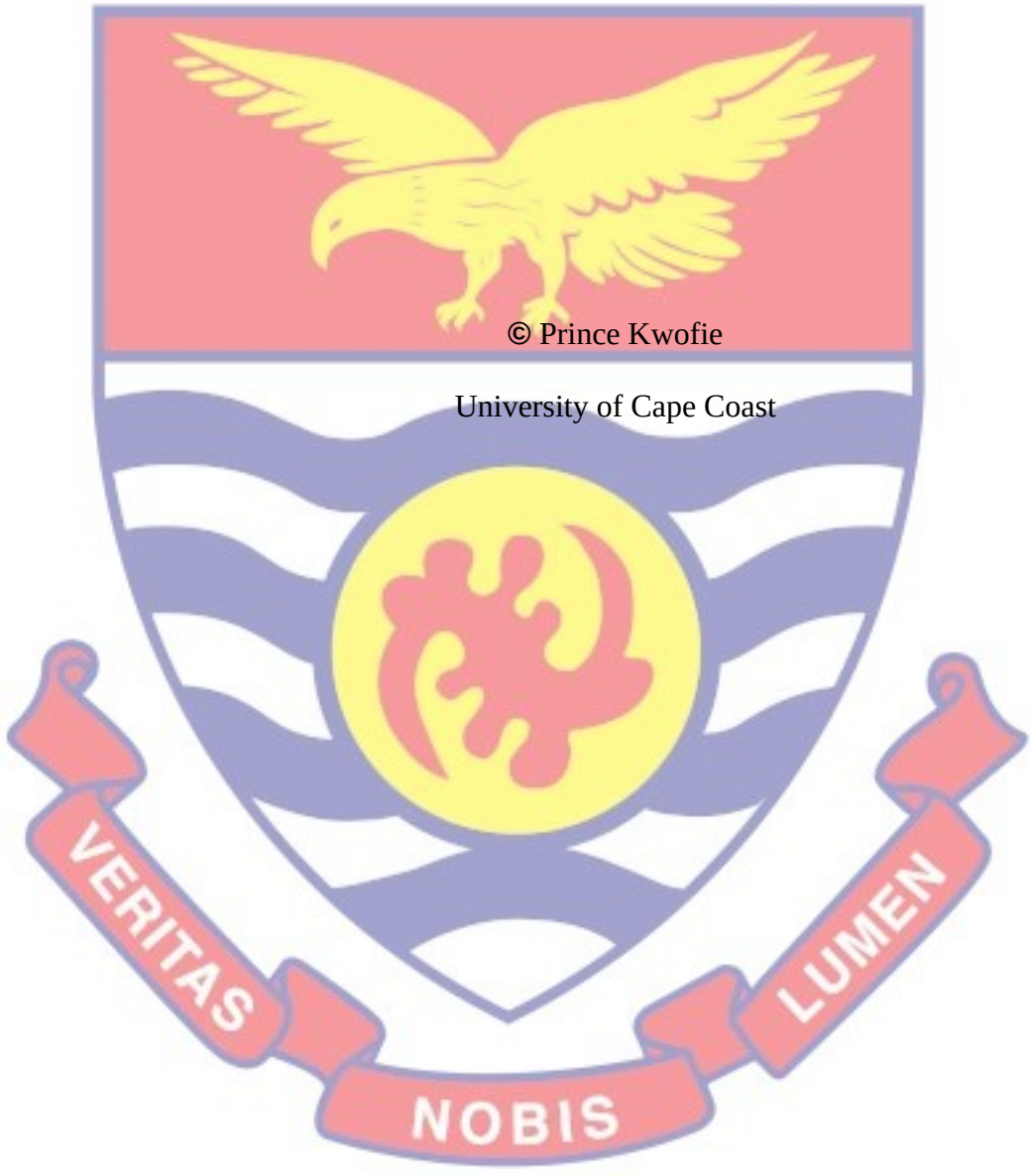
UNIVERSITY OF CAPE COAST

EXAMINING THE RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND BANKING SECTOR STABILITY IN GHANA

PRINCE KWOFIE

2022



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EXAMINING THE RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND BANKING SECTOR STABILITY IN GHANA

BY

PRINCE KWOFIE

Thesis submitted to the Department of Finance of the School of Business, College of Humanities and Legal Studies, University of Cape Coast in partial fulfillment of the requirements for the award of Master of Commerce degree in Finance.

SEPTEMBER 2022

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature…… Date…….

Name: Prince Kwofie

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature…… Date…….

Name: Prof. Anokye Mohammed Adam

ABSTRACT

The expansion of financial services, particularly those offered by commercial banks, has coincided with faster economic growth. Banks are becoming more exposed to borrowers with high debt servicing costs due to rising consumer and corporate debt. Following the worldwide financial crises of 2008–2009, the banking sector has become unstable. This study investigated the relationship between macroeconomic variables and bank stability in Ghana. The analysis relied on secondary data collected from January 2007 to December 2021. This study analyzed the short and long-run dynamics between macroeconomic variables and bank stability measured by the capital adequacy ratio. The bounds test showed a long-run relationship between the variables of the study. From the ARDL error correction model, exchange rate and return on asset have a positive long-term impact on bank stability. On the other hand, the Ghanaian bank stability was negatively impacted in the short term by the exchange rate. The variables return to equilibrium at a significant rate of 28.9%. The study recommended that banks should establish internal policies that ensure adequate liquidity levels, strengthen the institutional environment in the country, strict compliance with laws and regulations, and currency hedging.

KEY WORDS

Autoregressive Distributed Lag Model

Banking Sector Stability

Error Correction Model

Ghana

Macroeconomic Variables

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor, Prof. Anokye Mohammed Adam of the Department of Finance, for his professional guidance, advice, encouragement, and goodwill with which he guided this thesis.

I am again grateful to Prof. Siaw Frimpong, Prof. John Gartchie Gatsi, and Dr. Samuel Kwaku Agyei for their unflinching support and guidance throughout my master's degree program with the School of Business, UCC.

I wish to thank my loving and caring wife, Mrs. Winnifred Kwofie for her support and care. A special thank you goes out to my children and siblings.

Finally, I wish to thank my family and friends for their support, especially my program mates and all lecturers and administrators of the School of Business, UCC.

DEDICATION

To my dear wife, Mrs. Winnifred Kwofie, and my children, Peony E. Kwofie, Prince N. Y. Kwofie, Gabriella E. Kwofie, Gabriel K. M. Kwofie.

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LIST OF ABBREVIATIONS

APT	Arbitrage Pricing Theory
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BoG	Bank of Ghana
CAR	Capital Adequacy Ratio
ECM	Error Correction Model
EXR	Exchange Rate
FDI	Foreign Direct Investment
GDP	Gross Domestics Product
GFC	Global Financial Crisis
GSE	Ghana Stock Exchange
IMF	International Monetary Fund
INF	Inflation Rate
INT	Lending Interest Rate
LN	Natural logarithm
MPR	Monetary Policy Rate
NPL	Non-Performing Loans
OLS	Ordinary Least Square
PP	Phillips-Perron
ROA	Return on Asset
ROE	Return on Equity
VECM	Vector Error Correction Model

CHAPTER ONE

INTRODUCTION

Since the 1990s, Africa has been among the world's fastest-growing economies. The banking sector is considered one of the key sectors in an economy. The acceleration in economic growth has been accompanied by an expansion of access to financial services, particularly commercial banks, which have been traditionally, and remain, the backbone of financial systems in Ghana. The banking industry forms the greater portion of the sectoral contribution of GDP in Ghana. Increasing debt in the household and corporate sectors has left banks exposed to borrowers with high debt-service burdens. Banking sector stability has become an issue, especially after the 2008-09 global financial crisis in which research reports suggest that good corporate governance can reinforce bank stability and shape bank risk-taking behavior. Many believed that the formal and informal institutions, which differ across countries and influence the internal and external operating environment of banks, lead to the fragility of banks. It is, therefore, imperative to study the relationship between macroeconomic variables and stability in the banking sector in Ghana.

Background to the Study

Commercial banks play a vital role in the economic resource allocation of countries (Ongore, 2013). They contribute to the economic growth of the country by making funds available for investors to borrow as well as financial deepening in the country (Otuori, 2013). Commercial banks appear very profitable in Sub-Saharan Africa (SSA), average returns on assets were about 2 percent over the last 10 years, significantly higher than bank returns in other

parts of the world (Yakubu & Bunyaminu, 2022). To survive in the long run, a bank needs to find out what are the determinants of profitability so that it can take initiatives to increase its profitability. However, because there are few studies on the determinants of bank profitability, various studies indicate divergent views on the effect of macroeconomic factors on bank profitability.

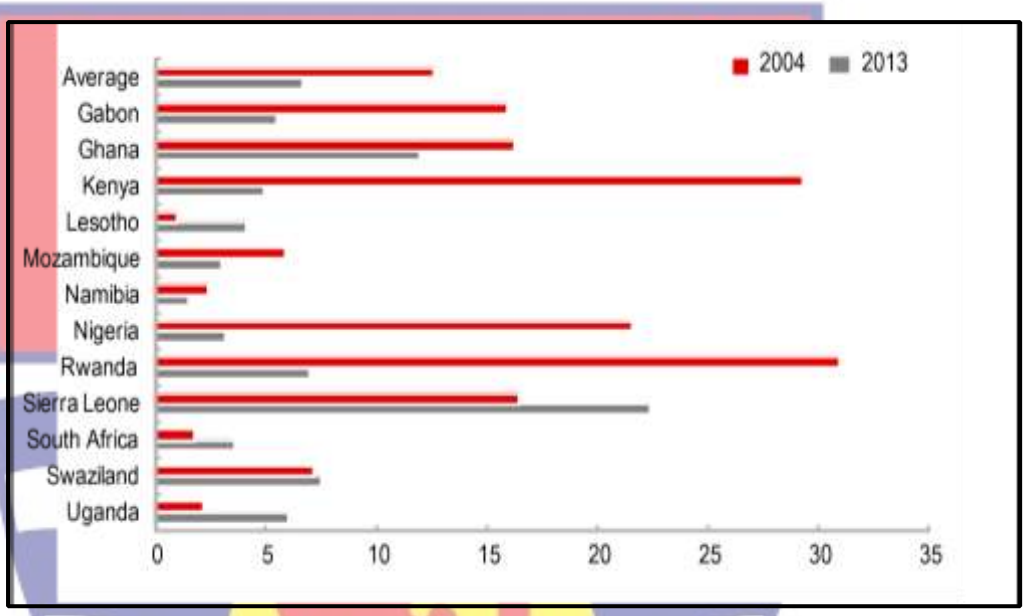

Figure 1: Nonperforming loans in 2004 and 2013 (percent of total loans)

Source: IMF African Department Survey (2013)

From Figure 1, Non-performing loans to total loans for some selected countries in Africa and the average for Africa in 2015 indicate that financial soundness has improved over the years, but some persistent weaknesses remain. From 2012 to 2013, average non-performing loans (NPLs) for all SSA stood at close to 7 percent, compared with 9.4 percent from 1996 to 1999 and 9.1 percent from 2000 to 2003. This indicates the possibility that a bank borrower or counterparty would fail to meet its obligations following agreed terms. Ultimately, high NPL banks are less able to finance the real economy than sounder banks, and this has a detrimental impact on economic growth and the wider public interest.

For developing countries, improvements in the banking sector could have a significant impact on the allocation of financial resources since the sector remains, still, the most important source of financing for the private investment of firms, given the underdevelopment of the financial markets. Because of the vital role banks play in the economy, the banking sector has been singled out for special protection and it is clear why such great emphasis is placed on regulation and supervision of the banking sector (Stewart & Chowdhury, 2021; Barth, Caprio Jr & Levine, 2004). The importance of the financial sector in the development of the overall economy of countries cannot be underestimated because the banking sector dominates the economic development of a country by mobilizing the savings of general people and channeling those saving towards investment.

In developing economies, the banking sector among other sectors has also witnessed several cases of collapses, some of which include the Alpha Merchant Bank Ltd, Savannah Bank Plc, Societe Generale Bank Ltd (all in Nigeria); the Continental Bank of Kenya Ltd, Capital Finance Ltd, Consolidated Bank of Kenya Ltd and Trust Bank of Kenya among others. Ten years ago, Nigeria had 89 banks, but as a result of the reforms by the Central Bank of Nigeria that were taken due to challenges faced by the industry, they have 25 banks in 2018. Between 2015 and 2016, some regional banks — Crane Bank (Uganda), Dubai Bank, Imperial Bank and Chase Bank (Kenya), and Twiga Bancorp (Tanzania) experienced a dramatic collapse. In August 2017, The Bank of Ghana revoked the licenses of UT Bank and Capital Bank, and subsequently took over by Ghana Commercial Bank, after having been declared "irredeemably insolvent". Also, the recently-established Consolidated Bank

Ghana Limited was morphed by fusing uniBank, The Construction Bank, The Royal Bank, The Beige Bank, and Sovereign Bank.

In 2018, banks in Ghana's stock of non-performing loans increased from GH¢6.14 billion as of December 2016 (39.0% year-on-year growth) to GH¢8.58 billion in December 2017 (39.8% year-on-year growth). The current stock of NPLs translated from an NPL ratio of 17.3 percent in December 2016 into an NPL ratio of 22.7 percent in December 2017 (BoG Report, 2018). Also, South Africa, which is one of the largest economies in the continent, has experienced about 14 banks that have gone into liquidation over the past 30 years with recently African Bank and VBS Mutual Bank being liquidated in 2014 and 2018 respectively. In several African economies, banking sector vulnerabilities have increased partly due to a rise in non-performing loans and a reduction in profitability as well as capital buffers.

The Ghanaian banks' capital to risk-weighted assets is said to have experienced an increase from 9.1 % in 2003 to 19.1% in 2010 whereas, the Tier I capital to risk-weighted assets also increased from 16.2% in 2005 to 18.6% in 2010 (IMF Country Report 2011). This shows that the minimum capital standing in Ghanaian Banking Sector is higher than the requirement set by Basel II at 8% (Basel Committee's response to the Financial Crises 2010). However, the illiquid nature of bank assets (loans) which are financed by liquid liabilities (deposits) threatens the stability of banks by exposing them to runs by depositors who cannot accurately assess the financial health of banks, because of the existence of asymmetric information between depositors and banks (Louhichi, Saghi, Srour & Viviani, 2022; Manu, Adjasi, Abor & Harvey, 2011; Diamond, 1984). Runs on banks, especially those driven by rumors, can result

in a bank failure. Runs that result from information asymmetry about the quality of bank assets lead to depositors' panic as they consider all banks to be illiquid or insolvent. Massive withdrawal of deposits at banks ensues as a result of panic. These massive withdrawals of deposits may be limited to one bank only or can spread to other banks in the system via contagion, and these manifold failures of banks can have destabilizing effects on the financial system and the overall economy, because of the inherent systemic risk they present to the system (Le & Nguyen, 2021; Laeven & Valencia, 2013; Hoggarth & Saporta, 2001).

The dire consequences on banking and financial systems and ultimately the overall economy brought about by bank failures pose serious policy challenges to policymakers all over the world. Bank failures have afflicted almost all countries, be they developed or developing, and will continue to do so into the foreseeable future. Financial crises arising and/or resulting from bank failures and their costs are well documented (Le et al., 2021; Laeven et al., 2013; Hoggarth et al., 2001). Ghana has also been a victim of bank failures over the years. The stability of the banking sector is therefore critical for the economic and social development of the economy. Against these backgrounds, this study is conducted to examine the relationship between macroeconomic variables and the stability of the Ghanaian banking sector, focusing on how macroeconomic variables influence the stability of commercial banks in Ghana.

Statement of the Problem

The effect of macroeconomic variables on bank stability has been an ongoing debate for both academics and policymakers. Several empirical studies found inconclusive results about the effect of different types of macroeconomic variables on bank stability (Phan et al., 2022; Bektas et al., 2022; Yensu et al.,

2021; Viphindrartin et al., 2021; Alfadli et al., 2020; Atoi, 2018). A reason for such inconclusiveness is a result of cross-country variation in bank risk-taking behavior (Ashraf, 2017). Generally, episodes of crises in the financial sector have been experienced in the sub- Sharan Africa (Akinsola, et al., 2017; Moyo et al., 2014; Maredza et al., 2013; Akinboade et al., 2010). In Ghana, studies on crisis episodes focused on whether or not favorable macroeconomic variables drive stability in the banking sector (Loloh, 2015; Caprio et al., 2002).

Ghana experienced a severe banking crisis between August 2017 and January 2020 when the Bank of Ghana (BoG) allowed several indigenous banks to be taken over (BoG Report, 2020). A crisis in all or part of the banking sector may impose costs on the economy as a whole or parts within it. First, 'stakeholders' in the failed bank will be directly affected. These include shareholders, the value of whose equity holdings will decline or disappear; depositors who face the risk of losing all, or part, of their savings and the cost of portfolio reallocation; other creditors of the banks who may not get repaid; and borrowers, who may be dependent on banks for funding and could face difficulties in finding alternative sources. In addition, taxpayers may incur direct costs as a result of public sector crisis resolution. Some major causes of the collapse of the banks have been cited as corporate governance (Abdelbadie et al., 2019; Anginer et al., 2018), credit risk (Ferhi, 2018; Amara et al., 2019), and regulatory lapses (Siddika et al., 2019; Mathuva et al., 2021).

Even or perhaps particularly in tranquil times the assumption and transformation risks remain the core function of the banking business which undoubtedly can be associated with instability. Therefore, extending empirical research to banking stability and linking it to macroeconomic factors in non-

crisis and crisis periods can provide a more rounded view of how contemporary macroeconomic variables relate to stable banking operations and systems. The overall purpose of this study is to examine the relationship between macroeconomic variables and stability in the Ghanaian banking sector. Although negative consequences of adverse macroeconomic events are not limited to the banking sector alone, it has been recognized that banks play a special role in the economy, and their failure markedly reinforces the adverse macroeconomic developments that may have caused them to fail (Merlin, 2012; Nieto et al., 2004; Sijben, 2002). Given that banks are theoretically more prone to (economically undesirable) risk-taking than nonfinancial institutions (Zulkhibri, 2019; Ajello et al., 2022; Hellwig, 1995) and those weak macroeconomic fundamentals simultaneously affect a large number of institutions, it is more important to understand how macroeconomic variables influence banking stability in Ghana.

Purpose of the Study

This study sought to explore the relationship between macroeconomic variables and bank stability in Ghana.

Objectives of the Study

The research would be guided by the following research objectives:

1. To examine the long-run relationship between macroeconomic variables and bank stability in Ghana.
2. To examine the short-run relationship between macroeconomic variables and bank stability in Ghana.

Research Hypotheses

The hypotheses tested in this study were as follows:

1. H_1: There is a significant long-run relationship between macroeconomic variables and bank stability in Ghana.
2. H_2: There is a significant short-run relationship between macroeconomic variables and bank stability in Ghana.

Significance of the Study

The study is particularly relevant in the context of Ghana where the banking sector is experiencing turmoil, instability, and uncertainty in the wake of the collapse and consolidation of some commercial banks in recent times. So, studies like this provide signals as to how the economy is performing in achieving policy targets. The Bank of Ghana (BoG), through this study, may be in a position to assess how inflation-targeting macroeconomic policy is being achieved so that the necessary policy actions and interventions can be implemented if targets are far from being achieved. To promote public confidence in the banking system, the central bank, based on the findings of this study, may relearn how inflation and interest rates relate to building a stable banking sector. Recommendations that may flow from this study may serve as guiding points for the central bank for policy purposes.

The government and its fiscal policy managers and economic management team may get an insight into how inflation is contributing, positively or negatively to stabilizing the banking sector of the financial services sector. In this way, they may be cautious about how fiscal policy can destabilize the system through government borrowing and spending behaviors. Findings on how GDP growths affect stability may inform the economic management team

and other relevant economic stakeholders about how improved output can be beneficial to the banking sector.

It is further envisaged that commercial banks may benefit immensely from the findings of this study. Commercial banks may have access to empirical research findings to assess how their lending rates are impacting on stability or otherwise of the banking system so that appropriate action can be taken. Recommendations may offer suggestions about operational efficiencies and credit risk management practices of the banks and how these may transmit into the stability of the system. Moreover, depositors or the banking population may be in a position to appreciate and understand how macroeconomic indicators shape happenings in the banking sector.

Delimitations of the Study

This study focuses conceptually on macroeconomic variables and how they influence stability in the banking sector. Macroeconomic variables such as real gross domestic product, monetary policy rate, inflation rate, exchange rate, and interest rate are the explanatory variables used. The study also controlled for two variables namely; return on asset and return on equity. This study focused on both the long and short-run dynamics of macroeconomic variables and bank stability in Ghana. This study used the capital adequacy ratio to measure bank stability which has been widely used in literature. The period for the dataset spans from January 2007 to December 2021, thus, monthly data for the variables were employed making 180 observations. In terms of methods, the study employed the Autoregressive Distributed Lag model.

Limitations of the Study

In the context of empirical research, it is impossible to cover all the aspects of a particular field of research in a single study, this study identified some limitations. First of all, how the variables were measured and estimated statistically for analysis. Further research was needed to analyze the method and approach to be adopted so that the research hypothesis could be measured reliably. In addition to this limitation, the unavailability of data restricted the period from January 2007 to December 2021. This may limit the extent of inferences and conclusions that could be drawn from the results.

Organization of the Study

The study is organized into five chapters. Chapter one presented the general introduction of the study. In this chapter, the study presents background information on the study and the statement of the problem. The purpose of the study, objectives, and research questions are also presented. Other sub-themes such as the significance of the study, delimitations, and limitations of the study are all covered. Chapter two reviewed the literature, both theoretical and empirical literature were thoroughly reviewed. Chapter three presented the write-up of the research methods. Chapter four presented the results and discussion of the findings. Lastly, chapter five presented the summary, conclusions, recommendations for policy intervention, and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The purpose of this chapter is to review literature pertinent to the study of the relationship between macroeconomic variables and banking sector stability in Ghana. The chapter is divided into three main sections. Section one reviews theories relevant to the topic under study and section two presents a conceptual review while section three presents a review of past studies.

Theoretical Review

In determining the relationship between macroeconomic variables and banking sector stability in Ghana, this study reviewed the theories of arbitrage pricing theory and the theory of bank behavior.

Arbitrage Pricing Theory

The first theory underpinning the study is the arbitrage pricing theory (APT). It was propounded by Ross (1976) who argued that a financial asset's expected return can be shown as a linear function of various macroeconomic variables or theoretical market indices, where sensitivity to variations in each variable is denoted by a variable-specific beta coefficient. It is a general theory that involves the analysis of asset pricing and macroeconomic factors (Ross, 1976). The model-derived rate of return would then be used to correctly price the asset. This means the price of the asset should equal the price expected at the end of the period discounted at the model-implied rate (Cetin, Jarrow, & Protter, 2010). Any divergence in price should be brought back into line by arbitrage.

APT allows the investors the opportunity to adapt the model to the type of security being analyzed. And just as other pricing models, it aids its user in deciding whether or not an asset is overvalued or undervalued to profit from such information. It helps managers to examine whether or not assets are exposed to certain macroeconomic factors thereby building better portfolios. APT could be more customizable than the Capital Asset Pricing Model (CAPM), but its application is also relatively more difficult because it takes a substantial amount of research to determine which variables affect stock or portfolio. It can be impossible trying to identify all the influential factors to talk of determining a security level of sensitivity to a particular variable. However, with APT getting 'close enough' is often good enough; empirical evidence attests to the fact that four or five variables will normally explain most of a security's return: inflation, GDP, investor confidence, and interest rates.

Theory of Bank Behavior

The theory of bank behavior is a derivative of Keynes' money demand theory. The theory of bank behavior states that interactions between people determine the interest rate in banking. Public behavior in using banking products can cause banks to become more or less liquid so that each of the banking products offered has risks. This risk will hurt all aspects involved. Especially, it will disrupt financial system stability. The theory of bank behavior is a derivative of Keynes' money demand theory with speculative motives. The speculation motive in liquidity preference theory involves information about the need to take anticipatory steps against factors that are uncertain (uncertainty) and expectations for the future (Fontana & Setterfield, 2016).

The interest rate is one of the economic variables that is often monitored by economic actors. Interest rates are seen as having a direct impact on economic conditions. Decisions regarding consumption, saving, and investment are closely linked to conditions of the rate of interest. Interest is the dependence on borrowed money, which is usually expressed as a percentage of the money loaned. The interest rate is the interest rate expressed in percent, for a certain period (monthly or annually). An increase in the interest rate will worsen the quality of the loan, the higher the cost of debt will make it more difficult for the debtor to repay the loan. Also, high-interest rates are a potentially detrimental alternative for debtors (Bofondi et al., 2011).

Conceptual Review

In this section, the researcher presents concepts relevant to the relationship between macroeconomic variables and banking sector stability.

Stability in the Banking Sector

Bank stability has been a key international agenda by policymakers following the Global Financial Crisis (GFC) of 2007-2009 (Beck, 2009). The Financial Stability Board and Basel Accords have been key in enhancing the financial stability of commercial banks. Globally, governments, central banks, and other policymakers have increasingly taken on the mandate of ensuring the financial stability of both financial institutions, the financial sector, and by extension the economic stability of countries (Čihák, Mare & Melecky, 2016). Consequently, countries and governments have increasingly prepared as well as implemented financial inclusion initiatives (World Bank, 2014). According to Mostak and Sushanta (2015), when a bank has financial stability, it performs its

financial intermediation process smoothly, thereby building confidence among users. Khan (2011) also observed that a financial system is said to be stable if it performs its financial intermediation process among the users smoothly, through a range of financial institutions supported by a myriad of financial infrastructure. Fluctuations in the global financial system are a constant concern. Due to this many countries prioritize financial stability over financial growth. This is because growth may be unsustainable over long periods if there is instability. To achieve financial stability, many countries strengthen financial regulation. Sparatt and Stephen, (2013) observed that a financial system can become unstable, triggering a crisis that devastates the real economy. After the GFC of 2007-2009, policymakers across the world including both advanced and developing countries prioritized the bank stability agenda (Beck, 2009). However, while policymakers are concerned more about the systematic banking crisis, individual bank fragility can also be worrying since several systematic banking crises initially start as crises in individual banks.

The debate on factors that affect bank stability continues but very little is known about how financial inclusion affects bank stability (Kalunda, 2015). According to the Basel II Accord, the core indicators relating to bank financial stability include capital adequacy, asset quality, management soundness, earnings and profitability, liquidity, and sensitivity to market risk CAMELS (Beck, 2009). Measuring individual bank stability has been based on accounting data using Z-score and Non-Performing Loan (NPL) ratio (Ghosh, 2008; Beck, 2009; Mostak et al., 2015). The Z-score is termed to be a more comprehensive measure of bank stability compared to the liquidity ratio and NPL ratio. This is because it combines leverage information (equity to assets) with performance

(return on assets) and risk (standard deviation of return on assets) to more fully approximates the likelihood of insolvency in commercial banks. The Z-score increases with higher profitability and capitalization levels; it decreases with unstable earnings reflected by a higher standard deviation of return on assets. An increasing value of the Z-score indicates a small risk profile for a bank and higher bank stability (Kalunda, 2015).

In addition, commercial banks have taken actions to address financial inclusion by designing new services and products targeting groups previously referred to as unbankable (Allen, Carlett, Qian, Senbet & Valenzuela, 2013). Commercial banks are important financial intermediaries in the economy which perform the basic functions of accepting deposits, lending money, and offering transfer services. They represent a critical role in the implementation of governments' economic policies, particularly monetary policy, linking them to the rest of the economy (Ongore & Kusa, 2013). In emerging market economies such as Ghana, commercial banks remain the dominant channel of financial intermediation. Bank deposits represent the most significant component of the money supply used by the public. Changes in money growth are highly correlated with changes in the prices of goods and services in the economy (Chibba, 2009). Access to bank credit and other bank services is essential for any country and this justifies the need to make banking services accessible, available, and attractive to all without any form of discrimination (Sarma & Pias, 2011). What it means is that if financial services are available and easily accessible to all, then banks can attract more savings and in turn improve their profitability. This is possible through financial inclusion which ensures more people are included in the formal financial system (Allen et al., 2013). However,

for commercial banks to efficiently perform their intermediation role of providing liquidity, they must be stable.

In 2001, following expert consultative meetings and surveys from member countries, the International Monetary Fund (IMF) endorsed a set of core financial soundness indicators (FSI) which have been revised and refined over the years (IMF, 2015). The idea behind the development of the financial soundness indicators is, therefore, to provide an idea of the soundness or stability of the financial system as a whole, as well as that of the banking sector, given the significant role played by these sectors in an economy. The IMF has thus developed a total of 39 indicators that are divided into two groups, with 12 main or core sets relating only to the banking sector, while the remaining set of 27 encouraging indicators pertains to some other banking sector indicators and also to households, financial markets, nonbank financial institution, non-financial corporations, and property markets. From the 12 core FSIs for the banking sector, this study will investigate the three indicators that are commonly and widely used in measuring the banking sector stability in many jurisdictions, to establish the relationship between these measures and economic growth. The indicators are capital adequacy; asset quality and liquidity.

Macroeconomic Variables

Macroeconomic factors are relevant to a broad economy at the regional, national level and local level as it affects a large population rather than a few select individuals. Macroeconomic factors such as economic output, price levels, unemployment, inflation, national income, gross domestic product, savings, and investment are the key determinants of economic performance which are closely monitored by governments and financial institutions (Cooper

& John, 2009). Macroeconomic variables in Ghana over the years have shown wide variations. Changes resulting from variations of macroeconomic variables, pose a great risk to planned investment and returns. This has the potential to discourage local investment and FDI in Ghana due to increased risk to expected returns (Mensah et al., 2012). The stimulants of investment and savings occur through the mediation role of the stock market where financial assets are traded (Jaffry, Ghulamd, & Cox, 2013). However, studies have indicated changes in the value of financial assets to be responsive to macroeconomic factors such as inflation rate, exchange rate, interest rates, GDP, money supply, unemployment rate, dividends yield, and so forth (Bondzie, Fosu, & Asare Okyere, 2014). Volatilities of macroeconomic variables have the potential to discourage investors as systemic risks are greatly increased (Kuwornu, 2011). Even though the macroeconomic environment cannot be predicted or controlled to a large extent, the management of a company can mitigate the impact of the unexpected fluctuations, and even take advantage of them, by adding the elements of adjustability and flexibility to the structure of the company's operations.

Macroeconomic variables are majorly closely scrutinized by businesses, governments, and consumers but due to their influence on the banking sectors, they are focal points that must be observed by commercial banks. Kwon and Shin (1999) consent that GDP, currency exchange rate, interest rates, inflation, and market risk are the most impactful macroeconomic variables. Sharma and Singh, (2012) found out that there is a positive relationship between how they carry out investments over an elongated period since the variables stabilize over a period and this become favorable to the bank's daily operation and impact them positively. The largest quantifiable measure of overall economic

occurrences in a nation's GDP precisely represents all goods and services monetary worth made over a definite duration inside the geographical borders of a country. Escalation in the rate of prices over a while is called inflation. Price increase is caused by constituents that normally affect it which are: fiscal guidelines and policies, the consumer price index, commercial banking, and credit accessibility all of which play a part in prompting a rise or fall in inflation. Unemployment measures the number of residents enthusiastically in search of employment but not currently working. Mishkin (2004) states that economic growth areas are majorly influenced by individual macroeconomic variables. These variables are banking, the consumer price index, and government regulation changes.

Macroeconomic Variables and Bank Stability

The performance of commercial banks can be affected by internal and external factors which can be classified into bank-specific (internal) and macroeconomic variables (Ongore, 2013). Profitability and liquidity are the most notable issues that any management aspires to maintain and control. Project financing is highly discouraged by commercial banks' high-lending rates trend and this leads to equally efficient equity financing taking a lead though they are relatively expensive. High treasury bill rates encourage investments in additional tools of government. They (Treasury bill) contest with stocks, deposits, and bonds towards the investment by shareholders. As the need for demand deposits and stock market instruments reduces, it results in an ultimate decrease in their prices. Anticipated correlation resulting in Treasury bill rates and financial performance is therefore negatively influenced and also has a positive influence concerning lending rates (Maghyereh, 2002).

Financial reporters' confirmation shows that shareholders mostly conclude that macroeconomic measures and fiscal policy have a big impact continuously leading to the change in financial performance (Muchiri, 2012). Pricing and financial performance are affected by Economic factors that have an impact on changing investment opportunities; the pricing policies and factors that affect speculative dividends. As Muchiri (2012) concluded, earlier studies argue that the consumer prices index is a particular element made up of several macroeconomic variables. These variables are the discount rate, price increase, and goods market as concluded by (Gan, Lee, Yong, and Zhang, 2006). A study had findings that concluded that a negative effect was established among the variables. It is influenced by the advanced peril of forthcoming profitability. For instance, future productivity may be reduced as a result of bill rise level which increases the overhead production budget. On the other side, others believe that positive stock prices may result as a result of an increase in price levels because equity is used to confine inflation.

Sharma and Singh (2012) advocate that banks first acquire information about borrowers which is very costly before extending loans to current potential or existing customers, allocation of the available funds is highly affected by the variability of economic conditions and the high probability that loan default would have clear positive or negative effects on their lending behavior. A study by Kwon and Shin (1999) extrapolates that during a recession, banks reduce their lending rate unlike when the economy is on the boom when banks make most loans during this period since the level of macroeconomic variability is greatly reduced. The economic environment is a routine risk component that has an impact on the economy of all participants in a country. Economy

Performance and progression are calculated in terms of macroeconomic aggregates, which include the total amount of goods produced, generally rise in price levels, employment level, money supply for trading, and changes in the exchange rate.

Determinants of Bank Profitability

According to Devinaga (2010), researchers who paid more attention to the discovery of the determinants of a bank's performance and profitability classified them into two main factors. These are the internal and the external factors. According to Husni (2011), the internal determinants of profitability are made up of factors that can be controlled by the banks. Thus, it is within the power of the banks to determine the level these factors should take. These determinants affect both the revenue and cost incurred by the banks. Some research papers have divided these determinants into two groups. They are the financial statement variables and non-financial variables. The financial statement variables have a direct effect on both the financial statement and the statement of financial position of the bank and the non-financial statement variables consist of factors like the number of branches of a particular bank, and location (Haron, 2004). The following are the internal determinants of the profitability of banks.

Loan Quality

Banks play different roles through which income is generated. One of these roles is the advancement of loans to borrowers. It has been established that loan and advances are one of the main avenues through which the bank make a profit. This means the more the banks give out loans, the more they grow in

terms of profit (Abreu and Mendes, 2003). However, banks have to tread cautiously because this exposes them to liquidity and default risks which affect the profit and survival of the banks (Devinaga, 2010). For instance, the global financial crisis that began in the United State of America in 2008 had its roots in the sub-prime loans that the banks engaged in, and when the housing market experienced a decline in prices, borrowers or customers who were granted these sub-prime loans could not pay back the loans and the interests attached to them and this led to the doom of some banks (Vong & Hoi, 2009). During this period of financial recession, Ghanaian banks experienced profit despite the continuous increase in non-performing loans. The stress test conducted by the IMF revealed that anytime the assets of the bank are not put into efficient and effective use and bad debt rises, the financial strength of the banks begins to decline, and this can cause the banks to collapse if immediate steps are to taken. Therefore, it is important to put measures in place to enhance the quality of loans to avoid a large number of defaults. Furthermore, the ratio of loan loss to total loans (LLTR) is also a significant determinant of banks‟ profit (Sufian & Chong, 2008). The rise in LLTR represents a rise in the credit risk to which the banks are exposed. Hence higher credit risk affects the profitability of a bank adversely. A study carried out by Vong and Hoi (2009) revealed that loan loss provisions are inversely related to the performance of banks in Macao. Another measure of loan quality is the ratio of loan to the total asset (LOLA). Again, the work of Vong *et al* (2009) disclosed that LOLA had a negative relationship with profitability instead of increasing it and according to these authors; this result was confirmed by the initial finding of Vong (2005). To summarize this point,

the quality of a loan can be measured using non-performance loans, loan loss provisions, and loans and advances ratio as suggested by Vong and Hoi, (2009).

Income

According to Devinaga (2010), the income of a bank can be broken down into two, namely, interest and non-interest income. Interest income is made up of Interest charges on loans, overdrafts, and trade finance which are made available to customers by the bank. Non-interest income on the other hand consists of fees, commissions, brokerage charges, and returns on investments in subsidiaries and securities. From these two incomes generated by the banks, interest income is the major source of revenue (Vong, & Hoi, 2009) because it contributes about 80% of the earnings of the banks.

Deposits

Banks are said to be deeply reliant on the monies largely given by the customers in the form of deposits to generate the credit being offered to borrowers. It has been established that deposits are an inexpensive source of financing for banks and therefore positively affected the profitability of banks when the request for loan facilities is on the rise. This implies that banks make more profit when the level of deposits rises and loans are given out to customers (Devinaga 2010). However, the caveat here is that, if the loan demand is low, having more deposits could rather reduce the profit because of the interest the banks pay on these deposits (Devinaga 2010). A study carried out by Husni (2011) on the determinants of commercial banks' performance in Jordan unveiled that ROA and Total Liability to Total Assets are positively related.

Capital Ratio

The capital ratio was identified as a variable in the studies done by both Devinaga (2010) and Vong *et al* (2009) on the topic "Determinants of banks profitability and performance". They both share the view that shareholders' funds, reserves, and retained profit which make up the capital structure influence the profitability of banks because of its consequence on leverage and risk. According to these researchers, the assets of banks can be raised through capital (equity) and debt. Among the two, debt financing can be riskier when it comes to credit and liquidity risk. For instance, banks that are financed through debt will be scared to move into risky investments because when losses are made, they are still obliged to settle the debt. On the other hand, a bank financed by capital can invest in more risky projects and also absorb problems that arise as a result of liquidity and credit risks. Sufian *et al* (2008) also stressed the importance of a strong capital structure for banks in developing countries because it offers them the ability to endure financial crunches and protect depositors in times of bankruptcy and distress macroeconomic conditions. Molyneux *et al* (1992) argued that a lower cost of capital can be achieved when a bank is financed predominantly by equity and this can boost the profitability of that bank. In addition, Both Basel II and III accord concedes that the majority of bank bankruptcies are a result of credit loss and for this reason, it is important for banks to have a strong capital base that will serve as a cushion against loss (Basel Committee's response to the Financial Crises 2010).

Berger, Herring, and Szegö (1995) also stated that banks with weak capital base stand on risky grounds. This will harm profitability. This is the brain behind the Bank of Ghana's persistent increase in the capital requirement in the

banking industry. The Ghanaian bank's capital to risk-weighted assets is said to have experienced an increase from 9.1 % in 2003 to 19.1% in 2010 whereas, the Tier I capital to risk-weighted assets also increased from 16.2% in 2005 to 18.6% in 2010 (IMF Country Report 2011). This shows that the minimum capital standing in Ghanaian Banking Sector is higher than the requirement set by Basel II at 8% (Basel Committee's response to the Financial Crises 2010). This might account for the persistent rise in profitability by the Ghanaian banks during these years of the global financial crisis. Research carried out by Karkrah and Ameyaw (2010) on the topic of profitability determinants of commercial banks in Ghana disclosed that the equity ratio which is the measure of the capital strength of the banks is positively related to the ROA.

Liquidity Ratio

According to Devinaga (2010), regulators of the banking industry require banks to hold enough liquid assets (cash) to deal with day-to-day activities like meeting the withdrawal needs of the customers. He explained that this is possible if the banks can amass enough cash and the quickest way to raise funds from other sources. This means that the ability of a bank to survive also depends greatly on the level of liquidity. However, Devinaga (2010) stated that the lesser earnings on liquid assets and funds which are not utilized harm the profitability of a bank. And because of this, liquidity management serves as an important factor in profitability.

The IMF Country Report 2011 has shown that irrespective of the financial distress that hit the world, Ghanaian banks are strong in terms of liquidity. The report revealed that in 2010 Ghanaian banks had 25.3% in the area of Liquid assets to total assets and 33% for Liquid assets to short-term

liabilities. Based on these ratios it was concluded that Ghanaian banks had generated profit because of their strong liquidity. Devinaga (2010) used the ratio of loans and advances to deposits as a measure of liquidity. The researcher used this ratio because information on loans and deposits is easily accessible.

Empirical Review

The section reviewed empirical literature linking the main macroeconomic variables to bank stability in Ghana. This study employed these macroeconomic variables real GDP, inflation, exchange rate, and interest rate.

Gross Domestic Product (GDP) and Bank Stability in Ghana

Gross domestic product (GDP) gives a comprehensive scorecard of the overall health of an economy. Thus, investors are very much concerned about a nation's GDP report in every investment decision. Positive economic growth of a country is usually shown in the size of the GDP which helps to boost corporate profits as well as stock market performance (Mburu, 2015). This implies that dwindling economic growth leads to a negative effect on stock market performance.

According to Vong *et al* (2009), the real GDP growth rate is used as a measure of the economic growth of a country and has a positive impact on the profitability of a bank. These authors stressed that, when there is favorable economic growth, the probability of borrowers defaulting is very low and vice versa. However, some studies have revealed a diverse relationship between the profitability of a bank and GPD. As some research works to support the idea of a positive relationship between these variables, others reveal otherwise. A study conducted by Sufian *et al* (2008) on Philippian banks revealed a positive

relationship between banks‟ profitability and GDP. This is in line with the work done by Athanasoglou *et al*., (2008) which showed a positive correlation between the variables. On the other hand, a study by Husni (2011) on the banks in Jordan indicated a significant and inverse relationship between ROA and GDP. Interestingly, the finding of Vong *et al* (2009) showed an insignificant relationship between the two variables.

Inflation Rate and Bank Stability in Ghana

An increase in the inflation rate increases the cost of living which shifts scarce resources from investment in stocks to household consumption. The inflationary economic situation results in to decrease in the demand for investment in stocks and banks. There is always a negative correlation between inflation and bank performance. Inflation is not good for any economy because it affects all the segments, misrepresents prices, and threatens the clear relationship that is essential to exist between the value and price of a product or service (Gurioveleen & Bhatai, 2015). The relationship between inflation and banks' performance can be positive or negative depending on whether the economy is confronted with foreseen or unforeseen inflation (Talla, 2013). If inflation is anticipated, an increase in prices would result in to increase in the firms' earnings which would lead to paying more dividends and hence increase the price of the firms' stocks. However, if inflation is unexpected, an increase in prices would increase the cost of living which consequently shifts resources from investments to consumption thereby harming stock market prices and subsequently banks performance in the banking sector. The effects of inflation on an economy are varied and can have either positive or negative repercussions. According to Mensah, Awunyo-Victor, and Sey, (2012) in May

2007, the BoG announced the adoption of a primary monetary policy that aims at targeting full-fledged inflation as a tool for the stabilization of price (inflation) levels in Ghana. Magnus and Fosu (2011) observed that low inflation and sustained growth by the BoG are premised on the common consensus that gives credence to the existing explanation that, inflation could be costly insofar as it weakens economic activity and does not help the course of poverty alleviation policies by the GoG.

Exchange Rate and Bank Stability in Ghana

The exchange rate is the value of one currency for conversion to another. Exchange rate movements greatly affect the stock market returns due to their information content to the investors. Currency volatility affects stock returns and when it appreciates, especially if it is an export-oriented country, it makes the exports less attractive thereby harming the domestic stock market. Under this scenario, the quoted companies doing the export in the country become less profitable and less attractive to investors, thus the stock market loses (Muthike & Sakwa, 2012). The frequency of exchange rate fluctuation has a major impact on the financial market (Mechri, Hamad, Peretti & Charfi, 2019). The price paid for a country's currency relative to another country's currency is known as the exchange rate (Olweny & Omondi, 2011). Exchange rate sensitivity affects the rates of return of both domestic investors who aim at diversifying their portfolios in foreign markets and foreign investors in the domestic stock market as well. Ghana is an import dominant economy, and therefore it is expected that when the currency appreciates, input costs will reduce and will invariably have a positive effect on domestic stock prices. Some notable researchers, for example, Verdelhan (2010) have conducted various studies to establish the

extent and degree of the relationship between the sensitivities of exchange rates and stock returns. Generally, exchange rate changes under a floating or flexible exchange rate system are of prime importance to both listed companies and investors on the GSE, irrespective of the nature of trading these agents. In the financial sector, there has been limited analysis of how bank stock returns respond to changes in both interest rate and exchange rate.

Over the years, many researchers have conducted studies to discover the impact of exchange rates on the profitability of banks. A study by Atindehou and Gueyie (2001) on the topic 'Canadian Banks and their exposure to foreign exchange rate risk' indicated that the profitability of Canadian Banks depended on the foreign currency variation over a period. Other research by Elyasiani and Mansur (2005) showed that data on exchange rates had a strong impact on the financial performance of a bank. This is contrary to the findings of Chamberlain, Howe, and Popper, (1997). According to Bracker, Imhof, and Lallemand (2009), variations in the U.S. Dollar are one of the major sources of bank risk. The study revealed that the exchange rate has a significant impact on profitability. However, the results of the study were not consistent, while some periods indicated a positive relationship; the others generated an inverse relationship.

Interest Rate and Bank Stability in Ghana

The key function of a stock market is to act as a mediator between borrowers and lenders (Issahatu, Ustarz & Domanban, 2013) in obtaining capital at a prevailing interest rate. Stock markets enable lenders (Banks and other financial institutions) to give credit facilities to individuals and firms who in turn use the funds for investment in stocks. The link between the stock market

and interest rate is a blend of debt and equity financing. If the rate of interest paid by banks to depositors is increased, investors will patronize the banks the more and fewer investors will invest in the stock market (Winful, Sarpong & Sarfo, 2016). On the other hand, a high-interest rate increases the cost of borrowing and at the same time reduces corporate profit and dividends, thereby affecting the share prices of firms. Researchers have reported that the financial structure of some industries makes firms in that industry more susceptible to interest rate volatilities than others (Khan & Mahmood, 2013). A rise in interest rate influences investing decisions, thus investors make changes in their investment structure, generally from the capital market to fixed income securities (Syed and Anwar 2012). Syeed and Anwar (2012) confirmed that even in the banking sector investors should invest stocks when exchange rate and interest rates are highly volatile. Though this indicates some risks and variations in expected returns, the result, however, supports the view that exchange rate and interest rate can be used as an indicator for investment decision-making in banking sector stocks. The rate of interest that is determined after adjusting for inflation is referred to as the real interest rate. Obillo (2014) highlighted that when interest rates increase or decrease; it brings about an impact on bank profitability through the change in revenues. The T-bill CBK rate will be used in this study.

Interest rates have been used in many studies as a determinant of a bank's profitability since net income interest which is the difference between interest income and interest expenses has a massive influence on the profitability of a bank (Devinaga, 2010). This researcher described interest rate as an external factor since it is determined by the economic policies of the

government and the invisible hand of demand and supply. Additionally, he stressed that the effect of change on profitability depends on the extent and speed at which interest rate differs in both short and long-run periods in the bank.

According to Devinaga (2010), banks frequently change their rate of return on their assets to cancel any differences as a result of variations in economic policies. The assets of the banks especially short-term loans have short maturity and these loans are usually flexible in terms of rate. This makes it easy for the banks to amend their rate to suit the fluctuations in the interest rate. A study by Uhomoibhi (2008), into the impact of interest rate on the profitability of commercial banks, revealed that interest rate is not only significant but also has a positive impact on profitability. The finding was in line with that of Karkra and Ameyaw and Husni (2011). Furthermore, research conducted by Pasiouras and Kosmidou (2007) on the factors influencing the profitability of domestic and foreign commercial banks in the European Union" indicated a positive relationship.

Effect of Macroeconomic Variables on Bank Stability (CAR)

A review of the literature reveals several but parallel working definitions for liquidity. Rejda (2008) defines liquidity risk as the possibility that an institution will experience a loss as a result of its inability to meet obligations as they fall due. It is the tradition of banks to use a limited amount of their resources to grant loans to entrepreneurs and consumers, thus providing them with the needed liquidity to finance their investment and consumption needs (Siaw, 2013). The net effect now is that in as much as banks gain some number of incentives in holding liquid assets as buffers, these are barely sufficient to

insure against liquidity risk or an eventual bank run as expounded by Saunders et al. (2008) as well as Bonfim and Kim (2012). As per the European Central Bank report series (Nikolaou, 2009), liquidity can be defined in the context of funding liquidity as well as market liquidity. As such, funding liquidity is defined by the Basel committee of banking supervision as the ability of banks to meet their liabilities, unwind or settle their positions as they become due, while market liquidity is defined as the ability to trade an asset at short notice, at low cost and with little impact on its price (Nikolaou,2009). As per the above definition, holding enough liquid assets at hand plays a key role in the stability of a banking institution as well as the financial sector at large given the fact that liquidity risk has the potential to lead to the failure of even solvent institutions, which may have an impact on economic growth. In this regard, this section provides a review of the empirical studies that have been conducted on the relationship between the liquidity of the banking sector and economic growth in different jurisdictions.

Ojiegbe, Oladele, and Makwe (2016) carried out a study to determine the effect of bank liquidity on economic growth in Nigeria. Using data from the central bank of Nigeria statistical bulletin covering the period between 1980 to 2013, Ojiegbe et al. (2016) employed the Ordinary Least Square (OLS) regression analysis and the econometrics co-integration test. The study established a significant and positive relationship between total bank credit ratios and economic growth in Nigeria, implying that high liquidity in banks leads to increases in banks' credit ratios and eventually in economic growth. This finding is also supported by a study conducted by Fidrmuc, Fungacova, and Weill (2015) on the contribution of bank liquidity creation to economic

growth in Russia. The authors used macroeconomics data and banking sector data between the period 2004 and 2011 employing the fixed effect model with benchmark regression. The results established a positive coefficient, implying that the liquidity creation role of banks is beneficial for economic growth.

Conceptual Framework

The study developed a conceptual framework based on the purpose of the study to examine the relationship between macroeconomic variables and stability in the banking sector in Ghana. From figure 2 below, the conceptual framework showed that macroeconomic variables have a direct relationship with banking sector stability. The study employed four indicators of macroeconomic variables namely; real GDP, monetary policy rate, inflation rate, exchange rate, and interest rate. Also, the conceptual framework included two bank-specific control variables in the empirical analysis. These variables were; return on asset and return on equity.

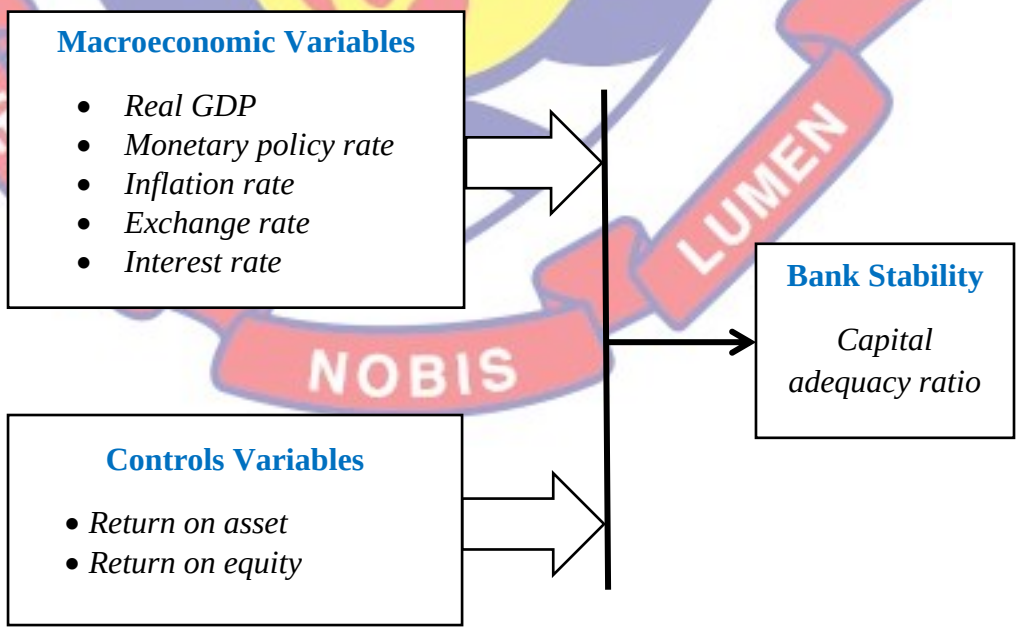

Figure 2: Conceptual framework

Source: Author's construct (2022)

Chapter Summary

The chapter reviewed theories that were related to the study. Among the theories reviewed included the Arbitrage Pricing Theory and the Theory of Bank Behavior. The study provided these theories to explain the objectives formulated. The conceptual and empirical reviews were discussed based on the objectives formulated on the relationship between macroeconomic variables and stability in the banking sector in Ghana. The chapter identified some empirical gaps and provided a conceptual framework to explain the various relationships between macroeconomic variables and bank stability in Ghana.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter discussed extensively the methods used by other researchers in similar studies and presents a framework by which data would be analyzed. This study focused on examining the relationship between macroeconomic variables and bank stability in Ghana. This chapter of the study presents the methods and data collection procedures that were employed to facilitate the conduct of this empirical investigation. This chapter seeks to describe the research design, research approach, model specification, descriptions of variables, and econometric techniques used to achieve this study's objectives

Research Paradigm

The choice of research philosophy is often influenced by the researcher's basic ontological and epistemological positions (Pittaway & Thorpe, 2012). Positivism and interpretivism are the two widely acknowledged research philosophies. Positivistic approaches seek to establish causal links and relationships between the different elements (or variables) of the subject and relate them to a particular theory or practice (Hammersley & Traianou, 2012). This study adopted the positivist philosophy due to ontological and methodological considerations. These considerations influenced the assumptions and hypotheses about relationships among study variables and testing of the hypotheses to discover relationships that would be generalized to the study population.

Research Design

This study used explanatory research that uses quantitative methods to examine the relationship between macroeconomic variables and stability in the banking sector in Ghana. The explanatory research design is employed for several reasons. Ivankova, Creswell, and Stick (2006) concluded that explanatory designs seek an in-depth explanation of the results from quantitative measures. Again, the findings of quantitative research design are more accurate and reliable due to the rigorous nature and could be generalized to represent the view of the entire population (Dudwick, Kuebnast, Jones & Woolcock, 2006).

Research Approach

The study adopted the quantitative research approach which is generally associated with the positivist paradigm. It usually involves collecting and converting data into numerical form so that statistical analysis could be made and conclusions are drawn. The quantitative approach suits the study as it addresses research questions developed into hypotheses to be tested for possible relationships between variables (Amaratunga, Baldry, Sarshar, & Newton, 2002). Moreover, the quantitative design was used because of its effectiveness in establishing statistical relationships among variables (Abba & Suleiman, 2016). Also, the adoption of quantitative research design was informed by the type of data needed for regression modeling purposes; this study used secondary data from the Bank of Ghana economic database, and using such pre-existing data was in line with empirical literature and further helped in accomplishing the objectives of the study.

Model Specification

The classical regression model for a time series model is expressed below:

$$Y_t = \emptyset_0 + \beta_i X_t + \delta_i Z_t + \mu_t \qquad for\ t = 1,2,\dots T \qquad (1)$$

Where Y_t is the endogenous variable for the *tth* period; $\emptyset_0$ is the intercept; β_i indicates the coefficients of the explanatory variables ($\beta_i \neq 0$) and δ_i represents the coefficients of the control variables ($\delta_i \neq 0$). X_t represents the vector of explanatory variables for the *tth* period. Z_t represents the vector of control variables for the *tth* period. It is assumed that μ_t satisfies the assumptions of the classical model.

The relation between bank stability and macroeconomic variables was analyzed under the analytical framework of Alfadli et al. (2020); Okyere et al. (2022); Koju et al. (2018); and Al-Homaidi et al. (2018), the benchmark regression model was set as follows:

$$CAR_t = \emptyset_0 + \beta_1 LnGDP_t + \beta_2 MPR_t + \beta_3 INF_t + \beta_4 EXR_t + \beta_5 INT_t + \beta_1 ROA_t + \beta_1 ROE_t + \mu_t \qquad (2)$$

The explanatory variables included the natural log of real gross domestic product (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), and control variables; return on assets (ROA) and return on equity (ROE). The endogenous variable is the capital adequacy ratio (CAR).

A Prior Expectations

Table 1 below depicts the expected signs of the explanatory variables based on theoretical and empirical literature discussed in Chapter 2.

Table 1: A prior expected sign of the explanatory variables

Variables	Model 1 (CAR)
LnGDP	+
MPR	-
INF	-
EXR	-
INT	-
ROA	+
ROE	+

Source: Author's computation (2022)

Notes: Capital adequacy ratio (CAR), the natural log of real gross domestic product (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), return on assets (ROA) and return on equity (ROE).

Pre-Estimation Technique

Unit root test

A stochastic process for a variable Y_t is said to be stationary if its mean and co-variance are time-invariant; covariance and correlation between random variables Y_t and Y_s are dependent on time interval with lag k. If the variables are not stationary, then estimation may lead to spurious results which have no economic meaning. The stationarity test is vital for improving the reliability as well as the accuracy of the models that would be developed (Dickey et al., 1979; Yesuf et al., 2018). This study used the Phillips-Perron (PP) test to test for stationarity in the variables. When the long-run relationship between variables is estimated without checking their stationarity, it may result in a spurious regression. Unit root tests are used to test if the series are integrated into the order of one *I* (1).

Phillips and Perron (PP) Test

Literature has found the PP test to be more robust than the DF and ADF tests (Kwiatkowski et al., 1992; Phillips et al., 1988). Phillips et al. (1988) developed several unit roots tests that have become popular in the analysis of financial time series. Although the PP tests tend to be more powerful, also subject to more severe size distortions. The Phillips-Perron unit root test is a non-parametric test good for overcoming serial correlation and heteroscedastic errors. The Phillips-Perron generalized ADF test is specified as:

$$\Delta Y_t = \alpha_0 + \rho Y_{t-1} + \sum_{i-1}^{q} \beta_i \Delta Y_{t-i} + \alpha_1 t + \mu_t,\ \epsilon_t \sim I(0) \quad (3)$$

The test statistic used to reject the null hypothesis or otherwise is presented as:

$$t_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0}\right)^{1/2} + \frac{T(f_0 - \gamma_0)\left(se(\hat{\alpha})\right)}{2{f_0}^{1/2}s} \quad (4)$$

Where $(\hat{\alpha})$ is the estimated parameter and $se(\hat{\alpha})$ is the associated standard error for the test. Based on the above Eqn. (2.1 & 2.5), the null (H_0) and alternative hypotheses (H_1) for the unit root test in Y_{t-1} are: H_0: $\rho = 0$ (Y_t is non-stationary) against H_1: $\rho < 0$ (Y_t is stationary).

Econometric Model

The Autoregressive Distributed Lag (ARDL) Model

This study used the ARDL model due to the following benefits over other cointegration models. First, the autoregressive distributed lag model is superior in consideration regardless of sample size, which can be either small or finite and consist of 30 to 80 observations (Ghatak and Siddiki 2001). Second, this approach is more suitable when variables integrate in a different order, as when some variables are *I* (0), and some variables are *I* (1). Third, modeling

ARDL with the appropriate lags is correct for both serial correlation and the indigeneity problem (Pesaran et al. 2001). Fourth, the ARDL model, simultaneously, can estimate long-run and short-run cointegration relations and provide unbiased estimation for the study (Pesaran et al. 2001). A simplified ARDL model for these variables X, Y, and Z can be expressed as:

$$\Delta y_t = \emptyset_0 + \gamma_1 y_{t-1} + \gamma_2 x_{t-1} + \gamma_3 z_{t-1} + \sum_{i=1}^{a} \beta_{1i} \Delta y_{t-i} + \sum_{i=0}^{b} \beta_{2i} \Delta x_{t-i} + \sum_{i=0}^{c} \beta_{3i} \Delta z_{t-i} + \mu_t \quad (5)$$

Where, γ_1, γ_2, and γ_3 are long-run coefficients whose sum is equivalent to the error correction term at the VECM model, and β_{1i}, β_{2i} and β_{3i} are short-run coefficients.

The generalized ADRL model for assessing macro-economic variables' effect on the bank stability of Ghana was as follows;

$$\Delta CAR_t = \emptyset_0 + \sum_{i=1}^{a} \varphi_i \Delta CAR_{t-i} + \sum_{i=0}^{b} \varphi_i \Delta LnGDP_{t-i} + \sum_{i=0}^{c} \varphi_i \Delta MPR_{t-i} + \sum_{i=0}^{d} \varphi_i \Delta INF_{t-i} + \sum_{i=0}^{e} \varphi_i \Delta EXR_{t-i} + \sum_{i=0}^{f} \varphi_i \Delta INT_{t-i} + \sum_{i=0}^{g} \varphi_i \Delta ROA_{t-i} + \sum_{i=0}^{h} \varphi_i \Delta ROE_{t-i} + \lambda_1 CAR_{t-1} + \lambda_2 LnGDP_{t-1} + \lambda_3 MPR_{t-1} + \lambda_4 INF_{t-1} + \lambda_5 EXR_{t-1} + \lambda_6 INT_{t-1} + \lambda_7 ROA_{t-1} + \lambda_8 ROE_{t-1} + \mu_t \quad (6)$$

Where, Δ was the first-order differential operator, μ_t was the error term (white noise), $t-1$ was for the lagged period, and λ_1 to λ_8 were the long-run coefficient. Whether there was a long-term equilibrium relationship

between horizontal variables can be tested using F-statistic, and the null hypothesis was that there was no long-term equilibrium relationship.

Bounds test for the existence of a level relationship

The bound test for examining the long-run association among variables can be conducted using F tests. to determine the joint significance of lagged levels of the variables involved. Pesaran et al. (2001) provide two sets of asymptotic critical values for the F-test. One set assumes that all the variables are *I* (0) and another assumes they all are *I* (1). The null hypothesis of the non-existence of a long-run relationship is denoted by $H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = \lambda_7 = \lambda_8$ against $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq \lambda_7 \neq \lambda_8$.

For decision-making criteria about (H_0 *or* H_1), Pesaran et al. (2001) proposed the following procedure;

1. If F_s > upper bound of critical value, confirm the existence of cointegration.
2. If F_s < lower bound of critical value, conform variables are not cointegrated.
3. If F_s ≤ upper bound and ≥ lower bound of critical value then the conclusive decision may not reach about variables cointegration.

Once, the long-run association is established, the next two steps need to be executed to estimate the long-run and short-run coefficients of the proposed ARDL models. The long-run ARDL (a, b, c, d, e, f, g, h) equilibrium model is as follows:

$$CAR_t = \emptyset_0 + \sum_{i=1}^{a} \varphi_1 CAR_{t-i} + \sum_{i=0}^{b} \gamma_2 LnGDP_{t-i} + \sum_{i=0}^{c} \delta_3 MPR_{t-i} + \sum_{i=0}^{d} \eta_4 INF_{t-i} + \sum_{i=0}^{e} \zeta_5 EXR_{t-i} + \sum_{i=0}^{f} \theta_6 INT_{t-i} + \sum_{i=0}^{g} \psi_7 ROA_{t-i} + \sum_{i=0}^{h} \omega_8 ROE_{t-i} + \varepsilon_t \quad (7)$$

The lag lengths of the ARDL model are to be estimated using Akaike Information Criterion (AIC). Using time series data for the study, Pesaran et al. (2001) proposed that the maximum lag length is 2. The short-run elasticities can be derived by formulating the error correction model as follows:

$$\Delta CAR_t = \emptyset_0 + \sum_{i=1}^{a} \varphi_1 \Delta CAR_{t-i} + \sum_{i=0}^{b} \gamma_2 \Delta LnGDP_{t-i} + \sum_{i=0}^{c} \delta_3 \Delta MPR_{t-i} + \sum_{i=0}^{d} \eta_4 \Delta INF_{t-i} + \sum_{i=0}^{e} \zeta_5 \Delta EXR_{t-i} + \sum_{i=0}^{f} \theta_6 \Delta INT_{t-i} + \sum_{i=0}^{g} \psi_7 \Delta ROA_{t-i} + \sum_{i=0}^{h} \omega_8 \Delta ROE_{t-i} + \lambda_9 ECM_{t-1} + \nu_t \quad (8)$$

where the error correction model can be expressed as;

$$ECM_{t-1} = CAR_t - \emptyset_0 - \sum_{i=1}^{a} \varphi_1 CAR_{t-i} - \sum_{i=0}^{b} \gamma_2 LnGDP_{t-i} - \sum_{i=0}^{c} \delta_3 MPR_{t-i} - \sum_{i=0}^{d} \eta_4 INF_{t-i} - \sum_{i=0}^{e} \zeta_5 EXR_{t-i} - \sum_{i=0}^{f} \theta_6 INT_{t-i} - \sum_{i=0}^{g} \psi_7 ROA_{t-i} - \sum_{i=0}^{h} \omega_8 ROE_{t-i} \quad (9)$$

Description of Variables

The variables used in this study were the capital adequacy ratio which served as the endogenous variable. The natural log of real gross domestic product, monetary policy rates, inflation rate, exchange rate, and interest rate were the explanatory variables while controlling return on assets and equity.

Capital adequacy ratio (CAR)

The Capital Adequacy Ratio (CAR), measures the degree of banks' solvency, stability, and soundness as well as their ability to absorb risk. CAR

estimates a bank's internal strength to absorb different risks including the risk of loan losses (Kumar 2018; Dhar et al., 2015). It is expressed as a proportion of capital to risk-weighted assets. According to some studies (Makri et al., 2014 & Dhar et al., 2015). CAR is negatively related to credit risk; Olarewaju (2020), reported that capital adequacy has a significant and indirect impact on the credit risk of the banks in Low Middle Income (LMI) economies. This means an increase in CAR will enable banks to keep more funds aside to meet liabilities and other obligations hence reducing the number of initial loans.

Real gross domestic product (LnGDP)

Real gross domestic product is a macroeconomic indicator for the overall economic conditions prevailing in the country. Following studies like Fofack (2005), Rajan et al. (2003), and Salas et al. (2002) argue that an improvement in gross domestic product growth is an indication of improvement in the standard of living and hence improvement in loan repayment which improves the liquidity of banks in the country. Economic growth is computed as the natural log of real gross domestic product. This variable is a proxy that measures the stage of development of an economy is in (Alexius & Sp, 2018).

Monetary policy rate (MPR)

Monetary policy rates are used to adjust the quantity of money in circulation and control interest rates (Aliyu, Saidu, Zubair, & Dawood, 2017). As regards the links to monetary policy, the relationship between interest rates, bank lending channels, and banking stability is crucial. As documented in Meeks (2017), a contractionary monetary policy shock harms the level of commercial bank assets but increases bank stability. This finding has been

confirmed in several other studies including Mazelis (2016) and Chen (2018). The monetary policy rate adjusts the short-term nominal interest rate in response to the money-growth rate, output, and inflation (Taylor, 1993 & Yang, 2019).

Inflation rate (INF)

Finance literature argues that bank performance is responsive to macroeconomic sensitivities (Nguena & Abimbola, 2015). Inflation (INF) is used to control for macroeconomic factors influencing financial stability (Jokipii & Monnin, 2013). Banks could benefit from higher price margins during inflationary periods to increase their profitability which contributes to greater financial stability (Jokipii et al., 2013). This study employed the inflation rate as a proxy for monetary instability (Beck, Demirgüç-Kunt, & Levine, 2006).

Exchange rate (EXR)

Currency fluctuations are due to the frequent changes in demand and supply mostly influenced by various internal and external factors (Abor, 2008). Companies are exposed to various foreign exchange risks due to these currency fluctuations. Most banks engage in various international transactions for companies such as exporting products to foreign countries or importing raw materials for production.

It is therefore important to know how the exchange rate is impacting their liquidity especially as the country has had a very unstable currency exchange rate over the period under consideration (Osoro & Ogeto, 2014). The cedi to the dollar exchange rate was used in this study because it was observed that it is the currency exchange mostly used by the banks under consideration.

Interest rate (INT)

The price charged annually to a borrower by a lender for the borrower to obtain a loan is referred to as the interest rate. The rate of interest is a measure of the return rate that lenders expect and thus should reflect all the available information with regards to the risk undertaken as well as the future changes in the purchasing power (Osoro et al., 2014). A high bank lending rate means a high cost of borrowing which is a disincentive to borrowing. Interest rate changes can also impact the value of a firm's assets, liabilities, and the present value of its future cash flows. It is thus important to conduct further studies to look at the effect of interest rates on the financial distress of banks.

Return on asset (ROA)

ROA is the ratio of income to total assets and it is a measure of a bank's profitability (Amalia, 2021; Chavali & Rosario, 2018; Derbali, 2021). It is an indication of the efficiency of management of an organization in generating a net income from all the resources it owns. In the context of emerging market economies, the findings of Godlewski (2004) indicate that there is a negative impact of ROA on the level of non-performing loans.

Return on equity (ROE)

Several ratios can be used to measure the performance of a bank which include return on net asset, return on capital, return on investment and return on equity (Amalia, 2021; Chavali & Rosario, 2018; Derbali, 2021). ROE focuses on returns to shareholders of the bank which was employed in this study to assess how bank performance affects banking sector stability in Ghana (Adusei, 2015; Akani, Nwanna & Mbachu, 2016).

Summary of Variables

Table 2: Description of variables, measurement, and data sources

Variable	Measurement	Data Source
CAR	Bank regulatory capital to risk-weighted assets (%)	BoG (2007 – 2021)
LnGDP	Natural log of real gross domestic product	BoG (2007 – 2021)
MPR	Monetary policy rate (%)	BoG (2007 – 2021)
INF	Inflation, consumer prices (annual %)	BoG (2007 – 2021)
EXR	Official exchange rate (GHS/US$),	BoG (2007 – 2021)
INT	Lending interest rate (%),	BoG (2007 – 2021)
ROA	The ratio of net income to total asset (%)	BoG (2007 – 2021)
ROE	The ratio of net income to total equity (%)	BoG (2007 – 2021)

Source: Author's computation (2022)

Estimation Technique

Several cointegration methods are available to use among those widely used methods including the residual bases Engle and Granger (1987) test, the maximum likelihood-based Johansen (1991); and the Johansen (1995) and Johansen and Juselius (1990) tests. Having a limitation with those models, in recent times, the ordinary least square (OLS) based autoregressive distribution lag (ARDL) approach become popular among researchers. The additional privilege over other cointegration methods is flexibility, this model allows a set of variables that are integrated in a different order (Pesaran et al. 2001). Moreover, a dynamic error correction model (ECM) can be derived from ARDL by using the linear transformation (Banerjee et al., 1993). More importantly, the

ARDL approach may be used regardless of the stationarity of the variables which eliminates the pre-testing issues that come with conventional methods.

Data Collection Procedures

This study employed secondary monthly data on bank stability measured by capital adequacy ratio, macroeconomic variables; the natural log of real gross domestic product, monetary policy rate, inflation rate, exchange rate, interest rate, and other control variables such as; return on asset and return on equity. The secondary data employed in the study were obtained from the Bank of Ghana economic data. The time-series data obtained utilized monthly information for a fifteen-year period which spans from January 2007 to December 2021, totaling 180 monthly data for the analysis, to make it feasible to hand-collect most of the information required in the study (Lütkepohl & Netšunajev, 2018). The period of the analysis (2007-2021) was a result of the availability of data on all the variables used.

Chapter Summary

This chapter presented the key variables and the appropriate econometric tests used to estimate the impact of macroeconomic variables on bank stability in Ghana. The explanatory research design was employed as it seeks to explain the relationships between macroeconomic variables and bank stability in Ghana. The Phillips-Perron test was used to investigate the stationarity of the variables. The bounds test was used to determine the existence of a level relationship among the variables. The autoregressive distributed lag model was used to examine both the short and long-run dynamics between the endogenous, explanatory, and control variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the empirical analysis of the relationship between macroeconomic variables and bank stability in Ghana. This chapter, therefore, presents and discusses the results of the study. The chapter presents the results of the descriptive statistics of the variables of interest, and a correlation matrix to assess multicollinearity. Furthermore, the unit root test and the bounds test to test cointegration between the endogenous and the explanatory variables were presented. The results from the Autoregressive Distributed Lags model to assess the short-run and long-run dynamics were presented, discussed, and related to empirical findings and the objectives of the study. Finally, the chapter presented a diagnostics test and a chapter summary.

Descriptive Statistics

Table 3 presented the descriptive analysis of 180 observations from the time series variables. The study presented the means, standard deviation, range, minimums, maximums, skewness, kurtosis, the Jarque-Bera test of normality, and the observations used for the study. The study used the capital adequacy ratio as a proxy for bank stability. The average CAR was 17.24% with volatility measured by the standard deviation of 2.173. Furthermore, LnGDP, MPR, INF, EXR, INT, ROA and ROE averaged 9.95, 17.06%, 12.42%, 3.08%, 17.35%, 3.86%, and 22.40% respectively. Most of the variables exhibited a long right tail (positive skewness) with MPR having the longest right tail. While CAR, LnGDP, MPR, INF, EXR, INT, and ROA exhibited platykurtic distribution,

ROE exhibited a mesokurtic distribution of the normal. Jarque-Bera test statistic which operates under the null hypothesis that series are normally distributed showed that CAR, ROA, and ROE are normally distributed while the remaining variables rejected the null hypothesis at 5% sig. level.

Table 3: Descriptive statistics of key variables

	CAR	LnGDP	MPR	INF	EXR	INT	ROA	ROE
Mean	17.24	9.95	17.06	12.42	3.08	17.35	3.86	22.40
Std. Error	0.16	0.06	0.30	0.28	0.13	0.30	0.08	0.37
Std. Dev.	2.17	0.76	3.97	3.79	1.70	3.99	1.04	4.97
Kurtosis	-0.60	-1.12	0.00	-0.93	-1.47	-1.51	-0.07	0.03
Skewness	-0.09	-0.70	0.97	0.59	0.25	0.19	0.45	0.11
Range	10.00	2.34	13.50	13.74	5.03	12.50	5.00	27.00
Min	13.00	8.47	12.50	7.00	0.92	11.00	1.00	7.00
Max	23.00	10.81	26.00	20.74	5.95	23.50	6.00	34.00
Jarque-Bera	3.12	23.8	27.97	17.06	17.85	17.96	5.95	0.38
Probability	0.21	0.00*	0.00*	0.00*	0.00*	0.00*	0.05	0.83
Obs.	180	180	180	180	180	180	180	180

Source: Author's computation (2022)

Notes: Estimation period = 2007:M1–2021:M12 and all calculations were made using Stata 16.0. *Rejection of the null hypothesis at 5% sig. level. Capital adequacy ratio (CAR), the natural log of gross domestic product (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), return on assets (ROA) and return on equity (ROE).

Correlation Analysis

A Pearson correlation analysis was conducted to explore the relationships between bank stability (CAR), natural log of real GDP growth (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), return on asset (ROA), and return on equity (ROE).

Correlation analysis was examined to check whether there was multicollinearity among the explanatory variables as this problem underestimates the statistical significance of the explanatory variables leading to unstable regression coefficients (Allen, 1997; Kim, 2019; Shrestha, 2020). The results showed varied relationships between the endogenous and explanatory variables. The hypotheses were tested at 1%, 5%, and 10% significance levels respectively. From the results presented in Table 4, there was a significant positive linear relationship between bank stability (CAR) and natural log of real GDP (LnGDP), *[r = .370; p < .001]*. Similarly, bank stability (CAR) and exchange rate (EXR); bank stability (CAR) and return on asset (ROA) exhibited a positive correlation with *[r = .607; p < .001]* and *[r = .175; p < .05]* respectively. On the contrary, monetary policy rate (MPR), inflation rate (INF), lending interest rate (INT), and return on equity (ROE) showed an inverse relationship with capital adequacy ratio (CAR) at the 1% significance level.

The findings from the results implied that rising economic growth, exchange rate fluctuations, and management efficiency could improve the capital adequacy in the banking sector of Ghana. However, increasing returns to shareholders, monetary policy, inflation, and lending interest rates could adversely affect the capital adequacy of banks in Ghana. Collinearity makes it difficult to distinguish the effect of one variable from the effect of another in the regression model (Lindner et al., 2020; Adam et al., 2017). The correlation matrix reveals that there were no issues of multicollinearity because of low correlations between the explanatory variables as there was no correlation coefficient of more than 0.85 which is usually a precursor to collinearity (Allen, 1997; Adam et al., 2017; Kim, 2019; Shrestha, 2020)

Table 4: Correlation matrix of key variables

Variables	CAR	LnGDP	MPR	INF	EXR	INT	ROA	ROE
CAR	1							
LnGDP	0.370***	1						
MPR	-0.199**	0.337***	1					
INF	-0.564***	-0.0497	0.657***	1				
EXR	0.607***	0.807***	0.253***	-0.249***	1			
INT	-0.221**	0.141	0.671***	0.672***	-0.00982	1		
ROA	0.175*	0.340***	0.237**	0.181*	0.127	0.551***	1	
ROE	-0.242**	0.0739	0.0800	0.314***	-0.253***	0.469***	0.757***	1

Source: Author's computation (2022)

Notes: Estimation period = 2007:M1–2021:M12 and all calculations were made using Stata 16.0. Capital adequacy ratio (CAR), the natural log of gross domestic product (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), return on assets (ROA) and return on equity (ROE). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Multicollinearity Test

To detect multicollinearity issues, this study further examined the correlation matrix presented in Table 4 by using the Variance Inflation Factor (VIF) and the Tolerance values (1/VIF) as shown in Table 5 below. Variance Inflation Factor (VIF) and Tolerance were used to measure the severity of multicollinearity in an ordinary least square regression (Adam et al., 2017). The higher the value of VIF or the lower the tolerance values the worse the problem; the results presented in Table 5 showed that all the explanatory variables have a variance inflation factor below 5 and tolerance values greater than 0.2. These indicated that there were no collinearity issues between the explanatory variables *[Mean VIF = 3.81 < 5]*.

Table 5: Multicollinearity test

Variables	VIF	1/VIF
EXR	4.77	0.210
LnGDP	4.03	0.248
ROE	3.94	0.254
ROA	3.88	0.258
INT	3.46	0.289
MPR	3.34	0.299
INF	3.25	0.308

Source: Author's computation (2022)

Notes: Estimation period = 2007:M1–2021:M12 and all calculations were made using Stata 16.0. Capital adequacy ratio (CAR), the natural log of gross domestic product (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), return on assets (ROA) and return on equity (ROE). *VIF* represents the variance inflation factor while *1/VIF* is the tolerance value.

Unit Root Test

Performing a unit root test is vital in minimizing spurious regression since it ensures that variables used in regression are stationary by differencing them and estimating the equation of interest through the stationary processes (Mahadeva and Robinson 2004). The Phillips Perron methods (Choi 2001; Hadri 2000; Maddala & Wu 1999) assume the unit root process as a null hypothesis of a unit root. An informal stationary test was done by analyzing the trend of the variables used in the study. It could be seen that variables seem to follow the same trend. Most of the series are trending series, which suggests that these series are not stationary. They are seen to be *I* (1), that is, they have stochastic trends. After the first difference of all the variables, they become stationary as they revert around the mean (see Appendix A & B).

Furthermore, the P-P test is applied to investigate the presence of unit root in the time series data. The results of the stationary test are presented in Table 6. The stationary test shows the mixed order of integration of variables. Among all the variables, CAR, ROA, and ROE conform to stationary at the level *I*(0) and the remaining variables conform to stationary after the first difference but there is no variable integrated after the second difference *I*(2). A mixed order of integration allows for performing ARDL bound testing, initially proposed by Pesaran and Shin (1998) and after further development conducted by Pesaran et al. (2001) to capture long-run cointegration among variables.

Table 6: Unit root test- PP test

	Level			*First Difference*				
Variables	*Z(t)*	*5% CV*	*p-value*	*Z(t)*	*5% CV*	*p-value*	No. of Lags	Order of Integration (*I*)
CAR	-3.914	-3.439	0.0116*	-17.295	-4.014	0.0000*	1	0
LnGDP	-2.287	-3.439	0.4413	-13.083	-4.014	0.0000*	1	1
MPR	-0.759	-3.439	0.9690	-12.992	-4.014	0.0000*	1	1
INF	-1.552	-3.439	0.8105	-11.006	-4.014	0.0000*	1	1
EXR	-2.304	-3.439	0.4319	-16.516	-4.014	0.0000*	1	1
INT	-1.709	-3.439	0.7468	-7.977	-4.014	0.0000*	1	1
ROA	-4.368	-3.439	0.0025*	-22.595	-4.014	0.0000*	1	0
ROE	-5.209	-3.439	0.0001*	-20.140	-4.014	0.0000*	1	0

Source: Author's computation (2022)

Notes: Capital adequacy ratio (CAR), the natural log of gross domestic product (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), return on assets (ROA) and return on equity (ROE). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, CV represents the critical values at 5% sig. level.

Cointegration Test Results

Before estimating the long-run coefficient, it was necessary to determine the lag order of the model. Table 7 presented the computed F-values for testing the existence of a long-run equation under the null hypothesis (no levels relationship). The F-statistics in Table 7 need to be compared with the critical bounds provided by Kripfganz et al. (2020); Pesaran et al. (2001). The outcome of the bounds test critically depends on the choice of the lag order, *p*. Thus, conditional models were estimated by imposing a maximum of three lags on the model and using Akaike Information Criterion (AIC).to select the optimum number of lags. The null hypothesis that no long-run relationship exists was conclusively rejected when the lag order of one (*p = 1*) was used, as suggested by the AIC and ARDL (1,0,1,0,1,0,0,0) was identified to be appropriate.

Table 7: ARDL bounds test for the existence of a level relationship

Maximum Lags	Lag order	F-statistic	Sig. level	Critical bound F- statistic	
				I (0)	*I* (1)
1	ARDL(1,0,1,0,1,0,0,0)	3.822[a]	1%	2.96	4.26
			5%	2.32	3.50
			10%	2.03	3.13
2	ARDL(2,0,0,0,1,1,2,0)	2.361[b]	1%	2.96	4.26
			5%	2.32	3.50
			10%	2.03	3.13
3	ARDL(2,0,0,3,1,0,2,2)	2.587[b]	1%	2.96	4.26
			5%	2.32	3.50
			10%	2.03	3.13

Source: Author's computation (2022)

Notes: Estimation period = 2007:M1–2021:M12 and all calculations were made using Stata 16.0. F-test is the statistics for testing zero restrictions on the coefficients of the lagged level variables in the particular model. Superscript a indicates that the statistic lies above the upper bound and superscript b indicates that it falls in between the lower and the upper bounds at 5% sig. level. Source of critical values: Pesaran et al. (2001).

Long-Run Dynamics from the ARDL Model

The primary motivation for choosing the ARDL model to achieve the objectives of this study of examining the short and long-run dynamics of the macroeconomic variables on bank stability in Ghana was to avoid serial correlation and the endogeneity problem and simultaneously estimate long-run and short-run cointegration relations from an unbiased estimation (Pesaran et al. 2001). The short and long-run dynamics between macroeconomic variables and bank stability measured by the capital adequacy ratio (CAR) were analyzed and presented in Table 8.

The results in Table 8 showed that exchange rate and return on asset influence bank stability and play an important role in explaining the long-run effect. The long-run equation showed that exchange rate and return on assets contribute positively to bank stability in Ghana, at the 1% and 5% sig. levels respectively. On the contrary, the natural log of real GDP, monetary policy rate, inflation rate, interest rate, and return on shareholder's equity does not matter for the stability of banks in the long run. In conclusion, in the long run, the degree of exchange rate grew by 1 unit and the capital adequacy ratio grew by about 0.962 units, also a unit increase in the returns of resources utilization increased the capital adequacy ratio by 1.616 units in the long term. This meant that in the long run, the degree of the exchange rate (EXR) and return on the asset (ROA) measured the volatility of the value of the Cedi to the Dollar and the efficient utilization of resources by management respectively can promote bank stability in Ghana.

Table 8: Estimation of the long and short-run results of the ARDL model

Variables	CAR	LR	SR
ECM (-1)			-0.289***
			(0.0567)
L.CAR	0.711***		
	(0.0567)		
LnGDP	-0.288	-0.995	
	(0.180)	(0.631)	
MPR	-0.243*	-0.110	
	(0.135)	(0.108)	
L.MPR	0.211		
	(0.129)		
INF	-0.0400	-0.138	
	(0.0337)	(0.113)	
EXR	-1.691**	0.962***	
	(0.781)	(0.310)	
L.EXR	1.969**		
	(0.778)		
INT	0.00962	0.0332	
	(0.0317)	(0.110)	
ROA	0.336**	1.161**	
	(0.151)	(0.450)	
ROE	-0.0303	-0.105	
	(0.0301)	(0.0969)	
D.MPR			-0.211
			(0.129)
D.EXR			-1.969**
			(0.778)
Constant	7.323***		7.323***
	(1.928)		(1.928)
R^2	*0.836*	*0.193*	*0.193*
Adj. R^2	*0.827*	*0.145*	*0.145*
Root MSE	*0.906*	*0.906*	*0.906*
F- stats	*85.88*	-	-
P-value	*0.000*	-	-
Log-likelihood	*-230.732*	*-230.732*	*-230.732*
No. of Obs.	*180*	*180*	*180*

Source: Author's computation (2022)

Notes: Estimation period = 2007:M1–2021:M12 and all calculations were made using Stata 16.0. Capital adequacy ratio (CAR), the natural log of gross domestic product (LnGDP), monetary policy rate (MPR), inflation rate (INF), exchange rate (EXR), interest rate (INT), return on assets (ROA) and return on equity (ROE). ECM represents the error correction model, *LR* and *SR* represent long-run and short-run cointegration results respectively, *D* denotes the difference operator and *L* is the Lag. *Lag order: ARDL (1,0,1,0,1,0,0,0).* * *p < 0.05,* ** *p < 0.01,* *** *p < 0.001*, Robust Standard errors are in parentheses.

Discussion of Results

The results were consistent with prior empirical findings as Liou (2007) stipulated that several macroeconomic variables are closely associated with failure, and have predictive value in specifying the relationship between financial distress and eventual failure. Bichanga (2016) concluded that the exchange rate has a positive influence on the corporate liquidity risk of microfinance banks. The frequency of exchange rate fluctuation has a major impact on the financial market (Mechri, Hamad, Peretti & Charfi, 2019, Muthike & Sakwa, 2012). A study by Atindehou and Gueyie (2001) indicated that the profitability of banks depended on the foreign currency variation over a period. Other research by Elyasiani and Mansur (2005) showed that exchange rates had a strong impact on the financial performance of a bank. According to Bracker, Imhof, and Lallemand (2009), variations in the U.S. Dollar are one of the major sources of bank risk. Singh et el. (2021), revealed that ROA has a positive and significant effect on bank stability. Also, Dwumfour (2017) posited that higher returns reduce liquidity risk or improve banking sector stability.

Contrary to the literature, Ali and Marsida (2015) found that credit growth in the Albanian banking system is positively related to GDP growth and inflation rate. Also, Singh et el. (2021) concluded that inflation has a significant and positive effect on credit risk. Amuakwa–Mensah et al. (2015) reported that the previous year's inflation negatively and significantly affects credit risk in the Ghanaian banking industry. Bichanga (2016) concluded that the consumer price index (CPI), gross domestic product (GDP), and interest rate positively and significantly influenced the corporate liquidity risk of microfinance banks. Benito et al. (2004) showed that the growth of GDP in real terms and financing

costs are both significant predictor variables of bankruptcy probability for Spanish firms. The findings of Godlewski (2004) indicate that there is a negative impact of return on the asset on the level of bank stability.

Short-Run Dynamics Adjustments

The short-run results are presented in Table 8. The results showed that in the short run, the exchange rate harms bank stability in Ghana although the monetary policy rate is insignificant. This result may imply that in the short run, a higher exchange rate will affect bank stability negatively. However, in the long run, the effect becomes different. More importantly, the error correction model, ECM (1), is statistically significant and has the expected negative sign. This coefficient gives a measure of the average speed at which bank stability adjusts to a change in equilibrium conditions. Moreover, the adjustment coefficient of the error correction terms was -0.289, indicating that when the short-term fluctuation deviated from the long-term equilibrium, it could be pulled back to equilibrium with an adjustment intensity or convergence speed of 28.9% and that bank stability tended to be self-stabilized.

Mechri et al. (2019) and Muthike et al. (2012), found similar results as the frequency of exchange rate fluctuation has a major impact on financial institutions. Similarly, the main cause of bank risk is the volatility of the value of the US dollar (Bracker et al., 2009). Also, Atindehou et al. (2001) argued that the profitability of banks depended on the foreign currency variation. On the contrary, Bichanga (2016) concluded that interest rate has a positive influence on the corporate liquidity risk of microfinance banks. Syeed et al. (2012) confirmed that even in the banking sector investors should invest stocks when interest rates are highly volatile.

Diagnostics of the ARDL model

To avoid misleading statistical inferences, the study verified and validated the model through diagnostic and stability checks. The study utilized various diagnostic tests for model validity, which included autocorrelation, heteroscedasticity, and the Ramsey RESET test proposed by Pagan and Hall (1983). The results presented in Table 9 showed that the null hypothesis cannot be rejected at the 5% sig. level, which confirmed that the specified model's residuals are homoscedastic, and not autocorrelated, which is desirable for a stable econometric model. Moreover, the ADRL model was correctly specified based on the Ramsey RESET test *[d.f = 3, t = 1.15, p > 0.05]*.

Table 9: Model diagnostics

Test	Test statistic	df	p-value
Ramsey RESET test (*F-value*)	1.15	3	0.332
Heteroskedasticity:			
White's test (χ^2)	62.73	65	0.557
Breusch-Pagan (χ^2)	0.86	1	0.352
Autocorrelation:			
Breusch-Godfrey LM test (χ^2)	3.427	1	0.064
Durbin-Watson	2.205		

Source: Author's computation (2022)

Notes: *df* represents the degrees of freedom.

Next, the study performed the stability tests for the ECM model. The tests were applied to the residuals of the ECM model. It can be seen from Figure 3 that the plot of CUSUM squared stayed within the 5% critical bound, which

suggested the stability of the residual variance. Thus, the results indicated the absence of instability of ARDL error correction model coefficients.

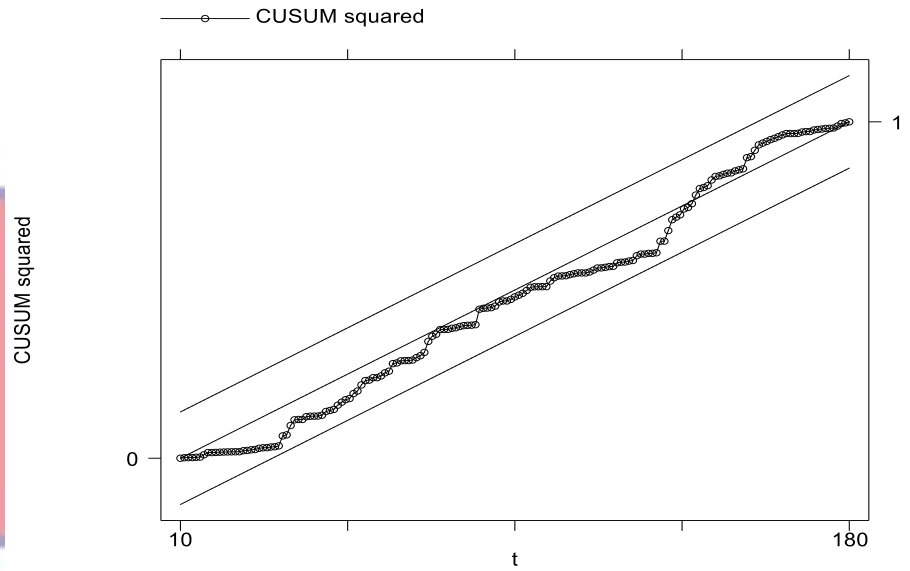

Figure 3: Parameter stability test of the ARDL- ECM

Source: Author's computation (2022)

Notes: The straight lines represent critical bounds at 5% sig. level.

Chapter Summary

This chapter analyzed the objectives of the study and related them to the literature on the relationship between macroeconomic variables and bank stability. The study used the ARDL bounds test. Precisely, it was observed in the long run that exchange rate and return on assets have a significant effect on banking sector stability at 1% and 5% sig. levels respectively. However, real GDP, monetary policy rate, inflation rate, interest rate, and return on equity do not contribute to bank stability in Ghana. Exchange rates in Ghana have a short-term detrimental impact on bank stability, even when MPR is negligible. Also, short-run dynamic adjustments revealed that with a significant rate of adjustment to an equilibrium of 28.9%, this takes approximately 3.5 months for

bank stability and macroeconomic variables to converge in Ghana. The chapter concluded on diagnostics on the ARDL model and revealed that there was no significant departure from the standard assumptions.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The other chapters have covered the problem statement, review of the literature regarding macroeconomic variables and bank stability, time series methodology, and the presentation of the results. This chapter summarizes the entire research, provides conclusions and makes recommendations for the steps to be taken for a stable financial environment. The short and long-run dynamics between macroeconomic variables and bank stability measured by the capital adequacy ratio were analyzed using the Autoregressive Distributed Lag Error Correction Model (ARDL-ECM). The research hypotheses which guided the study were:

H_1: There is a significant long-run relationship between macroeconomic variables and bank stability in Ghana.

H_2: There is a significant short-run relationship between macroeconomic variables and bank stability in Ghana.

Summary of Findings

This study examined the short-run and long-run dynamic relationship between bank stability, real GDP, monetary policy rates, inflation, exchange rates, interest rates, return on asset and return on equity. The data used was monthly and spans from January 2007 to December 2021 from the Bank of Ghana economic data. Times-series econometric techniques in the form of unit root, bounds test, and the ADRL error correction model were employed. The findings of Phillips-Perron tests revealed mixed order of integration of the

variables, thus *I* (0) and *I* (1). When the lag order of one (p = 1) was adopted, as indicated by the AIC and ARDL (1,0,1,0,1,0,0,0) was determined to be suitable, the null hypothesis that there is no long-run relationship was conclusively rejected.

The long-run dynamics depicted that, at the 1% and 5% sig. levels, respectively, exchange rate and return on assets contribute favorably to bank stability in Ghana. On the other hand, the long-term stability of banks is unaffected by the natural log of real GDP, interest rates, inflation rates, monetary policy rates, and returns on shareholders' equity. As a result, over a long time, the capital adequacy ratio increased by about 0.962 units and the degree of exchange rate increased by one unit. Additionally, growth in the returns on resource utilization over the long term boosted the capital adequacy ratio by 1.616 units. Additionally, the short-run dynamic adjustments showed that it takes around 3.5 months for bank stability and macroeconomic variables to converge in Ghana with a considerable rate of adjustment to an equilibrium of 28.9%. Also, the short-run relationship revealed that the exchange rate harmed bank stability in Ghana although the monetary policy rate is insignificant.

Conclusions

The results and findings of this study using the bounds test suggested that a long-run relationship exists between bank stability, real GDP, monetary policy rates, inflation, exchange rates, interest rates, return on asset, and return on equity. Moreover, a change in exchange rate together with return on assets had a significant positive long-run effect on bank stability in Ghana. On the other hand, the exchange rate revealed a negative short-run effect on bank

stability in Ghana. Accordingly, the degree of the exchange rate (EXR) and return on the asset (ROA), which measure, respectively, the volatility of the value of the Cedi to the Dollar and the effective utilization of assets by management, can support bank stability in Ghana over the long term. Additionally, the outcome suggests that a higher exchange rate will adversely impact bank stability in the short term. In the long run, nevertheless, the outcome changes. This suggests that changes in exchange rates have a detrimental impact on bank stability.

Recommendations

The results of this study have policy implications, and the following recommendations have been proposed. On the bases of the findings of this study, the following recommendations are made:

Banks in Ghana should establish internal policies that ensure that there is an adequate liquidity level to contain customers' withdrawal patterns while at the same time making a prudent investment of excess funds.

Furthermore, regulators should ensure strengthening the institutional environment in the country as it reduces the probability of banking crises and keeps the degree of financial stability in the country.

Financial institutions in Ghana should ensure strict compliance with laws and regulations governing granting of financial resources to users.

Due diligence should be taken by financial institutions in other to reduce the probability of loan default by customers as this affects the capital ratio of banks generally.

Finally, commercial banks in Ghana must undertake currency hedging as a risk management approach to reduce the impact of currency or foreign

exchange risk on their profit margin. Hedging currency is accomplished through the use of forward contracts, spot contracts, and foreign currency options.

Suggestions for Further Research

A fruitful direction for future research would be to extend this study to other geographical areas as this study only concentrated on Ghana. Furthermore, this study employed monthly data on all the variables, similar studies could be conducted using other data frequencies to see the dynamism. Finally, further studies could employ other estimation techniques than the one employed in this study.

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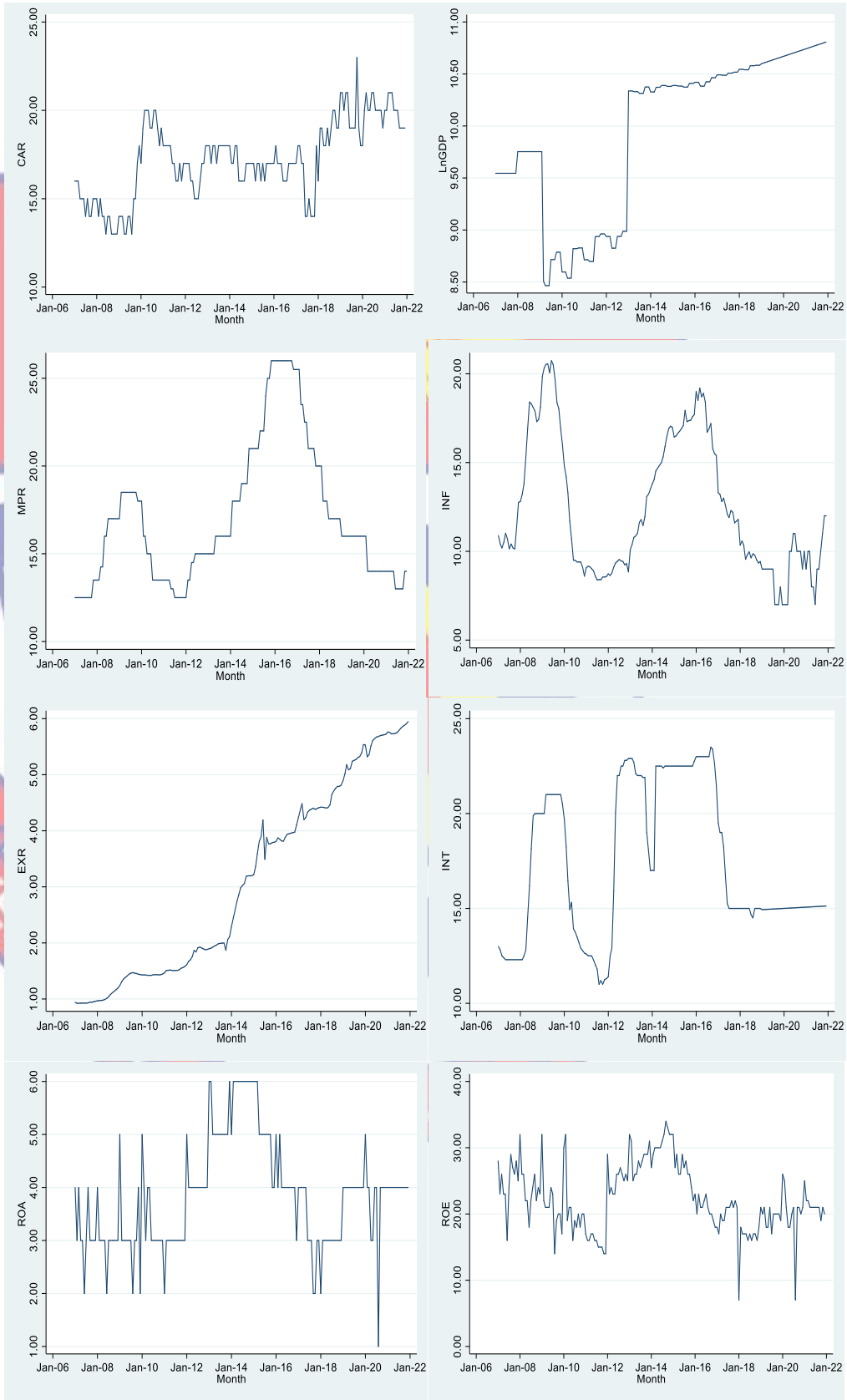
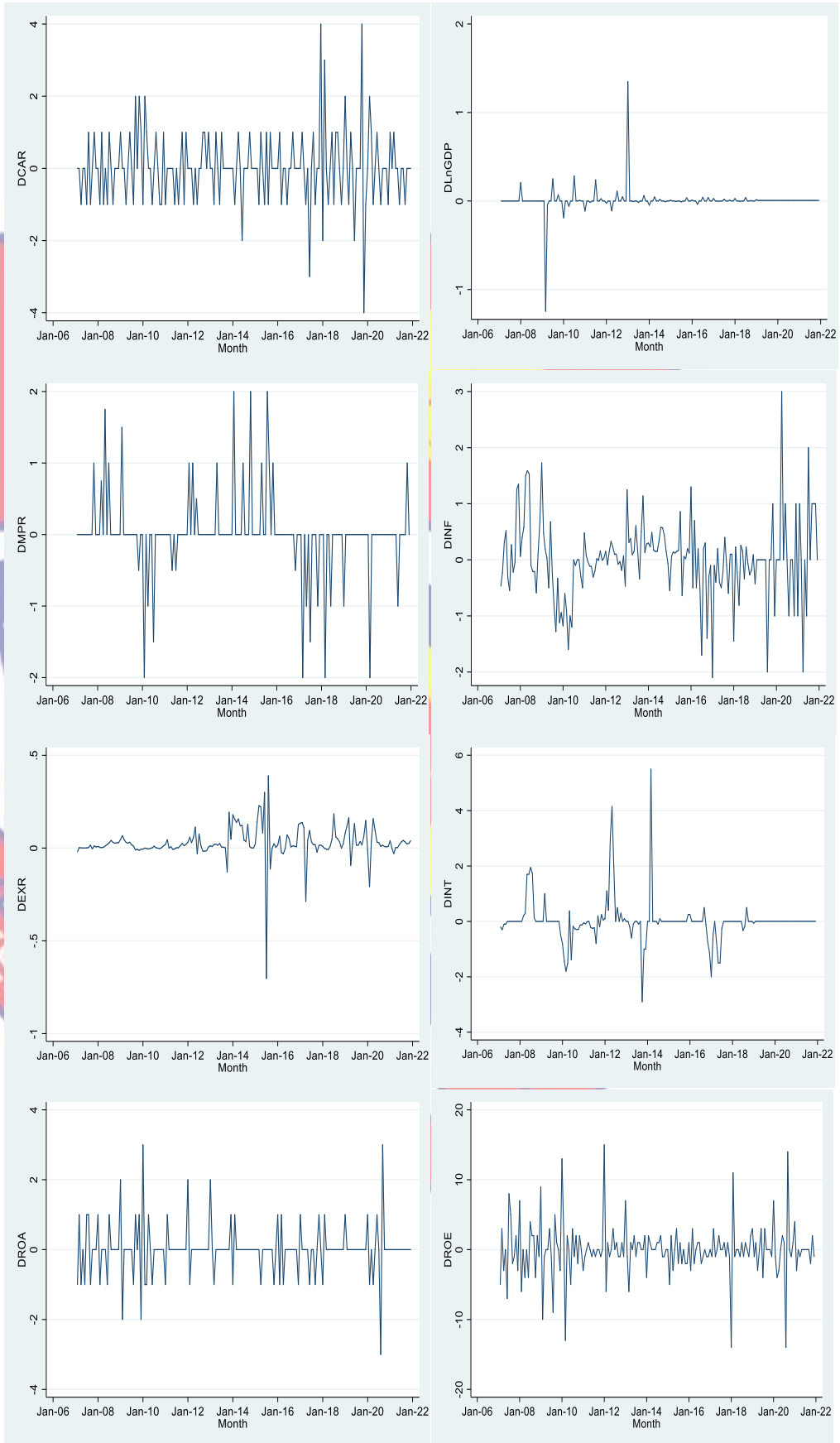
APPENDICES

Appendix A: *Trend of the variables at levels*



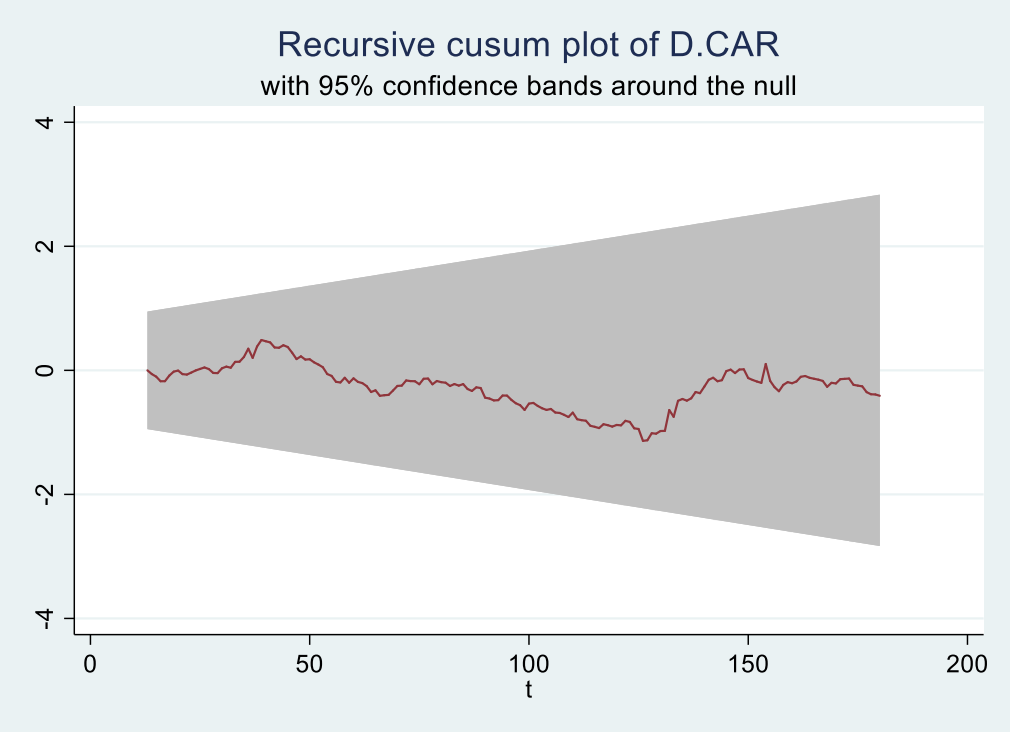
Source: Graphed by author, Kwofie (2022)

Appendix B: *Trend of the variables at the first difference*



Source: Graphed by author, Kwofie (2022)

Appendix C: *Parameter stability test – CUSUM plot*



Appendix D: *Output from Stata v. 16*

```
ARDL(1,0,1,0,1,0,0,0) regression

Sample:         2 -       180                 Number of obs      =       179
                                              F(  10,    168)    =     85.88
                                              Prob > F           =    0.0000
                                              R-squared          =    0.8364
                                              Adj R-squared      =    0.8267
Log likelihood = -230.73152                   Root MSE           =    0.9064
```

CAR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CAR						
L1.	.7105373	.0566767	12.54	0.000	.598647	.8224276
LnGDP	-.2879049	.1803644	-1.60	0.112	-.6439776	.0681679
MPR						
--.	-.2428674	.1353807	-1.79	0.075	-.5101339	.0243992
L1.	.2110331	.1285536	1.64	0.103	-.0427556	.4648218
INF	-.0400262	.0337472	-1.19	0.237	-.1066495	.0265971
EXR						
--.	-1.690986	.7809407	-2.17	0.032	-3.232708	-.149265
L1.	1.969359	.7775732	2.53	0.012	.4342851	3.504432
INT	.0096244	.0317491	0.30	0.762	-.0530542	.0723029
ROA	.3361273	.1506762	2.23	0.027	.0386646	.6335901
ROE	-.0303067	.0300942	-1.01	0.315	-.0897183	.0291049
_cons	7.323419	1.928297	3.80	0.000	3.516604	11.13023

```
. ardl CAR LnGDP MPR INF EXR INT ROA ROE , lags(1 0 1 0 1 0 0 0) ec

ARDL(1,0,1,0,1,0,0,0) regression

Sample:         2 -       180                   Number of obs      =       179
                                                R-squared          =    0.1925
                                                Adj R-squared      =    0.1445
Log likelihood = -230.73152                     Root MSE           =    0.9064
```

D.CAR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADJ						
CAR						
L1.	-.2894627	.0566767	-5.11	0.000	-.401353	-.1775724
LR						
LnGDP	-.9946181	.6307364	-1.58	0.117	-2.239809	.2505724
MPR	-.1099769	.1083361	-1.02	0.311	-.3238525	.1038986
INF	-.1382775	.1132025	-1.22	0.224	-.3617603	.0852053
EXR	.9616857	.3100501	3.10	0.002	.3495893	1.573782
INT	.0332491	.1099247	0.30	0.763	-.1837627	.2502609
ROA	1.161211	.4503031	2.58	0.011	.2722294	2.050193
ROE	-.1046999	.0968708	-1.08	0.281	-.2959408	.086541
SR						
MPR						
D1.	-.2110331	.1285536	-1.64	0.103	-.4648218	.0427556
EXR						
D1.	-1.969359	.7775732	-2.53	0.012	-3.504432	-.4342851
_cons	7.323419	1.928297	3.80	0.000	3.516604	11.13023

Pesaran/Shin/Smith (2001) ARDL Bounds Test

H0: no levels relationship F = 3.822
t = -5.107

Critical Values (0.1-0.01), **F-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_7	2.03	3.13	2.32	3.50	2.60	3.84	2.96	4.26

accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), **t-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_7	-2.57	-4.23	-2.86	-4.57	-3.13	-4.85	-3.43	-5.19

accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors

Pesaran/Shin/Smith (2001) ARDL Bounds Test

H0: no levels relationship F = 2.361
t = -3.698

Critical Values (0.1-0.01), **F-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_7	2.03	3.13	2.32	3.50	2.60	3.84	2.96	4.26

accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), **t-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_7	-2.57	-4.23	-2.86	-4.57	-3.13	-4.85	-3.43	-5.19

accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors

Pesaran/Shin/Smith (2001) ARDL Bounds Test

H0: no levels relationship F = 2.587
t = -3.528

Critical Values (0.1-0.01), **F-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_7	2.03	3.13	2.32	3.50	2.60	3.84	2.96	4.26

accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), **t-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_7	-2.57	-4.23	-2.86	-4.57	-3.13	-4.85	-3.43	-5.19

accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors

```
. reg CAR LnGDP MPR INF EXR INT ROA ROE
```

Source	SS	df	MS	Number of obs	=	180
				F(7, 172)	=	50.94
Model	570.199067	7	81.4570096	Prob > F	=	0.0000
Residual	275.045377	172	1.59910103	R-squared	=	0.6746
				Adj R-squared	=	0.6614
Total	845.244444	179	4.722036	Root MSE	=	1.2646

CAR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnGDP	-.596346	.2482729	-2.40	0.017	-1.0864	-.106292
MPR	-.11611	.0435437	-2.67	0.008	-.2020588	-.0301613
INF	-.1578292	.0449406	-3.51	0.001	-.2465353	-.069123
EXR	.7377149	.1214112	6.08	0.000	.498067	.9773627
INT	.0104777	.044071	0.24	0.812	-.0765119	.0974673
ROA	1.239481	.1796493	6.90	0.000	.8848799	1.594082
ROE	-.1898519	.0377244	-5.03	0.000	-.2643143	-.1153894
_cons	24.13932	1.963807	12.29	0.000	20.26306	28.01558

```
. vif
```

Variable	VIF	1/VIF
EXR	4.77	0.209704
LnGDP	4.03	0.248183
ROE	3.94	0.254035
ROA	3.88	0.257734
INT	3.46	0.288703
MPR	3.34	0.299456
INF	3.25	0.307588
Mean VIF	3.81	

```
. estat dwatson

Durbin-Watson d-statistic( 11,   179) =  2.205235

. estat bgodfrey, lags(1)

Breusch-Godfrey LM test for autocorrelation
```

lags(p)	chi2	df	Prob > chi2
1	3.427	1	0.0641

H0: no serial correlation

```
. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(65)     =     62.73
         Prob > chi2  =    0.5569
```

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	62.73	65	0.5569
Skewness	12.81	10	0.2344
Kurtosis	3.78	1	0.0519
Total	79.32	76	0.3748

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of D.CAR
       Ho:  model has no omitted variables
                 F(3, 165) =      1.15
                  Prob > F =      0.3316
```

```
. estat vif
```

Variable	VIF	1/VIF
EXR	5.60	0.178622
ROA	5.31	0.188273
ROE	4.84	0.206579
LnGDP	4.13	0.242005
INF	3.56	0.280528
MPR	3.52	0.283781
INT	3.48	0.287748
CAR		
L1.	3.29	0.303729
MPR		
D1.	1.12	0.894010
EXR		
D1.	1.04	0.961697
Mean VIF	3.59	