions, increased financial inclusion, and enhanced monetary policy effectiveness. However, FinTech utilization promotes inflationary pressures in an economy through avenues such as facilitated credit expansion, asset price inflation, and changes in monetary policy transmission. Additionally, the interaction between monetary policy and access to FinTech services has a positive correlation with

price stability driven by enhanced financial inclusion, efficiency gains, and improved monetary policy effectiveness while the interaction of tight monetary policy and FinTech utilization reduces inflation in emerging and developing countries. The paper contributes to extant literature on the relationship between monetary policy, FinTech and inflation and further adds new contributions on how these two affect the stability of prices of goods and services in the era of technological financial innovations in an economy.

6.3 Contributions of the Thesis

This thesis makes a number of useful contributions to knowledge with respect to theory, empirics, methodology and policy.

6.3.1 Theoretical Contribution

This thesis is pioneering work on how the financial intermediation and credit channel theories are employed to explain the role of FinTech and its impact in the financial process of an economy. These theories emphasize the role of financial intermediaries in channeling funds from surplus to deficit units and facilitating economic transactions. FinTech introduces new models for financial intermediation, which can either complement or disrupt traditional intermediaries. The study, therefore, contributes to theory by evaluating how FinTech innovations alter traditional financial intermediation processes on and how financial stability and efficiency are affected as a result.

Second, the thesis contributes to the Stability-Fragility hypothesis theory. This hypothesis suggests that heightened rivalry in financial markets can lead to both stability and fragility. On one hand, greater competition can reduce risk by diversifying services and improving efficiency; on the other hand, it can encourage taking unwarranted risks and instability if not properly regulated.

The thesis contributes to this by analyzing how FinTech adoption affects market concentration, competition, and financial stability, thereby providing insights into the dual nature of competition and its effects on financial system stability.

Third, the thesis contributes to the Finance-Growth theory which argues that a sound financial system is essential for economic expansion as it facilitates investment and resource allocation. The study highlights how FinTech and monetary policy affect financial inclusion and development. It thus, contributes to understanding the relationship between financial innovation and economic growth, particularly in emerging markets.

Another important contribution to theory is employing Information Asymmetry theory to explain the disparity in information between parties in a financial transaction, which can result in problems like adverse selection and moral hazard. FinTech's impact on information dissemination and transparency is crucial for addressing these problems or exacerbating information asymmetries and their impact on financial stability and credit markets.

Lastly, the thesis relied on macroprudential policy framework which emphasizes the financial system's stability as opposed to the stability of specific institutions. It involves taking regulatory action to stop systemic hazards and advance financial stability in general. By exploring how FinTech and monetary policy interact, the research contributes to the understanding of how macroprudential policies can be designed and implemented in the context of evolving financial technologies and their impact on systemic stability.

6.3.2 Empirical Contribution

On the empirical front, the thesis makes important contributions. First, it provides empirical evidence on the intricate relationship between monetary policy and FinTech, focusing on how

independently and their combined forces may enhance or impede financial development, financial stability and inflationary pressures in emerging and developing economies. Again, the study contributes to the empirics by being the first to decompose FinTech into demand and supply side factors and evaluating how these independently and jointly with monetary policy affect macroeconomic aggregates such as inflation, financial stability and development. This thesis further adds to the empirics by showing that banking crisis does not affect the stability of the financial system across countries when FinTech penetration is high in an economy. This study provides the first evidence that shows that financial stability is enhanced during banking crisis when the adoption of FinTech is greater in an economy.

The study empirically demonstrates that demand-side variables of FinTech are positively associated with inflation, whereas supply-side factors that aim to expand access to financial services exhibit an inverse relationship with inflation. This is the first of its kind in the extant literature to decompose FinTech in this form to establish these relationships. Consistent with theoretical expectations and previous empirical studies, monetary policy also shows an inverse relationship with inflation. However, the interaction between demand-side FinTech variables and monetary policy has a negative impact on price stability, the first in the empirics to establish this.

6.3.3 Contribution to Methodology

In terms of methodology, this study is one of the few studies to use a two-step system Generalized Method of Moments to determine the independent and interactive relationships between monetary policy and FinTech decomposed into supply-side and demand-side variables and macroeconomic aggregates such as inflation, financial stability and financial development as well as other control variables. This provides a first-hand data series on FinTech variables decomposed into the two forms of FinTech for a large group of developing and emerging countries. The study addresses the

issue of endogeneity and reverse causality, which are likely to arise in the panel data used. To examine the relationship and interactions between monetary policy and FinTech on various economic indicators, such as inflation, financial development, and financial stability, the two-step system of generalized methods of moments employed helps mitigate the endogeneity problems commonly found in research using macroeconomic data in a panel form.

6.3.4 Contribution to Policy and Practice (Policy Recommendations)

The study concludes that FinTech and monetary policy jointly influence the trajectory of financial development, stability, and inflation in emerging and developing economies. FinTech's role as a moderating factor is evident: it amplifies monetary-policy effectiveness in financially mature economies but may destabilize fragile systems when unregulated.

Policymakers should thus prioritize developing integrated digital-financial regulations and real-time data monitoring systems to support effective monetary-policy transmission. Central banks are encouraged to adopt FinTech-inclusive policy frameworks that recognize digital payment systems, peer-to-peer lending, and blockchain-based platforms as part of the formal monetary ecosystem.

Furthermore, policies should be context-specific—promoting innovation in emerging economies while strengthening regulatory safeguards in developing ones. By doing so, countries can harness FinTech's potential to foster financial inclusion and stability, ultimately contributing to sustainable and inclusive economic growth.

This thesis offers several recommendations for policy based on the findings of the various empirical papers. These are stated in turns below.

6.3.4.1 Monetary Policy, Financial Technology and Financial Development

The paper finds that, overall, there is a negative relationship between monetary policy and financial development. In other words, any effort by the central bank to increase the money supply by

lowering the policy rate tends to result in lower financial development. Similarly, FinTech also has a mixed impact on financial development. While expanding access to FinTech services (on the supply side) tends to reduce financial development, increased usage of FinTech services (on the demand side) enhances it. Therefore, an expansionary monetary policy through reduced policy rates, combined with greater usage of FinTech, can significantly boost financial development. However, simply increasing access to FinTech or expanding the money supply by lowering policy rates may negatively impact financial development. To foster financial development, greater access to FinTech should be paired with simplified adoption processes and more efficient service delivery to encourage usage. Alongside a lower monetary policy rate, these measures can help strengthen the financial system.

6.3.4.2 Effects of Monetary Policy and Financial Technology on Financial Stability

Expanding FinTech acceptance is essential to improving access to financial services for excluded populations such as low-income groups and rural regions, and enhancing financial stability in developing and emerging economies. Increased financial accessibility can lessen the effects of financial difficulties while bolstering the financial system's overall resilience and ability to recover. Secondly, policymakers should ensure that attempts to encourage FinTech adoption and usage for sustaining financial stability are supported by sound macroeconomic policies. Monetary policy should focus on tightening money supply channels to improve market credit conditions. This approach helps stabilize the financial system, fosters financial inclusion through intermediation, and ultimately contributes to financial stability.

Thirdly, governments in emerging and developing countries should use FinTech and tight monetary policy tools independently, even during times of banking sector crises, to maintain

stability across the financial system. Countries vulnerable to economic shocks should focus on addressing financial exclusion by determining the obstacles that prevent small enterprises and deprived groups from obtaining financial services, using FinTech-driven interventions. Such interventions include investing in cloud infrastructure, particularly in underserved areas, promoting financial education to help consumers make informed decisions, and driving financial inclusion policies for marginalized groups like women and low-income individuals.

However, using both monetary policy and FinTech simultaneously during a financial crisis can be counterproductive to stability and should be avoided by policymakers. In such situations, policies should focus on either enhancing the effectiveness of monetary policy transmission or promoting FinTech, but not both at the same time.

6.3.4.3 Effects of Monetary Policy and Financial Technology on Inflation

Policymakers need to carefully adjust monetary policy measures to reflect the rapidly changing financial technology landscape, making use of FinTech's potential to promote both price stability and economic innovation while encouraging inclusive growth. Striking a balance between the advantages and risks of integrating FinTech within existing monetary policy frameworks is essential for achieving sustainable economic outcomes in this digital age.

To achieve this, policymakers should strategically leverage FinTech innovations and align them with well-designed monetary policies. This approach can help economies capitalize on the benefits of financial inclusion and technological progress while minimizing macroeconomic volatility. By thoughtfully incorporating FinTech into monetary policy decisions, governments can create a more resilient and adaptable financial system that supports long-term growth, stability, and equitable economic development.

6.4 Direction for Future Research

In the areas of future research, this thesis has a number of gaps still unattended to. First, the study relied on the Z- score to measure financial stability. This serves as a limitation of this study as its reliance on the Z-score as the primary measure of financial stability, does not encompass all sectors of the financial system. Therefore, it is recommended that future research investigates the causal relationship between monetary policy and FinTech, and their impact on financial stability, using a broader range of measures to provide a more comprehensive understanding of this complex interaction.

Again, this study does not consider the time dynamics of how the impacts of the variables used might evolve over the long run. Future research should examine both the short-term and long-term outcomes to provide a more comprehensive understanding of these findings.

Lastly, the research gap identified from these findings is the lack of a well-defined theoretical framework that explains the complex interplay between monetary policy, FinTech adoption, and financial development. While existing literature suggests that a well-developed financial system may diminish the effectiveness of monetary policy and that FinTech can both enhance financial inclusion and potentially disrupt financial development over time, the underlying mechanisms driving these relationships are not yet fully understood. This gap highlights the need for future research to develop a comprehensive theoretical foundation to better understand how monetary policy and FinTech interact to influence financial development, stability, and inclusion in both the short and long term.

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Appendix 3: List of Countries in the Study

Afghanistan	Ghana	Philippines
Argentina	Greece	Poland
Angola	Hong Kong	Costa Rica
Algeria	Hungary	Portugal
Austria	India	Romania
Bangladesh	Indonesia	Russian
Belarus	Iran	Rwanda
Belgium	Ivory Coast	Saudi Arabia
Belize	Israel	Seychelles
Brazil	Iraq	Kuwait
Bulgaria	Jamaica	Slovak Republic
Cameroon	Jordan	Slovenia
Botswana	Barbados	Bolivia
Chad	Kazakhstan	South Africa
Chile	Kenya	Spain
China	South Korea	Sweden
Colombia	Latvia	Switzerland
Croatia	Lebanon	Thailand
Cyprus	Lithuania	Tunisia
Denmark	Cuba	Uganda

Ecuador

Egypt

Estonia

Ethiopia

Finland

France

Georgia

Morocco

Nepal

Malta

Mexico

Netherlands

New Zealand

Nigeria

Norway

Pakistan

Peru

Ukraine

United Arab Emirates

Honduras

Malawi

Uruguay

Venezuela

Vietnam

Zimbabwe

