UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

MONETARY POLICY, EXCHANGE RATE AND BANK RISK-TAKING IN SUB-SAHARA AFRICA

BY

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF A DEGREE OF MASTER OF PHILOSOPHY IN FINANCE

DEPARTMENT OF FINANCE

JUNE 2017

DECLARATION

I declare that this work is the result of my own research. Neither anyone nor I have previously presented this work for an academic award in this, or any other university. All references used in the work have been fully acknowledged. Notwithstanding these, any remaining shortcomings in the report are solely mine.

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CERTIFICATION

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

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(SUPERVISOR)

DEDICATION

My parents, Peter and Rita

My wife, Lucy

My brothers, Julius and Jeffrey

TO GOD BE THE GLORY

ACKNOWLEDGEMENTS

The Bromkamp Endowment of Germany funded this project. I thank the Office of Research, Innovation and Development (ORID) of the University of Ghana, for their role in the grant administration. My distinguished Professors, Godfred Bokpin and Anthony Aboagye gave me invaluable guidance during the period of my studies; particularly research training. Their methods may have been unconventional but yet very powerful. I am glad I followed their guidance. I can face the world because of the training they gave me. Dr. Patrick Assuming helped me to get access to some of the data that I used for this research work and Dr. Lord Mensah offered useful suggestions and advice along the way. To all other faculty members, including Dr Saint Kuttu, who made useful comments at seminars; my senior colleagues, Teaching Assistants in the Department of Finance, Gabriel Nomortsu Teye-Ali and Bernard Amoah for taking time to read through my work and for your useful comments.

Richard Akomatey, Blatter Akambase, Wasilatu Tampuri, Richard Amankwa, Chrisantus Kpinye and Lucy Boachie-Mensah taught me a lot at our group studies and that is why I excelled on my coursework. Lucy has been the best friend I had; God bless you. I also thank all the people who shared their challenges in their own theses with me. As we worked out a solution to their challenges, I increased in knowledge, understanding and experience and I am glad they gave me those opportunities. To you and everyone who played any role and provided support in any way I am grateful, thank you.

Long ago, my mum told me '…son, you will attend all the school your dad and I could not attend…' There could not have been a better motivation to succeed in school than this. In all, nothing could have been achieved without God. I acknowledge the mighty hand of God in each achievement.

ABSTRACT

In the years preceding the global financial crisis which begun in the US in 2008, it was revealed that the US and several European countries had prolonged periods of low interest rates. Since the crisis, extant literature has established a strong causal relationship between monetary policy and risk-taking mainly in the countries that were most affected. We cannot discount the effect of exchange rate when examining monetary policy. This is because during the period many of the countries that were affected had strong currencies. In the recent decade (2007 to 2017) however, it has been observed that African countries are exhibiting some of these characteristics, that is, falling policy rates and currency appreciation. On the basis of this observation, it is important to establish the causal relationship between the two macroeconomic variables and bank risk-taking in the context of Africa. We study an unbalanced panel of 534 banks from 37 countries in sub-Sahara Africa from 2001 to 2015.We examined five types of risks: default, credit, asset, liquidity and capital risks. The LSDV and PCSE techniques were implemented. The results suggest that low policy rate increases default risk, asset risk and capital risk and reduces credit and liquidity risk. Currency appreciation on the other hand increases all four risk types but decreases credit risk. These results are significant both economically and statistically. We find that the risks of big banks were amplified by monetary policy changes except for credit risk where monetary policy diminished the risks of big bank. Monetary policy also amplified the risks of more profitable banks except for capital risk where the impact was reduced for more profitable banks. We recommend that, based on our results monetary authorities should be modest in reducing interest rates to enhance the stability of the financial system in Africa.

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LIST OF ABBREVIATIONS

2SLS	Two Stage Least Squares
BRICS	Brazil Russia India China South Africa
CAP	Capitalisation
CAR	Capital Asset Ratio
CBPR	Central Bank Policy Rate
CDS	Credit Default Swap
COSTEFF	Cost Efficiency
CR3	Three Firm Concentration Ratio
EXCH	Exchange Rate
FINOPP	Financial Openness
GDP	Gross Domestic Product
GMM	Generalised Method Of Moments
IFS	International Financial Statistics
IMF	International Monetary Fund
LIQ	Liquidity
MENA	Middle East and North African Countries
MPR	Monetary Policy Rate
NPL	Non- Performing Loans
NPLR	Non- Performing Loans Ratio
LSDV	Least Square Dummy Variable
OLS	Ordinary Least Squares
PBT	Profit Before Tax
REER	Real Effective Exchange Rate
ROA	Return On Assets

ROE	Return On Equity
FGLS	Feasible Generalised Least Squares
T-ASSETS	Total Assets
LATD	Ratio of liquid Assets-to-Deposit and short term borrowing
LLR	Loan Loss Reserve to Gross Loans
PCSE	Panel Corrected Standard Error

CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

1.1.1 Overview and Context

This study examines the risk-taking channel of monetary policy for sub-Sahara Africa. The discussion about the risk-taking channel of monetary policy can be traced to the 2008 global financial crisis. That crisis proved that even the most advanced financial systems are vulnerable to uncertainties which can lead to failures both for the domestic financial system and international financial markets and could have damaging consequences on the real economy. The crisis was sparked by excessive credit expansion and the burst of a chain of bubbles in the real estate market (Özşuca & Akbostancı, 2016).These events led to instability in the global credit market which threatened the stability of the global financial market.

Policy makers and researchers alike have systematically raised questions about the possible causes of the crisis in an attempt to explain the factors that are responsible for the fragility of the global financial system. In the meantime however, though empirical research in this regard is scant, there appears to be a consensus on some possible factors that could have caused the crisis. These include failure of macroprudential policies, regulatory and supervisory failure, the emergence of complex financial instrument and weak corporate governance systems (de Moraes, Montes, & Antunes, 2016; Kara, Özkan, & Altunbas, 2016).In addition to these, monetary authorities have also been blamed for implementing excessively accommodative monetary policies in the half decade before the crisis (Dell'Ariccia, Laeven, & Marquez, 2014).The latter reason has however sparked a strong debate among economists because those who point fingers at monetary policy have argued that when the monetary condition is lax such as in a period of low interest rates and loose liquidity over prolonged periods, there is an increased incentive for financial intermediaries to take more risk. Thus, the proponents of this side of the debate hold the view that monetary policy was an important driving tool that caused the financial crisis. The situation becomes even more controversial when we consider that in an attempt to remedy the effects of the crisis monetary authorities in some countries eased the monetary condition.

Consequently, the debate over the relationship between monetary policy and financial stability has intensified among researchers and in policy discourse. Prior to the financial crisis, monetary policy paid little attention to financial stability because traditionally the role of monetary policy has been thought of mainly in terms of price stability whereas macroprudential policies were considered to be the duty of supervisory authorities. Moreover, the seemingly rapid innovation in the financial sector has been regarded as a tool for achieving stability in the financial system. That notwithstanding, the crisis has given strong basis to argue that policy decisions aimed at financial stability can no longer be taken without recourse to the effect of monetary policy. As well, monetary policy decisions must consider implications for financial stability.

The question of how monetary policy transmits to banks' risk-taking incentives has been central in the said debate and has led to the emergence of the so-called risk-taking channel of monetary policy. Risk-taking channel refers to the perception and the pricing of risk as a result of the monetary policy stance at a given time. The emphasis has been on how policy stance affects the risk appetite and the risk perception of banks. The central argument here is that when interest rates are very low banks will lean towards higher risk-taking and cause a shift in the supply of credit; that is the risk-taking channel implies an increase in the riskiness of lending via low quality portfolios. In this way, monetary policy can contribute to financial instability via a build-up of imbalances in the financial system. While the debate has been based on the prolonged period of low interest rates in the US and EU in the 7years preceding the crisis, it is important to admit that that argument only loosely relates to the situation in sub-Sahara Africa. Interest rates have not been low in Africa both in absolute terms and when compared to rates in the US and EU for any period in the past but since the end of the global financial crisis, interest rates in many sub-Sahara African countries have demonstrated a tendency to decline (Fig.1).

Figure 1.1 Money Policy in Sub-Sahara Africa

That notwithstanding, there is a justification for studying the risk-taking channel of monetary policy in the context of Africa for valid reasons, especially if context specific conditions and dynamics are taken in account. To begin with, while interest rates have not fallen so low as in the case of the US and EU, they have fallen to historically low levels in many countries in the years after the crisis, particularly for countries that are part of common currency areas, but also for other countries. Moreover, the business community continues to advocate for even lower interest rate so that cost of credit can fall and boost real investments.

In addition to this, individual African countries have either implicitly or explicitly adopted inflation targeting since 2000 (Quartey, Afful, & Afful-Mensah, 2014).Also, African countries are largely bank-oriented and coupled with the prevailing policy environment in many countries provides us with an ideal setting for analysing this transmission channel of monetary policy (Oima & Ojwang, 2013). Consequently, our focus in this study is to empirical determine the relationship between monetary policy and risk-taking of banks operating in 37 countries in sub-Sahara Africa using data from 2001 to 2015 and different risk measures. This study also determines the impact of size and capitalisation in moderating banks risk-taking behaviour. The results show evidence of the existence of a risk-taking channel of monetary policy in the context of sub-Sahara Africa when assessed using five risk measures. This study also examined the role of exchange rate in determining risk taking because of the close association between interest rates and exchange rates.

To the best of our knowledge, this study is the first to address the relationship between interest rate, exchange rate and the risk-taking channel in Africa. Most of the scant empirical studies in this area have focused on advanced economies (Altunbas et al., 2014; Maddaloni &

Peydró, 2011).Furthermore this study introduces a novelty in risk-taking literature for Africa by using a large cross-country panel consisting of only Africa countries. Additionally, this study highlights bank-specific characteristics that may have an impact on risk-taking and assesses the different ways in which banks with different attributes respond to monetary policy in term of risk taking.

1.1.2 Vulnerability of the banking sector

The strength or weakness of a banking industry is a function of how much risks it is exposed to Laeven & Valencia (2013) observed that there has been 147 banking crisis across the world from 1970 to 2011 and this was accompanied by 218 currency crisis. They observed that these crises often occurred in one country and then spread to other countries due to increasing integration of the global financial sector. Cihák & Schaeck (2010) agreed with this observation and affirmed that these crises are difficult to predict.

In Africa and Latin America, Laeven & Valencia's (2013) report revealed that most countries have experienced a banking, or currency crisis at least once during the period before the crisis. A peculiar characteristic about these crises is that while crises in Asia, North America and Europe have resulted into financial crises that had wide scale impacts on other countries, and in some cases on entire continents, or the global economy, crises in the Latin America and Africa have not as yet led to inter-country, or global crisis. This could be explained to mean that countries in Africa and Latin America are not (so much) financially integrated among themselves and with the global financial system. For instance between 1995 and 1997 Asia experienced a severe financial crisis that begun in Thailand and spread to other parts of the continent.

Another crisis which begun in the US financial sector in 2007 had an impact on Europe and had consequences for Africa and Asia (Alter & Schüler, 2012).This has since been followed by a European financial crisis (Carbó-Valverde, Benink, Berglund, & Wihlborg, 2015; Lane, 2013).It is imperative therefore to ask if we should be expecting an African, or Latin American financial crisis soon. Such a question will be against the background that Africa is increasingly being interwoven and dependent on the global financial system (Ioannidou, Ongena, & Peydró, 2015).If Africa's financial system will get into a crisis, it is most certain to originate from the banking industry because the African economy is heavily bank-oriented (Demirgüç-Kunt & Levine, 1999; Levine, 2002; Oima & Ojwang, 2013).

1.1.3 The role of management and the new spotlight

Laeven & Valencia's (2013) report also revealed that many of the factors that led to most of the banking crises were within the control of bank management and were due to internal policies and decisions. Industry players have therefore tended to focus more attention on the management of uncertainties that the sector is prone to. Consequently, risk and risk management have become topical in the banking literature. This has particularly been the case following the global financial crisis that occurred at the dawn of 2008 and which had its roots firmly in the banking industry. One is likely to conclude that given the structural deficiency of Africa's economy, there is an enormous risk in the banking industry. There is the need however, to obtain an empirical basis for the sources and nature of the factors that put the financial system at risk and how the sector responds to these factors over time. This is because the risk in the banking industry has proven to be crucial for the overall financial health of any economy (Alter & Schüler, 2012). At least this is evident from the impact of banking crisis in the US, Europe and Asia (Black, Correa, Huang, & Zhou, 2016; Carbó-Valverde et al., 2015).

1.1.4 Government intervention; the macroeconomy is important

Government intervenes in the economy from time to time to achieve some macroeconomic objective. One of the tools of intervention has been the monetary policy stance. Loose monetary policy can impact bank risk-taking in a number of ways such as the valuation of bank assets (Altunbas, Gambacorta, & Marques-Ibanez, 2010; Gambacorta, 2009).In terms of valuation, lower interest rates increase the value of assets, incomes and collateral and may cause banks to modify their estimation of risk downward, thus increasing their risk appetite. Our focus in this study is partly to determine the impact of monetary policy on bank risk-taking in sub-Sahara Africa.

Another macroeconomic variable which is the focus of this study is the exchange rate. Extant literature has established a strong link between bank risk exposure and exchange rate movement (Chang & Velasco, 2000; Gagnon & Ihrig, 2004).Banks are important intermediaries in the international currency market and profits from this market are expected to impact the bottom line of banks. Moreover, for a bank that has businesses in foreign countries, the movement of exchange rates exposes their bottom line to translation risk. Translation risk is the risk that the profit earned in one country would have a lower value when converted into the currency of the bank's home country due to a depreciation of the host country's currency (Ioannidou et al., 2015).

Horndren (1995) argues that there is an important relationship between monetary policy and exchange rates. His argument is anchored on an interest rate channel. He states that lower interest rates lead to weaker exchange rates since lower interest rates make short run foreign investments become more attractive to investors. As a result, demand for foreign currency by local investors to purchase foreign currency denominated investments will increase and cause the local currency to depreciate (Demir, 2014). In the long run, however, monetary policy is expected to impact exchange rates through an inflation channel (Engel, 2013; Friedman & Kuttner, 2010).Given that the exchange rate is itself a price, it is expected to rise with inflation (Horndren, 1995).Notwithstanding this, Taylor (1999) expresses the opinion that the nature of the relationship between monetary policy and exchange rates is uncertain. A few past studies have studied the impact of monetary policy on bank risk-taking, but exchange rate appears to have not been examined before. This study introduces a novelty by examining the role of exchange rates in bank risk-taking behaviour.

1.1.5 The Gap in Africa

Few studies exist on the determinants of bank risk-taking in Africa. For instance, a search of the bank risk-taking literature revealed that one out of twenty papers focused on Africa (see chapter two).The papers on Africa that were sighted focused on Egypt, South Africa, or Ghana. This presents a significant context gap on the African continent. This study contributes to filling this context gap. Furthermore, twelve unique themes were found to exist in the literature. It was observed that with the exception of ownership, the other themes appear to be significantly under-researched. This also presents significant issue gaps. This study contributes to filling the "monetary policy gap" together with an exchange rate gap. The third gap that this study contributes to is a level of analysis gap. There exists a level of analysis gap in the literature on Africa that arises partly from the scarcity of research on Africa. The studies that used cross-country data included Egypt with other gulf countries or South Africa with other BRICS countries, thus excluding the "larger" Africa.

1.2. Statement of Problem

Many African countries are bank-oriented (Demirgüç-Kunt & Levine, 1999; Levine, 2002; Oima & Ojwang, 2013).This means that the total asset of the banking industry as a percentage of GDP is bigger than the size of the stock market as a percentage of GDP. Thus a crisis in the banking industry would lead to significant adverse consequences for the rest of the economy. Banking crisis ordinarily is the result of the exposure of banks to uncertainties in the economy.

The policies that banks adopt, and their attitude towards the factors that expose them to uncertainties, is known as risk-taking behaviour (Altunbas et al., 2012; Borio & Zhu, 2012).It has been found by Laeven & Valencia (2013) that most of the factors that lead to banking crisis are as a result of policies that are implemented by bank management. These policies are informed by other factors that are in the macroeconomy such as the monetary policy stance and the exchange rate. Monetary policy is a tool used by central banks to control the money supply (Altunbas et al., 2014; Lafuente, Pérez, & Ruiz, 2016).Central banks sometimes use a policy rate as an instrument of monetary policy. Banks set their interest rates based on the policy rate. Interest rates are a key determinant of bank profitability and movements in the interest rates affects the values of the assets and liabilities of banks (Sun, Mohamad, & Ariff, 2016).Thus, any changes in the monetary policy stance are expected to influence banks' attitude to risk-taking (Borio & Zhu, 2012; Ioannidou et al., 2015; Maddaloni & Peydró, 2012).As the global economy becomes more integrated, countries are affected by changes in the value of other countries' currencies.

Banks are an important intermediary in the market for currencies and their bottom line is expected to be affected by movements in the currency market (Barnhill Jr., Papapanagiotou,

& Schumacher, 2002; de Moraes, Montes, & Antunes, 2016; Dell'Ariccia, 2010; Matemilola, Bany-Ariffin, Etudaiye, & Mukhtar, 2015).It is expected that exchange rate movements will influence the attitude of banks to risk-taking.

As already highlighted, there is generally little research on the factors that impact risk-taking by banks. Moreover, among the few existing studies emphasis has been on USA, Canada, Asia and Europe while Africa and Latin America are almost neglected (Drakos, Kouretas, & Tsoumas, 2016; Guidara, Lai, Soumaré, & Tchana, 2013; Haq, Faff, Seth, & Mohanty, 2014; Haq & Heaney, 2012; Kanas, 2013; Pathan, 2009). Given the importance of the banking sector to the African economy, it is important that extensive research is conducted on the factors that impact its exposure. It appears that we cannot fully understand these factors, as a number of them bother on human behaviour which keeps changing. Therefore, there is the need to continuously research already known factors and new phenomena that are expected to impact bank risk-taking.

This study contributes to this gap in our understanding in three ways. First, it contributes to an issue gap by examining how monetary policy and exchange rates impact risk-taking. It also contributes to a context gap by focusing on Africa, a green field and finally, it contributes to a level of analysis gap by using bank level cross-country data from sub-Sahara Africa.

1.3. Research Objectives

1. To determine the relationships and causal effects of monetary policy on bank risk-taking.
2. To determine the relationships and causal effects of exchange rates on bank risk-taking.
3. To determine the impact of bank size and profitability in moderating the effect of monetary policy on bank risk-taking.

1.4. Research Questions

1. What is the relationship and impact of monetary policy rate on bank risk-taking?
2. What is the relationship and impact of exchange rate movement on bank risk-taking?
3. Do bank size and profitability influence the impact of monetary policy on bank Risk Taking?

1.5. Significance of Study

This study explores a green field in the bank risk-taking literature. Policy makers can now understand how monetary policy and the exchange rate movements affect bank risk-taking. In addition, this study provides relevant empirical evidence to banks with operations in sub-Sahara Africa of how their attitude to risk-taking is influenced by monetary policy and the exchange rate. Finally, the extensive assessment of existing literature and the highlight of gaps in chapter two is an excellent compass for bank risk-taking researchers; besides our study is expected to be followed by country level studies.

1.6. Limitations

A key limitation of this study is the non-availability of data on some banks and countries for some years. Notwithstanding this limitation, our results are reliable and our findings and interpretations are relevant.

1.7. Delimitations

Firstly, this study is limited to countries in sub-Sahara Africa. Countries in sub-Sahara Africa have similar structural characteristics and so it is appropriate to study them together. North African countries are similar to countries in the Middle East and are often studied together. Secondly, the study period is restricted to 2001-2015 to make the findings relevant to present realities. Finally, the study focuses on monetary policy and exchange rate although other factors such as corruption, religiosity, competition, regulation, size, performance, leverage, capital, ownership, corporate governance and disclosure are known factors that influence risk-taking in the banking industry.

1.8. Outline of the Research Report

The research report is organised into five chapters. This chapter, chapter one, serves as an introduction to the report. It presents the background to the study, its objectives and the questions that the study seeks to answer. This introduction also highlighted the significance of the study as well as its limitation and delimitations. This is followed by a comprehensive literature review, chapter two. The review is followed by the development of a conceptual framework. The study presents details of the data, variables and methods of analysis of the data in chapter three. The study also provides justifications for the selected methods and the analysis that follow in chapter four. The results of our analysis and a discussion of implications are presented in chapter four. Finally, in chapter five, the study highlights key issues in the research that settles the research questions posed in chapter one and emphasise conclusions that arise from the findings of the research.

1.9. Chapter Summary

This chapter provided the background of the research topic as well as brief highlights of related issues. It established the contribution of the study to policy, practice, the literature and future research. It also explained the research purpose and stated the objectives the study seeks to achieve and the questions that they seek to answer. The study also highlighted the significance of the study as well as its limitation and delimitations and presented a map to the content of the report.

CHAPTER TWO

A REVIEW OF RELATED LITERATURE

2.1. Introduction and Overview of Chapter

There is an on-going conversation in the bank literature about the factors that explain the risk-taking behaviour of banks and other financial institutions. Some perspectives explored by past authors include ownership characteristics, regulation, sovereign debt, liquidity and competition (Adhikari & Agrawal, 2014; De Bruyckere, Gerhardt, Schepens, & Vander Vennet, 2013; Hassan, Unsal, & Emre, 2016; Laeven, Ratnovski, & Tong, 2015; Ratnovski, 2013).This study joins the conversation by bringing to the fore a perspective on Monetary Policy and Exchange Rate and situates the conversation in the context of sub-Saharan Africa.

In this chapter, the study takes a walk through the underlying theories and existing empirical works that are related to this study. It begins with a presentation of definitions and description of concepts that relate to the research topic and a critical analysis of these definitions. This is to provide a background to many of the concepts that run through much of the literature on monetary policy, exchange rates and bank risk-taking. The study provides a theoretical background to the various concepts that arise later in the chapter. This is followed by a critical analysis and discussion of empirical studies that have a close relation with the research topic. This is necessary to establish what is already known as a result of previous studies and to establish what is not known and make a case for why this research is relevant to our field of study. The discussion up to that point results in a conceptualisation of relationship into a framework that guided the research.

Section four classifies existing literature to establish knowledge gaps in the bank risk-taking literature and includes a review of methodologies used in previous studies and serves to give a justification to the methodology adopted in this research. It is a preamble to chapter three which discusses methodological issues in greater details. The style of review in this chapter is the thematic approach. The chapter concludes with a summary, in section five, of what has been discussed in the chapter.

2.2. Conceptual and Theoretical Literature

2.2.1. Risks in the Banking Industry

Risk and risk management have become topical in banking literature following the 2008 global financial crisis which begun in the US sub-prime mortgage market (Anginer, Cerutti, & Pería, 2014; Jednak & Jednak, 2013; William, 2012).Risk connotes the exposure that organisations face because of one, or more characteristics, or conditions. Every aspect of business entails some risk. The banking sector is no exception for it faces significant exposures that threaten its success and survival. The notion of risk is becoming unclear as several definitions exist, some of which are general and others being specific to a given context (Tileagă, Niţu, & Niţu, 2013).

The risks that banks face can be classified into credit risk, liquidity risk, asset risk, capital, default market risk and operational risk; this study discusses some of these in a bit. A measure of risk that is regarded to capture multiple risks is the capital adequacy ratio. This ratio captures credit risk-taking, market risk and operational risk (Hassan et al., 2016). The risk in the banking sector is important for banks, but even more important for the economy as a whole. This is evident from the effects of banking crisis in the US, Europe and Asia in the last two decades (Almeida et al., 2014; Altunbas, Marqués-Ibáñez, & Manganelli, 2011;

Carbó-Valverde et al., 2015; Jovanovic & Petreski, 2014; Kanas, 2013; Wehinger, 2014; Werner, 2015).This has drawn much research since then to examine the nature of risk-taking by banks and factors that influence them.

Nonetheless, we still have a gap in our knowledge of these factors. It does not seem that we can fully understand them at any point simply because many of these factors bother on human behaviour which keeps changing (Anginer, Demirguc-Kunt, & Zhu, 2014; González, 2005; Laeven & Levine, 2009).This implies that there is the need for examination of new factors and continuous re-examination of all other factors from time to time.

- **Credit Risk**

Credit risk refers to the possibility of exposure to loss due to the failure of a credit customer to honour their obligations under the contract reached, or failure to execute those obligations partially, or fully in the required time frame (Hassan et al., 2016).To control for this risk, banks keep an amount of credit risk weighted assets to prevent damage if they are exposed to credit risk-taking (Stolz & Wedow, 2011).Credit risk comprises of non-performing loans, changes in exchange risk and changes in values of collateral (Sarno & Valente, 2005). It is expected that credit risk-taking will be impacted by the exchange rate and monetary policy through the lending channel as high-interest rates increase the likelihood of default by borrowers. Credit risk has been found to significantly impact negatively on the profits of large banks (Terraza, 2015).This poses a severe threat to bank performance and has implications for default risk (Funso, Kolade, & Ojo, 2012).

- **Liquidity Risk**

Liquidity risk comes about when banks use short-term debt to finance long-term projects, or assets (Arif & Nauman Anees, 2012; Terraza, 2015).As long as they are able to roll over this short term liability by using successive short-term debt intermediately they will be protected against liquidity risks (Petria, Capraru, & Ihnatov, 2015).There is, however, a risk of failure that may result in the event that they are unable to retire their debt with new short-term debt before the maturity of the assets in their portfolio (Arif & Nauman Anees, 2012).One way in which commercial banks can hedge against liquidity risk is by holding tradable assets and maintaining a reputation of transparency (Ratnovski, 2013). Transparency can be regarded as the extent to which information is made available to external stakeholders. By being transparent, the bank can convince investors that it is solvent hence they will be willing to provide financing for it, allowing it to be able to replace successive debts intermittently (Ratnovski, 2013).Liquidity risk exerts an adverse effect both on performance and on reputation (Arif & Nauman Anees, 2012).

- **Market Risk**

Market risk refers to the probability of loss that banks are exposed to as a result of their market position, or market portfolio on, or off their balance sheet resulting from changes in interest rate, exchange rates and security prices (Hassan et al., 2016).To control for market risk, banks keep an amount of market risk-weighted assets to prevent damage should they be exposed to market risk (Chen, Chiu, Huang, & Tu, 2013; Mun, 2015; Othman & Ameer, 2009).

- **Operational Risk**

Operational risk is the likelihood of loss resulting from unsatisfactory, or ineffective internal processes, people, or systems, or factors that are external to the bank such as legal risk (Chernobai, Jorion, & Yu, 2011; Finke, Singh, & Rachev, 2010; Hassan et al., 2016).

2.2.2. Bank Risk-taking Behaviour

This sub-section presents a review of theories related to bank risk-taking behaviour. Three sub-subsections are included here. The first looks at the influence of monetary policy on bank risk-taking. The title of this sub-section does not connote any specific theory, but an array of theoretical issues that are considered to influence bank risk-taking. The second and third sub-subsections look at the moral hazard and the franchise theories respectively. The moral hazard theory argues based on information asymmetry as a factor that could influence risk-taking decisions by banks. The central argument of the franchise value theory is that banks will take up a certain amount of risk that will not jeopardise their value if the shareholders will be most affected by such behaviour.

- **Monetary Policy Influence**

Loose monetary policy can affect bank risk-taking in a number of ways. Key among them is the search for yield and the impact on valuation. Low-interest rates that are a result of loose monetary policy may increase incentives for managers to take up more risk for some corporate or contractual reason. To be able to meet some targeted nominal return, they will inevitably accept more risk (Altunbas et al., 2010; Gambacorta, 2009).

The sluggishness of this target in a period of low-interest rates may be as a result of factors such as money illusion, that is, investors may overlook the fact that declining interest rates could be counterbalanced by a fall in inflation rates (Altunbas, Gambacorta, & Marques-Ibanez, 2012; Gambacorta & Iannotti, 2007). Regarding valuation, lower interest rates increase the value of assets, incomes and collateral and may cause banks to modify their estimation of risk downward and increasing their exposure.

- **Moral Hazard Theory**

The moral hazard theory is one theory that has been used to explain bank risk-taking behaviour. The theory emphasises asymmetric information and deposit insurance shielding banks from the control of depositors (Jokipii & Milne, 2011; Rahman, Zheng, & Ashraf, 2015).These works have shown that capital adequacy regulation may reduce the number of risky assets that are held by banks (Zheng, Xu, & Liang, 2012).They also show that if we assume a utility function for a risk adverse bank, their portfolio composition may be distorted towards more risky assets (Hamza & Saadaoui, 2013; Mensah, 2013).As a result average risk can increase and the bank may require risk consistent weights to adjust for moral hazard (Zheng et al., 2012).

- **Franchise Value Theory**

The franchise value (or Charter value) theory is another theory which explains bank risk-taking in a framework of franchise value. Franchise value can be defined as how much of the value of the bank would be foregone should the bank be closed (Chen, Hwang, & Liu, 2012).Factors that may increase franchise value include regulatory restrictions on entry and competition in the industry. It argues that since shareholders would lose big in case of closure, banks with higher franchise value would have lower incentives to take higher risk. Even though traditional theory suggests that high franchise value reduces bank risk-taking incentives, the recent financial crisis saw banks with exceptionally highly valuable franchises getting exposed.

Martynova, Ratnovski, & Vlahu (2014) attempt a reconciliation of theory with this evidence by considering a setup where bank risk-taking is by increasing leverage by investing in risky traded instruments. They argue that high franchise value enhances the capacity of banks and so they are able to take risks on a higher scale which will result in offsetting the lower incentives to take risk of a given size. This culminates in banks with high franchise values having higher incentives to take risks. They further assert that this proposition is even stronger for banks that are able to expand their balance sheet using inexpensive senior funding such as repos. In the recent franchise value literature, an emphasis has been given to the capital buffer theory (e.g.ElBannan, 2015; González, 2005; Haq, Faff, Seth, & Mohanty, 2014; Haq & Heaney, 2012).The capital buffer perspective takes it as given that banks will maintain a capital level above the regulatory minimum requirement. Thus it predicts that banks will maintain a level of capital above the regulatory minimum (buffer of capital).

The capital buffer theory includes the cost of altering the level of capital and allowing it to fall below the required minimum level. These costs are both explicit and implicit (Zheng et al., 2012).Implicit costs may arise from regulatory meddling designed to control excess demand insurance following expanded risk-taking while explicit costs may arise from penalties and , or restrictions that are imposed by the regulator as a consequence of regulatory breach (ElBannan, 2015).

The main contribution of the buffer theory is the separation between long and short-run relationships between capital and risk-taking and the impact of regulatory capital from observed bank capital (Jokipii & Milne, 2011).Regardless of risk weighting, regulatory capital will have a limited long-term effect on bank risk-taking. The short-run relationship between the capital buffer and risk will depend on the degree of capitalisation. For banks that are close to their preferred level of capital, there is a positive relationship while those approaching the regulatory minimum will have a negative relationship (ElBannan, 2015).That is, in the short-run, an increase in the regulatory minimum will lead to a reduction of the buffer. This has a similar effect as a direct reduction in the capital buffer that banks hold beyond the regulatory minimum.

2.2.3. Monetary Policy

Monetary policy has no consistent definition in economics (Senn, 1999).That notwithstanding, whichever way we consider monetary policy, it boils down to adjusting money supply in the economy to achieve some objective such as inflation and output stabilisation. Policy makers use different methods to achieve these macroeconomic objectives. In the long-run, the output is fixed so changes in the money supply only result in changes in prices, but in the short-run, prices do not change and so changes in money supply leads to an adjustment in actual output of goods and services (Friedman & Kuttner, 2010).It is because of this that monetary policy authorities use it as a tool to achieve growth and stabilise inflation.

In a period of recession, output falls, investments dip, there is a slump in consumption and unemployment increases. To solve these problems, governments need a policy that leans against the direction of the economy (Friedman & Kuttner, 2010).Expansionary monetary policy is often the preferred tool as it serves as a countercyclical tool in those circumstances (Angeloni & Faia, 2013).Money supply can be increased through a reduction of the policy rate which effectively serves as the basic interest rate in the economy. Lower interest rates will encourage investments and culminate in the growth of output and employment. However, the increased money supply will increase prices. As demand approaches the full employment level, increased demand will increase input costs such as wages. Following this process, workers will spend more as a result of the increase in income levels which leads to further increases in prices hence increasing headline inflation- something policymakers want to avoid (Ghosh, 2016).Governments are therefore often faced with a choice between growth and inflation.

There is also the contractionary monetary policy which seeks to achieve the reverse effect- controlling inflation-, but also slows down growth (Bouakez & Eyquem, 2015; Leitemo & Söderström, 2005).A characteristic of monetary policy is that the adjustment process can be slow and sticky and so it is difficult to predict with certainty the degree and timing of its effects (Zhang, Lowinger, & Tang, 2007).Horndren (1995) argues that monetary policy cannot influence fundamental variables immediately; instead, he suggests that it only affects them after one or more years of implementation.

Monetary policy is thus a set of decisions that governments- usually through independent bodies such as central banks- control money supply in the economy (Friedman & Kuttner, 2010; Osei-Assibey & Bockarie, 2013).It is conducted through changes in policy rates, bank reserve requirements, availability of credit, the exchange rates and the size of the monetary base (Ghosh, Ostry, & Chamon, 2016; Ida, 2013).This study will be referring to one or more of these tools when it mentions monetary policy in other parts of this report.

The mechanism through with which monetary policy can affect bank risk can be complex and dynamic. A number of ways can be identified. Firstly, it can affect the valuation of their incomes and cash flows and this affects how they measure risks. For instance a low-interest rate will bloat the value of their assets and increase their valuation potentially increasing their risk appetite (Altunbas, Gambacorta, & Marques-Ibanez, 2014).

Secondly, low-interest rates could make banks aggressive in an attempt to meet profit targets (Leonardo Gambacorta, 2009).Given that there is a positive relationship between risk and return, they will take on more risk to meet their set nominal targets (Altunbas, Gambacorta, & Marques-Ibanez, 2012).Another way the risk-taking channel can operate is through how policies are announced and the reaction function of the monetary policy making authority including the effect produced by the idea that the reaction function of the monetary policy maker is effective in curtailing excessive downside risk.

2.2.4. Exchange Rate and Monetary Policy

Existing theoretical literature has established a strong link between bank risk exposure and exchange rate movements (Bouakez & Eyquem, 2015; Gagnon & Ihrig, 2004).This has been established by both econometric evidence and by analysis of particular episodes (Chang & Velasco, 2000).This study takes interest in examining the relationship between exchange rates and bank risk-taking because of an increasing dollarization that is taking place in many countries (Ioannidou et al., 2015). It has been established by econometric evidence and analysis of specific episodes that exchange rates movements impact monetary policy (Chang & Velasco, 2000).Gonçalves & Guimarães (2011) developed a simple intuitive model to estimate the effects of changes in the interest rate on exchange rates. They applied the model to the Brazilian economy and concluded that in a country with a high probability of default (of sovereign debt) higher interest rates renders their currency unattractive and causes it to depreciate.

It is, therefore, plausible to assume that there is an important relationship between monetary policy and exchange rates (Bouakez & Eyquem, 2015).However, as Taylor (1999) observes, there is uncertainty about the nature of this relationship and how monetary policy authorities should respond to movements in the exchange rates. In figure 2.1 this study identifies three channels in the literature through which the exchange rate impacts on the economy. Generally, a depreciation of the currency has the effect of increasing real GDP as a result of expenditure switching (Taylor, 1999).It leads to an increase in inflation because prices of imports do not adjust as quickly to changes in exchange rates.

Secondly, depreciation generates wealth effects which may affect domestic investment and consumption. Household consumption may rise following a depreciation as a result of increases in wealth following increases in real income due to inter-temporal consumption smoothening (Gonçalves & Guimarães, 2011).Moreover, investment will rise in response to increasing consumption. The third channel is the effect on the value of assets hence the value of collaterals. Depreciation of the domestic currency has the effect of dampening the creditworthiness of domestic borrowers of external financing. All three channels directly affect aggregate demand and are important targets of monetary policy and so there could be a significant relationship between the two variables (Demir, 2014).

Horndren (1995) takes another perspective to the channel of monetary policy transmission to exchange rate. He states that lower interest rates bring about weaker exchange rates because in periods of lower interest rates short run foreign investment becomes more attractive.

Investors will demand more foreign currency to purchase foreign currency denominated investments leading to depreciation of the local currency. Similarly, there is a long-run effect of monetary policy through inflation (Engel, 2013; Friedman & Kuttner, 2010).Domestic inflation tends to weaken with lower interest rates; and since the exchange rate is itself a price, it will rise with rising inflation (Horndren, 1995).Apart from these factors, other factors influence changes in exchange rates such as the government budget position and expectations.

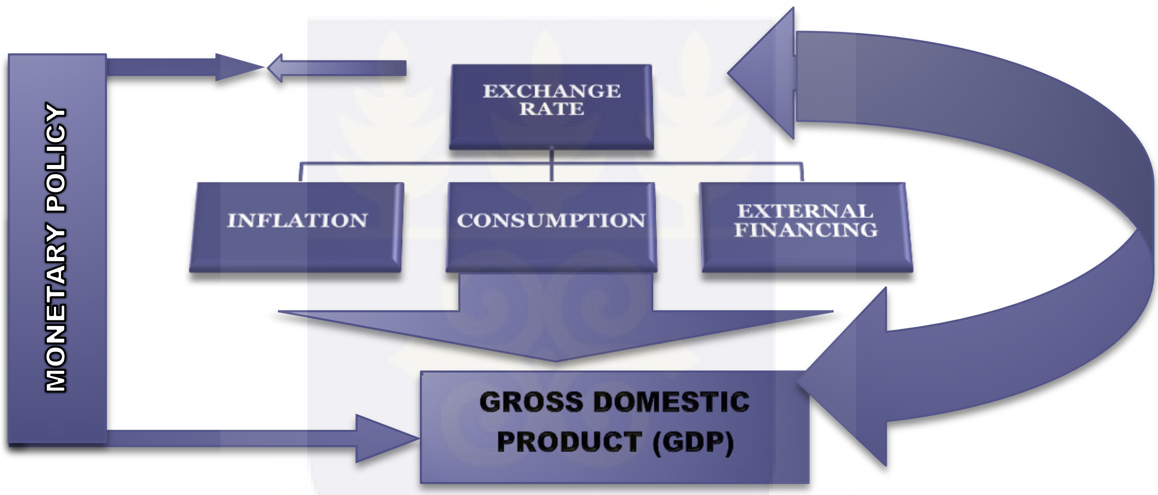


Figure 2.1.Monetary Policy and Exchange Rate

2.3. Empirical Literature

2.3.1. Monetary Policy and Exchange Rate

The question on the empirical relationship between monetary policy and the exchange rate has attracted much attention in the last two decades among researchers (Abouwafia & Chambers, 2015; Buyandelger, 2015; Duarte & Obstfeld, 2008; Elahi, Salimi, & Masoomzadeh, 2016).The exchange rate is an important part of the transmission mechanism of monetary policy. This is because changes in the exchange rate significantly impact the economy through its effects on aggregate demand which in turn is an integral part of monetary policy- in fact, it is the target of monetary policy interventions (Amato, Filardo, Galati, Peter, & Zhu, 2005).That said, it has been observed that there is no consensus in the empirical literature on the nature of the relationship between exchange rates and monetary policy. At best we can say there is a bi-directional relationship between them (Demir, 2014).

Demir (2014) argues that monetary policy is designed to respond to changes in exchange rates meanwhile the exchange rate tends to change with monetary policy. In a study of EU countries, he found that monetary policy responded to changes in the exchange rate, but the coefficient of the reaction was small and statistically significant. Exchange rates invariably change with changing interest rates- a factor determined by monetary policy. This gives credence to the hypothesis that monetary policy authorities do not target exchange rates except to the extent to which they impact on inflationary expectations and real output. The effect of exchange rate on inflation is through import prices and this might be the fastest channel (Clarida & Waldman, 2008; Gagnon & Ihrig, 2004).It is the necessary for monetary authorities to consider exchange rate in setting monetary policy rules (Taylor, 1999).While admitting the theoretical plausibility of contrasting views, Engel & West (2005) argue that long exchange rates cannot be predicted by monetary policy. This could be because of their belief about the persistence, or the memory decay of monetary policy influence over time.

On another hand, Taylor (2001) argues that exchange rate is invariably determined by monetary policy in countries that have a flexible exchange rate regime and supports the view that the two are interrelated (Abouwafia & Chambers, 2015).Furthermore, Taylor (2001) found in a study of long-run relationships, that in the EU and US, monetary policy rules that were made without reference to the exchange rates performed worse than those that considered the exchange rates.

Bacchetta & van Wincoop (2013) shows that the observed relationship of exchange rates on economic fundamentals is not as a result of changes in the fundamentals themselves, but as a result of expectations about these variables. The implication of their argument is that monetary policy does not directly influence exchange rates; neither does the reverse happen, but that economic agents form expectations about movements in these variables which translates into observed effects (Horndren, 1995). The bottom line of all the arguments is that monetary policy and exchange rates are inextricably linked and so one cannot consider them in isolation in the real world (Gagnon & Ihrig, 2004).For the banking industry, which is the focus in this study, both monetary policy and exchange rates directly affect bank activities apart from the endogeneity that exists between them. Interest rates and inflation are key determinants of performance whiles significant portions of bank assets are denominated in foreign currency. This presents substantial exposure to banks and other stakeholders in the industry.

2.3.2. Monetary Policy

This study contributes to the strand of literature that examines the risk-taking channel of monetary policy. Following the global financial crisis in 2007, there has been increasing evidence that shows that though the causes were multifaceted, monetary policy was an important one, hence a number of authors have coined the term "risk-taking channel" to refer to this new transmission mechanism (Altunbas et al., 2012; Borio & Zhu, 2012).Risk-taking channel refers to the perception and the pricing of risk as a result of the monetary policy stance at a given time.

An important study which focused on the transmission mechanism of monetary policy to bank risk-taking was the one by Altunbas et al.(2010).Key among the set of arguments presented in that study was the bank lending channel of transmission of monetary policy to bank risk-taking. They observed that following increasing securitisation of bank loan portfolios in the US and EU, banks are now able to off-load part of their risks to outsiders hence creating an incentive for excessive risk-taking. Angeloni & Faia, (2013) argue that bank risk-taking is significantly influenced by the monetary policy stance. They assert that in periods of expansionary policies, banks were significantly more likely to generate a tendency toward higher risk-taking.

There are two possible ways that monetary policy can primarily affect bank risk-taking. Firstly, it affects the valuations, incomes and cash flows of banks and this impacts on how they measure risks. A low-interest rate will bloat the value of their assets and increase their valuation potentially increasing their risk appetite (Altunbas et al., 2014). The second is that it affects their risk appetite. Low-interest rates could make banks aggressive in an attempt to meet profit targets (Altunbas et al., 2012; de Moraes et al., 2016; Leonardo Gambacorta, 2009). Given that there is a positive relationship between risk and return, they will take on more risk to meet their set nominal targets (Altunbas et al., 2012).

Banks are generally thought to take on more risk in a lax monetary policy environment. This means that while monetary policy authorities seek to achieve desirable macroeconomic ends using lax monetary policy measures, this can trigger bank failures as a result of excessive risk-taking by banks and defeat the intended purpose of the policy (Bekaert, Hoerova, & Lo Duca, 2013).What is not known is how long this process takes. For example, Jiménez, Ongena, Peydró, & Saurina (2008) and Ioannidou et al.(2015) find evidence that in Spain and Bolivia, a ‘‘too accommodative’’ monetary policy led to additional risk-taking by banks prior to the global financial crisis in 2008. It is known that prior to the crisis several countries were in recessions and monetary authorities used the traditional method of expansionary monetary policies to stimulate investment and to help their economies recover (Altunbas et al., 2012).Similar to the findings of Jiménez et al.(2008) and Ioannidou et al.(2015), Altunbas, Gambacorta, & Marques-Ibanez (2010) and Maddaloni & Peydró (2011) find supportive evidence of the risk-taking channel of monetary policy using cross-country data.

Drakos et al., (2016a) observed that monetary policy did not affect risk-taking by foreign banks, that is, banks that are headquartered in a foreign country. Their study used data from 11 central and eastern European countries. Their finding implies that ownership is important in moderating the impact of monetary policy on risk-taking (Haw, Ho, Hu, & Wu, 2010; Iannotta, Nocera, & Sironi, 2007; Shehzad, Haan, & Scholtens, 2010).There are a growing number of pan-African banks with branches spanning several countries. It is not clear if there is a relationship between monetary policy and risk-taking in sub-Saharan Africa as very few studies have examined this relationship. This study explores this relationship.

The foregoing discussion demonstrates clearly that monetary policy stance has implications for bank risk-taking (Angeloni & Faia, 2013; Borio, 2014; Matemilola et al., 2015).It is surprising however that insufficient attention has been paid to the relationship between monetary policy and bank risk-taking given that monetary policy is an important determinant of bank risk-taking (Borio & Zhu, 2012).In addition to this, little is known about the impact of monetary policy on bank risk in sub-Saharan Africa. This study contributes to this strand of literature by filling this gap. This and previous sections have examined key relationships that are the focus in this study. However as pointed by Altunbas et al.(2010), there are several other factors that account for bank risk-taking and thus this study examines the literature further hence.

2.3.3. Capital and Regulation

Despite efforts by authorities in many countries across the world to deregulate and liberalise the banking sector in their countries, the sector is arguably still the most regulated in most countries (Lindquist, 2004; Shim, 2013).This is against the background that failures in the banking sector can have extremely adverse effects on local and global economies. That notwithstanding, there is no consensus on the nature of bank regulation. A key tool of regulation for most banking regulators is the required capital (Zheng et al., 2012).It is the minimum capital that the regulatory authorities set for banks to maintain. As other forms of regulation fade away gradually, increasing emphasis has turned toward the capital adequacy ratio. It is a ratio that compares bank capital to assets. This requirement often affects bank decision making and activities and has consequences for risk-taking.

A high capital requirement restricts entry to the sector and can force existing banks to exit the industry. Bigger banks may acquire smaller ones as in the case of Ecobank and The Trust Bank of Ghana. This strengthens banks' position and makes them resilient to shocks, reducing the probability of failure (Lindquist, 2004).Poorly capitalised banks are exposed to high credit risk-taking and they can spur systemic risk and may threaten stability (Acharya, 2009).Banks often hold capital in excess of the regulatory requirement known as the buffer. This allows them to be able to exploit unexpected investment opportunities.

It can be argued that the amount of buffer that banks hold will depend on how difficult it is for them to raise additional capital on short notice (Lindquist, 2004).Literature on the relationship between bank capital, capital buffer and risk have often focused on whether capital buffer depends on the banks' risk profile, particularly their credit risk-taking and whether the buffer provides an insurance against violating the regulatory requirement and if so, whether it is adequate (Lindquist, 2004; Ofoeda, Abor, & Adjasi, 2012).There is considerable heterogeneity in the empirical results obtained by studies across countries and time (Jokipii & Milne, 2011; Shim, 2013) which we discuss next.

As one of the key instruments of modern day banking regulation, capital requirements are used to provide a cushion during adverse economic conditions and as a mechanism for restraining banks from excessive risk-taking ex-ante (Jokipii & Milne, 2011).Extant empirical literature has focused on investigating this relationship between capital and risk-taking behaviour of banks. Specifically, these studies have tested the role of capital regulation as a determinant of bank risk-taking behaviour. The dominant conclusion has been that there is a positive relationship between capital and risk appetite of banks consistent with theory. In a study of capital buffer risk in the Canadian banking industry, Guidara, Lai, Soumaré, & Tchana, (2013) examined the relationship between bank capital buffer and the business cycle.

Capital buffer refers to the minimum capital banks hold to meet regulatory requirements. Regulatory bodies may target the creation of adequate capital buffers to reduce the pro-cyclical nature of lending by creating countercyclical buffers (Jokipii & Milne, 2008).The cycle referred to here is the business cycle. When lending is pro-cyclical, it means that banks lend more in booms (expansions) and less in troughs (recessions).This has the tendency of prolonging recessions and so regulators intervene by making regulations that are countercyclical.

Guidara et al., (2013) found that there is a negative relationship between banks' capital buffer and their risk exposure, but this was statistically insignificant. Furthermore, they find a positive co-movement between the capital buffer and the business cycle, which is countercyclicality. Canadian banks were generally resilient to the global financial crisis which begun in the US shortly before their study period and they attribute this to the implementation of Basel II and other leverage constraints imposed by the Canadian regulators which controlled risk-taking by banks. This means that banks in Canada increased their capital buffer more in booms and less so in troughs. This is in contrast to findings on Europe and US (eg Jokipii & Milne, 2008, 2011; Shim, 2013; Stolz & Wedow, 2011), but confirmed similar results by Lindquist (2004) on Norway.

Zheng et al.(2012) document that among Chinese banks the relationship between capital and risk adjustments for banks with sufficient capitalisation is positive. This means that they increased risk-taking when capital increases and decrease risk-taking when capital requirement decreases. On the contrary, Chinese banks that had capital buffers close to the minimum capital requirement showed a negative relationship between capital and risk-taking. Thus low capitalised banks increased their capital buffer by taking less risk. Additionally, ElBannan (2015) noted that among banks in Egypt those who exceeded the regulatory requirement of the capital adequacy ratio were more likely to take higher risk. It is, therefore, apt to conclude that regulation and level of capital have implications for risk.

2.3.4. Size

On the question of bank size and risk-taking, it is imaginable that bigger banks will take more risk and extant literature provides supporting evidence. This was the case in Bangladesh when Rahman et al., (2015) researched on the relationship between size and bank risk-taking in that country. They documented that larger banks held lower capital ratios and were associated with higher risk-taking. Likewise, they found that highly capitalised banks take the lower risk. A plausible justification for why size might impact risk-taking is that size determines activities such as accessible investment opportunities, portfolio diversification, reputation and access to equity. In Egypt, ElBannan (2015) find that smaller banks have incentives to increase risk. They noted that following reforms that led to a consolidation of banks, competition and bank sizes increased. In the context of India, Shahid (2016) find that large banks took less risk by undertaking greater diversification and exploiting economies of scale.

2.3.5. Profitability

It is widely acknowledged that risk and return are directly related. This suggests that banks who take more risk would perform better. The evidence available however does not provide evidence to the assertion. For instance, Terraza (2015) found that among European banks, large banks that were exposed to credit risk-taking had significantly poorer performance. The results showed otherwise for medium banks. This suggests that the relationship between performance and risk is moderated by bank size.

Zhang, Jiang, Qu, & Wang (2013) examined the relationship between performance and risks among banks in BRICS countries and documented that banks who take less risk performed better. Furthermore, Arif & Nauman Anees (2012) studied the Pakistani banking sector and report that the results of multiple regressions suggest that higher risk-taking significantly reduced profitability. These findings resonate across several studies in the literature (e.g.Aebi, Sabato, & Schmid, 2012; Casu et al., 2013; Fredrick, 2012; Funso et al., 2012; Guidara et al., 2013; Sabeza, Shukla, & Bajpai, 2015; Tsai & Luan, 2016).This clearly shows a conflict between theory and empirical evidence; which needs to be reconciled- particularly for banks.

2.3.6. Cost Efficiency

Formally, cost efficiency is given by the ratio of operational cost to operating income. A lower ratio signals that a bank is cost efficient. Fiordelisi & Marqués-Ibañez (2013) argued that bank risk-taking profile is affected by cost efficiency. Cost efficient banks are expected to take less risk.

2.3.7. Market Power and Competition

Market power is measured by the Concentration Ratio and this also measures competition. Fiordelisi & Marqués-Ibañez (2013) argued that market power is a determinant of bank risk-taking. Tabak, Gomes, & Da Silva Medeiros (2014) find a negative association between market power and risk-taking behaviour among banks in Brazil. Their finding suggests that banks that have considerable market power are less likely to take up more risk than other banks that have less market power. This can be explained by the fact that banks' franchise values decline with increasing competitions and so asset risks rises (González, 2005; Haq et al., 2014; Jiménez, Lopez, & Saurina, 2013). Meanwhile Jiménez, Lopez, & Saurina (2013) report that the relationship between competition and bank risk-taking is a non-linear one (Gambacorta, 2009).ElBannan (2015) intimated that consolidation of banks enhanced their market and competition in the industry and in the Egyptian banking sector this impacted on risk-taking.

2.3.8. Other factors

There exists a strand of literature that focuses on qualitative determinants of bank risk-taking. This strand of literature argues that other factors influence risk-taking apart from the numbers and ratios. They study the role of factors such as religion and location determining risk-taking by banks. They argue that in the operations of banks, it is human beings who make decisions; the traits of the human beings and the preference of stakeholders will, therefore, influence decisions on risk. Moreover, logical factors and rationality based arguments have not successfully explained bank risk-taking fully.

The first factor that is considered is religion. Adhikari & Agrawal (2014) find that religiosity significantly influenced bank risk-taking in the US. Banks headquartered in more religious areas had exhibited lower stock return volatility, lower tail risk and lower idiosyncratic risk and were less likely to default on their obligations. Kanagaretnam, Lobo, Wang, & Whalen (2015) obtain similar results using cross-country data. This can be explained by the argument that religious people are honest and think more of the consequence of their actions on other people. Thus management is less likely to take decisions which would increase exposure. They grow their assets more slowly and they hold safer assets and rely less on non-traditional banking (Adhikari & Agrawal, 2014). Such banks usually provide their management less incentive for risk-taking. Moreover, borrowers who are religious and god-fearing are more likely to repay their loans as most religions teach (Kanagaretnam et al., 2015).Shareholder diversification has been found to affect bank risk-taking (García-Kuhnert, Marchica, & Mura, 2013).

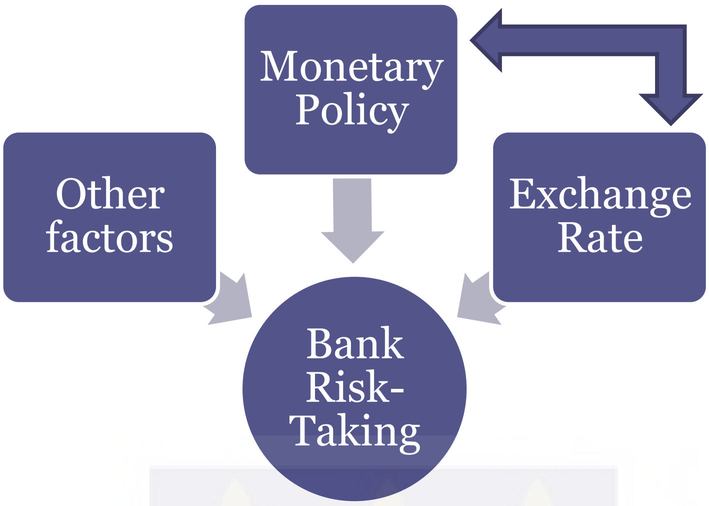
In addition, another factor that has been found to influence bank risk-taking is financial openness (Luo, Tanna, & De Vita, 2016).Financial openness shows the extent to which the financial system of a country is regulated. This is different from bank regulation as discussed in 2.3.5 above. A heavily regulated financial system is not open. Thus, when a country is financially open, it implies that the level of regulation in the country is relatively less. Highly regulated financial systems have governments dictating actions such as who to lend to, the lending rate, etc.

Financial openness has been identified as an indirect determinant of bank risk-taking. It has been found to affect bank risk through a channel known as the bank profit efficiency channel (Luo et al., 2016).Bourgain et al.(2012) studied countries in the MENA region and found that there is a negative relationship between the level of financial openness in a country and the risk-taking indicators of banks. Following their approach, this study measures financial openness with the Kaopen index developed by Chinn & Ito (2006).

2.3.9. Conceptual Model

Figure 2.2 shows a graphical conceptualization of the relationship between monetary policy, exchange rate and other factors and bank risk-taking (Gagnon & Ihrig, 2004).Based on the literature reviewed up until now, it can be concluded that the relationship between monetary policy and exchange rates is bi-directional. This is represented by a two-way arrow to the either variable in figure 2.2.In addition; the conversations in the literature suggest that both variables can independently affect bank risk-taking. The exchange rate is expected to influence risk-taking mainly through inflation (Chang & Velasco, 2000).It is important to emphasise that inflation is a monetary policy objective.

Figure 2.2.Monetary Policy, Exchange Rate and Risk-taking



It is appropriate to make an assumption here regarding the memory of monetary policy, or the persistence of monetary policy effects on bank risk. This is against the background that the effect of macroeconomic policies generally decays over time. This effect is measured in the empirical model by the inclusion of lag of the monetary policy variable.

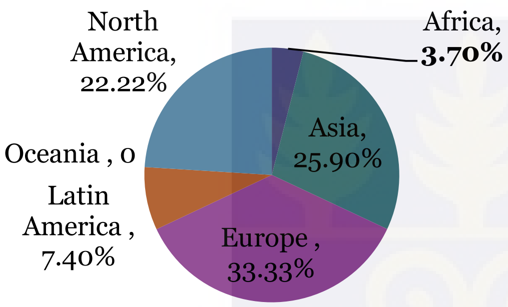
2.4. Exposition of Gaps and Classification of the Bank Risk-taking Literature

It is important at this point to highlight the gaps that have been identified in the literature and which requires further research. This is achieved by classification of the literature based on certain criteria. For each classification, a large sample (more than 30) was selected randomly from a total of 221 papers downloaded from Emerald, Science Direct and Taylor and Francis databases.

2.4.1. Geographical Classification and Context Gaps in the Literature

Figure 2.3 displays the results of the classification of literature based on the geographic focus of existing studies. It was found that of the bank risk-taking papers sighted only one out of twenty focused on the African continent. Nearly two out of every five papers focused on Europe; about one out of three papers focused on Asia while one in four were focused on North America. These papers were mainly focused on the US while a few others focused on Canada. Latin America had less than one out of ten papers. This result shows that bank risk-taking is woefully under-researched in Africa, Oceania and Latin America as shown in figure 2.3.This presents a gap in the literature on the African continent.

Figure 2.3.Classification of Literature Based on Geographical Focus

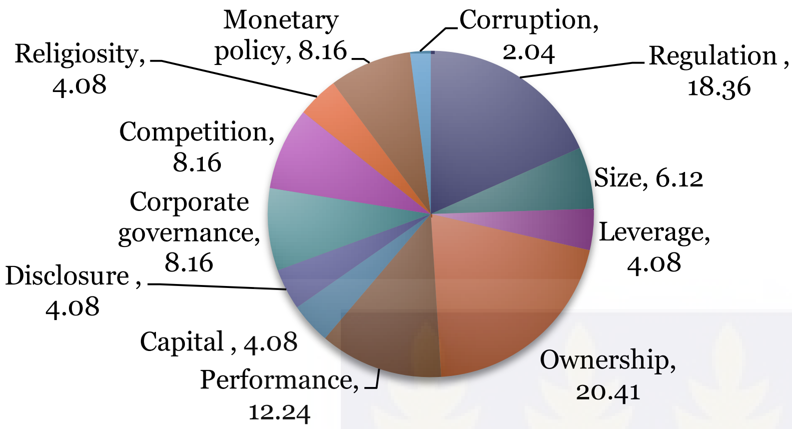


2.4.2. Classification Based on Issues and Identification of Issue and Evidence Gaps in the Literature

A total of twelve issues were identified in the literature. These included corruption, monetary policy, religiosity, competition, regulation, size, performance, leverage, capital, ownership, corporate governance and disclosure. The result is displayed in figure 2.4.The result shows that with the exception of ownership and regulation which have been given considerable attention, all the other factors had been relatively under-researched.

Moreover, there are innumerable factors that the banking sector is vulnerable to and which need to be given attention. There thus exists a gap in corruption, monetary policy, religiosity, competition, size, performance, leverage, capital, corporate governance and disclosure. Other factors that affect bank risk-taking also need to be studied apart from these factors. The present study will contribute towards filling the gap in monetary policy and exchange rate studies.

Figure 2.4.Classification of Literature Based on Issues Researched



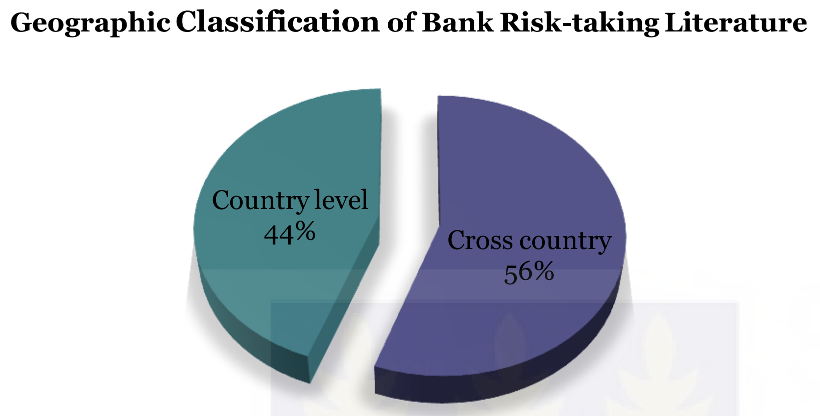
2.4.3. Classification Based On Level of Analysis and Level of Analysis Gaps

Figure 2.5 displays the results of classification based on the level of analysis of existing research. The results indicate that most previous studies have been conducted using cross-country data. This is important given the growing influence of multinational banks in many countries. The finding, however, suggests that there are a considerable number of country-level studies.

It is, however, important to reiterate that both ways African and Latin American countries still remain under research. In fact, an observation of the literature revealed that cross-country studies that included African countries either included countries in North Africa, or South Africa. This was either based on BRICS (which includes South Africa), or MENA (which includes Egypt).Thus sub-Saharan countries as a whole were excluded. There is, therefore, a level of analysis gap in Africa both for cross-country studies and for country-level studies.

Bank level studies are generally rare across the literature. The current study contributes to filling the cross country gap on sub-Sahara Africa.

Figure 2.5.Classification of Literature Based on Level of Analysis



2.4.4. Classification Based On Time and Period of Study and Time Relevance of Existing Literature

Research on bank risk-taking behaviour has grown persistently over time. This could be as a result of the devastating effect of bank crisis in the last two decades. Figure 2.6 displays this fact as it shows that research on bank risk-taking has grown continuously since 1999.The trend shows that existing studies are relevant for decision making presently as they are not remote from present realities in the industry.

Figure 2.6.Distribution of Research across Time

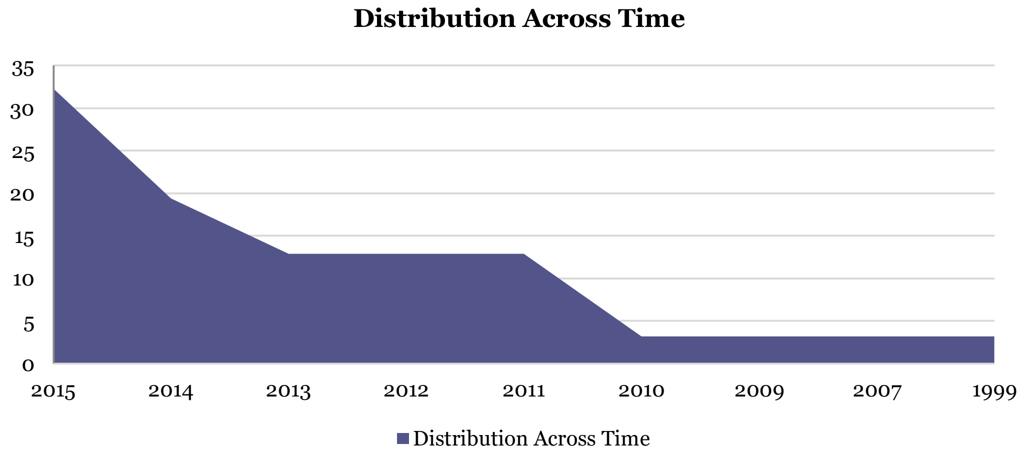
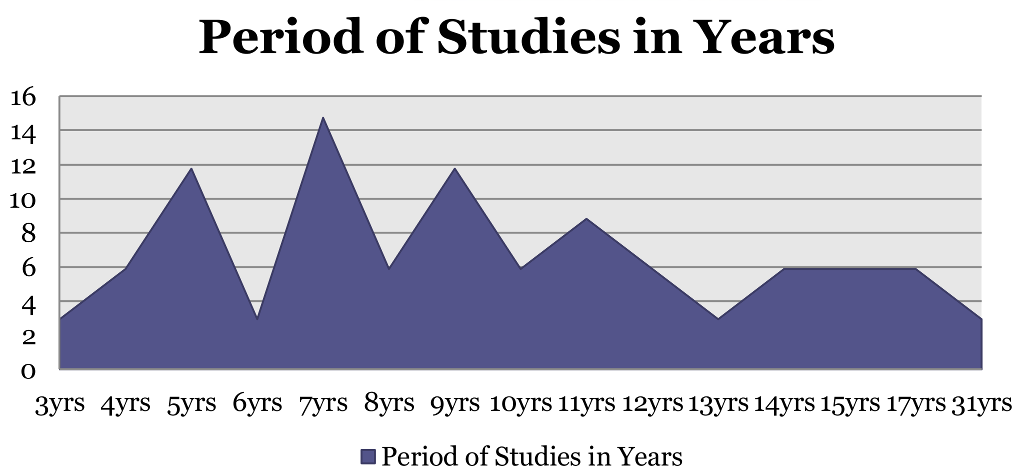


Figure 2.7 displays the results of classification based on the duration of the studies, that is, how many years' data were included in the studies. The main interest here is to determine whether existing literature focused on short, medium, or long-term factors. The result indicates that more is known about short and medium-term determinants or factors than long-term factors. It will be interesting to extend more research to include longer periods to show whether, or not there is any difference between the time effects of these factors. The present study includes 15 years data on sub-Sahara Africa.

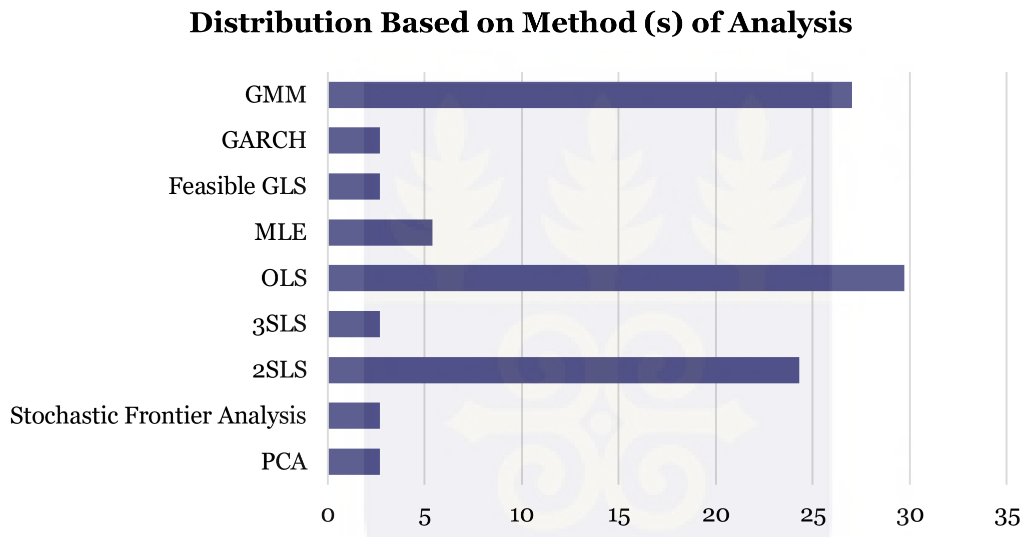
Figure 2.7.Distribution of Studies Based on Period of Study



2.4.5. Review of Methodological Approaches

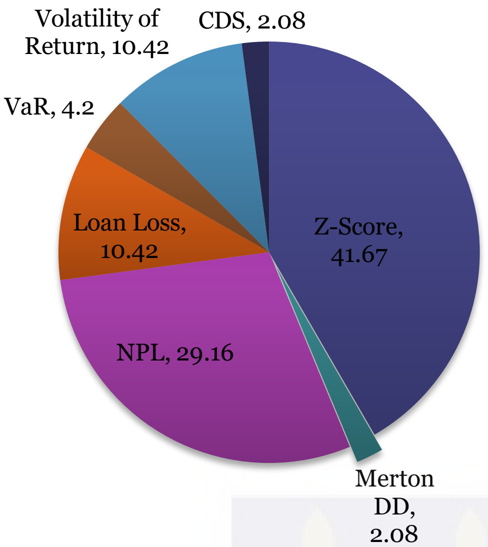
There are several methods of analysis that can be used for research. A survey of the literature discovered nine methods of analysis that have been used in existing literature. These are displayed in figure 2.8.The result indicates that OLS, 2SLS and GMM are the most used methods presently.

Figure 2.8.Classification of Literature Based on Method of Analysis Used



Another methodological issue that is important for the purposes of this thesis is the measure of risk-taking. The result of the survey shows that 42% of studies sighted used the Z-Score to measure risk-taking. The second most used measure is the NPL. These are easy to obtain, or compute from accounting records and so that could explain their popularity.

Figure 2.9.Classification of Literature According to Measure of Risk-taking Adopted



That notwithstanding, a forceful argument exists for why accounting data may not be the most appropriate. The section of literature that makes these arguments suggest that market-based measures such as CDS and volatility of return are more appropriate because they adjust in real time. The main challenge with using these measures, however, is the fact that apart from financial markets in the US and most parts of Europe, most other countries do not have very active financial markets, and even if they did it is unlikely that as many banks are traded. The result is displayed in figure 2.9.

2.4.6. My Contribution to the Bank Risk-taking Literature

This present study contributes to the bank risk-taking literature by filling three principal gaps. As identified in the preceding subsections, there exists a context gap (sub-Sahara Africa), level of analysis gap (cross country) and issue gaps (such as Monetary Policy and Exchange Rate).The study also contributes to other gaps such as method and time which arise following the context gap.

As a continent, Africa's financial sector is an evolving one. It is, therefore, imperative that we build a repository of knowledge about the sector to forestall the adverse outcomes as have occurred in Europe, Asia and North America in the last two decades. It is even more crucial to focus on the banking sector as the financial sectors of many countries in the continent are bank-oriented (Levine, 2002; Oima & Ojwang, 2013).Risks embody the totality of the likelihood of any adverse outcomes and it is instructive to understand the nature of risks and the factors that motivate risk-taking.

Monetary policies have been established to have potential implications for the banking sector. In addition, pan-African and transnational banks are gaining influence in the African continent and this makes exchange rates an important issue for banks as it affects translation of their profits. Moreover, the presence of multinational companies and increasing international trade means that foreign exchange fluctuations matter for all sectors of the economy; and banks are key players in the foreign exchange market. It is against this background that the present study is warranted as little is currently known about factors that influence risk-taking in the banking industry of Africa.

2.5. Chapter Summary

This chapter has extensively reviewed previous works on three key variables, monetary policy, exchange rates and risk-taking by banks. It included a review of additional variables that are widely discussed in existing literature and considered to impact bank risk-taking behaviour. Monetary policy influences bank risk-taking directly through the lending channel and the balance sheet channel. Exchange rate influences bank risk-taking through dollarized assets and liabilities. Monetary policy, in turn, feeds into the exchange rate through the interest rate channel and back to monetary policy through inflation and aggregate demand. A key conclusion in the literature is that the determinants of risk-taking are varied and that although much is already known, it is clear that there still remains much to be discovered. A new thread of literature has argued that attention should be paid to human characteristics as important factors in explaining bank risk-taking. This study examined other factors such as performance, size, capital, regulation and competition which have been widely regarded to determine risk-taking by banks in the existing literature. These discussions culminated in a conceptual framework that guided the research. The latter part of the chapter classified existing literature and established the gaps that exist to be filled by this and future studies.

CHAPTER THREE

EMPIRICAL METHOD

3.1. Overview of Chapter

For the purpose of replication, it is important to give details about the method employed to arrive at the conclusions. In this chapter, this study offers a closer look at the empirical methods that were applied to find answers to the research questions of chapter one. The purpose of the chapter is to describe the techniques chosen; as well as the motivation for including the variables that were selected for the study. The chapter also gives information about the sources of data on the variables. The rest of the chapter is organised as follows: Section 2 discusses briefly the design of the study. Section 3 discusses the research paradigm that guided the study. Section 4 presents the method of analysis and econometric model specifications. In section 5, this study tells the sources of the data adopted for the study while section 6 discusses in detail the measures of risk-taking and variables used in this study.

3.2. Research Design

The purpose of this research is to investigate the causal relationship between monetary policy, exchange rates and risk-taking by banks in sub-Saharan Africa. To achieve this research purpose, this study establishes interim relationships, as in chapter two, based on the intellectual discourse in the risk-taking literature; this study tests these relationships and analyse the findings in chapter 4.The method of this study is quantitative.

3.3. Research Paradigm

A research paradigm refers to a set of beliefs, values and techniques that are shared by members of an academic discourse community and it serves to guide how they perceive reality and how they study it (Boateng, 2014).The underpinning paradigm for this research is positivism. The positivist paradigm argues that there exists a single reality, which is objective and tangible. The nature of the subject matter of this study makes it amenable to the positivist paradigm and this is de facto paradigm for many banking studies. It leaves no room for personal opinions and reality is deemed to be independent of time and context. This is ensured by performing several robustness checks on the model specifications.

As is common with positivism, the methodology adopted is wholly quantitative. Secondary data was used and the setting of the study is experimental. Positivism thrives on deductive reasoning and so the conclusions in this study are made based on the parameter estimates obtained after running the specified regressions.

3.4. Method of Analysis

This section discusses the methods of analysis that are employed for this study. The principal methods of analysis are the LSDV and PCSE. The LSDV has been shown by Judson & Owen (1999) to be powerful for studies such as ours. The PCSE is performed for robustness. Appropriate parametric and diagnostic tests are carried out on each model.

3.4.1. Econometric Specification

Risk-taking is a function of monetary policy, exchange rate and other controls.

$$\mathrm{RISK\_TAKING}_{it} = \mathrm{f}(\mathrm{MONETARY\ POLICY}_{t}, \mathrm{EXCHANGE\ RATE}_{t}, \mathrm{CONTROL\ VARIABLES}_{it})$$

Specific models are formulated to examine variations of the relationships that were established in chapter two.

Model 1:

$$\text{Risk} - \text{Taking}_{\text{it}} =$$

$$\delta_1 \text{MonetaryPolicy}_t + \delta_j \sum_{j=1}^{J} \text{BankCharacteristics}_{it} + \delta_j \sum_{j=1}^{J} \text{MacroeconomicVariables}_{\,t} + \omega_i + \mu_t + \varepsilon_{it}$$

Model 2:

$$\text{Risk} - \text{Taking}_{\text{it}} = \alpha_1 \text{Exchange Rate}_t + \alpha_j \sum_{j=1}^{J} \text{BankCharacteristics}_{it} + \alpha_j \sum_{j=1}^{J} \text{MacroeconomicVariables}_{\,t} + \nabla_i + \infty_t + \epsilon_{it}$$

Model 3:

$$\text{Risk} - \text{Taking}_{\text{it}} = \beta_1 \text{MonetaryPolicy}_t + \beta_2(\text{MonetaryPolicy}_t \text{x Size}_{it}) + \beta_3(\text{MonetaryPolicy}_t \text{x Profitability}_{it}) + \delta_j \sum_{j=1}^{J} \text{BankCharacteristics}_{it} + \delta_j \sum_{j=1}^{J} \text{MacroeconomicVariables}_{\,t} + \gamma_i + \pi_t + \ni_{it}$$

Where t refers to the index for time (1………T), the year and i is the index for the individual bank (1……N) and $\ni, \epsilon, \mu, \infty, \pi, \omega, \nabla, \gamma$ *and* ε are the error terms. j=1,……J.

3.4.2.Least Squares Dummy Variable Regression (LSDV) and Panel Corrected Standard Error Regression

The LSDV estimator is pooled OLS including a set of N-1 dummy variables which identify the heterogeneity within each panels and hence an additional N-1 parameters. Due to the constant that is included, one of the individual dummies is dropped. The estimators for the FE and the LSDV are numerically alike and they are thus consistent under same assumptions. The use of Least Squares Dummy Variable Model helps to obtain the bank specific effects which absorb omitted variables that differ from one bank to another but are constant over time.

The LSDV estimates are optimal if the error processes have the same variance (homoscedasticity requirement) and the errors are independent of each other (no autocorrelation requirement).This study examined the data for homoscedasticity and autocorrelation and found that most of the specifications had heteroscedastic and autocorrelated error terms. It is however common to find panel processes being plagued by complex error correction issues and so this study reports robust standard errors instead of the standard OLS errors following a similar approach to Ofoeda et al.(2012).This ensures that the LSDV estimates are optimal. For robustness still, the Prais-winsten panel corrected standard error (PCSE) technique was implemented. The prais-winsten PCSE corrects for heteroscedasticity and autocorrelation. The two techniques use different error correction processes to achieve similar outcomes. The LSDV with robust standard error implements the white-correction whiles PCSE uses the Beck & Katz (1995) correction approach. The two methods however yielded qualitatively similar results.

3.5.Data

3.5.1.Sources of Data

There were many sources from which data could have been obtained\ on banks that were used for the analysis in this study. The sources include “DataStream”, “Bloomberg”, “Moody’s-KMV” and “BankScope”. It is also possible to obtain data manually from bank reports following authors such as Guidara, Lai, Soumaré, & Tchana (2013). The last option was considered but was found to be inefficient and expensive and so was abandoned it. After careful consideration, BankScope was selected. The main reason for selecting BankScope was availability and accessibility. Apart from that, data availability was considered as data available on BankScope is one of the most comprehensive on banks across the globe and Sub-Saharan Africa in particular. The database contains information on the financial reports of over 32000 banks and up to two hundred (200) data items. In addition, there are up to 36 pre-calculated ratios on each bank in the database (Bhattacharya, 2003; Bureau van Dijk, 2014; García-Kuhnert et al., 2013).Thus, the other sources were not used mainly due to accessibility.

For macroeconomic variables, this study used data from the International Financial Statistics (IFS) of the International Monetary Fund (IMF) and the World Bank database on development indicators. The IMF and World Bank databases on macroeconomic variables are among the reliable and comprehensive sources of data on most standard macroeconomic variables. The data also cuts across countries and includes all the countries in the sample. Moreover, these data were easily accessible. Lastly, financial openness was measured using the updated (2015) Chinn & Ito (2006) index.

3.5.2.Study Sample

The study sample includes 534 banking organisations in 37 countries in Sub-Saharan Africa whose data is available in the BankScope database. Selection of banks was based first on the availability of monetary policy data for the country and on the availability of bank data in BankScope. Thus banks in countries whose monetary policy data could not be obtained were not included. The period of the study is 15 years from 2001 to 2015. The data was unbalanced due partly to the year in which certain banks were established and partly due to whether any bank's data was reported for all years in BankScope.

3.6.Variables

3.6.1.Dependent Variable

There are different ways in which risk-taking can be measured. These include the loan loss provision, capital to equity ratio, ratio of liquid asset to total deposits, non-performing loans ratio (NPLR), the Z-Score, yield on the bonds issued by the bank credit rating and credit default swaps (CDS) premium (De Bruyckere et al., 2013; Fiordelisi & Marqués-Ibañez, 2013).Each of these measures captures specific types of risk-taking behaviour. De Bruyckere et al.(2013) argued that the CDS premium is the most appropriate measure to capture default risk because it is able to capture market perception in real time unlike credit ratings and bond yield, which do not adjust in real time. Moreover, CDS premium captures other factors ignored by the other measures of risk. This study measures default risk using the z-score due to data unavailability. Credit risk was measured using NPLR; asset risk using loan loss provision; liquidity risk using ratio of liquidity assets to total deposits; and capital risk using the ratio of capital to asset.

- **The Z-Score**

The Z-Score gives an indication of the probability of bankruptcy or default risk based on the amount of cushion that a bank has to be able to withstand any shock to its earnings. The Z-Score is stated formally as:

$$Z = \frac{ROA + CAP}{\sigma_{ROA}}$$

Where ROA (Return on Assets) is a measure of the extent to which the bank's asset is being used efficiently to generate profit. This information is obtained from the balance sheet of the banks in the study sample. ROA was calculated using the ratio of Net Profit before Tax (PBT) to the Total Assets of the bank at the end of a given year. It tells how many dollars or earnings a bank derives from each dollar of the asset in their portfolio. It provides a useful comparison of banks as it indicates the capital intensity of the bank. This is stated formally as:

$$ROA = {}^{PBT}/_{T\_ASSET}$$

The expression CAP is the Equity to Asset ratio.The term $\boldsymbol{\sigma}_{ROA}$ is the standard deviation of the rate of return on assets. Thus, Z-Score is interpreted as the total standard deviations by which banks return must fall before a bank's equity will be eaten up, or depleted (Luo et al., 2016; Tabak et al., 2014).A higher Z-Score means that a bank has a greater buffer and is solvent or stable. Thus in the basic form above, a high Z-Score is desirable. According to Laeven & Levine (2009), the Z-Score measure in the form stated above is highly skewed. They propose that to correct for this, the natural logarithm of the Z-Score should be used. Taking the natural log of the Z-Score also has the effect of smoothening extreme values (Bhagat, Bolton, & Lu, 2015).This can be expressed as:

$$\ln Z = \ln\left(\frac{ROA + CAP}{\sigma_{ROA}}\right)$$

Finally, following García-Kuhnert, Marchica, & Mura (2013) and Adhikari & Agrawal (2014) this study adopted what they called the inverse Z-Score. García-Kuhnert et al.(2013) stated the inverse Z-Score as $^{1}/_{\mathrm{Z-Score}}$.Adhikari & Agrawal (2014) on the other hand defined the inverse Z-Score as the basic Z-Score multiplied by -1 (i.e.–Z-Score, or –lnZ-Score).The advantage in using the inverse Z-Score is with the interpretation. The interpretation of the Z-Score now becomes direct, that is, high Z-Score means high insolvency, or high default risk. The definition of Adhikari & Agrawal (2014) of the inverse Z-Score is adopted for this study. However, for simplicity, it will continue to be referred to as the Z-Score hence. The inverse Z-Score is formally stated as:

$$-\ln Z = -\ln\left(\frac{\mathrm{ROA} + \mathrm{CAP}}{\sigma_{\mathrm{ROA}}}\right)$$

Iannotta et al.(2013) however point that compared to market measures of risk such as the volatility of stock return, stock betas and CDS; the Z-Score is methodologically weak. They argue that among other things, the Z-Score assumes implicitly that the quality of a bank's asset is accurately captured by the volatility in its accounting profit and that it relies on the standard deviation of the accounting return on assets, which is either measured with limited observations, or relies on distant past observations. The merit of their argument is that market values are able to capture risks better because market values adjust in real time and so accurately measures risk at any given time whiles accounting values proxy risk using historical data.

Moreover, market values incorporate other factors besides those represented by accounting ratios. While we acknowledge the plausibility of these arguments, we do not work with it in this study because financial markets in most Sub-Saharan African countries are significantly underdeveloped compared with markets elsewhere (Oima & Ojwang, 2013).What is more, a significant proportion of banks in Sub-Saharan Africa are either not publicly traded, or have little publicly available information on market proxies of risk-taking behaviour constraining the use of market values (Afful & Asiedu, 2014; Barnhill Jr.et al., 2002; Kenny & Moss, 1998).This study thus follows Drakos et al., (2016a), García-Kuhnert et al.(2013), Bokpin (2016) and others to use the Z-Score as the measure of default risk-taking in sub-Sahara Africa.

- **Non-Performing Loans Ratio (NPLR)**

The non-performing loans ratio is a measure that shows the stock of loans that are non-performing compared with the total loan stock at a given point in time (Angkinand & Wihlborg, 2010).An alternative model is estimated using NPLR (expressed as a percentage) as a measure of credit risk-taking (Shahid, 2016).Further, this variable is transformed by taking logs as follows:

$$\ln NPLR = \left(\frac{\text{Non\_Performing loans}}{\text{Total Loans}}\right)$$

Higher values of lnNPLR denote higher credit risk while lower values indicate lower credit risk.

- **Liquid Assets -To-Deposit Ratio (LATD)**

Liquidity risk is measured using the ratio of liquid assets to total deposits and short-term borrowing (expressed as a percentage).A higher ratio suggests that a bank is more liquid and will be able to meet its liabilities as they fall due or unforeseen demand for funds. In this way, a higher ratio is desirable; however this is inverted so that a higher ratio will mean higher risks. It is stated formally as:

$$\text{LATD} = -\frac{\text{Liquid Assets}}{\text{Total Deposits and Short-term borrowing}}$$

- **Loan Loss Reserve to Gross Loans Ratio (LLR)**

Asset risk refers to uncertainties in the realisation of the assets. A high risk means that there is a greater uncertainty on whether a bank would be able to realise its assets. Asset risk is measured using the ratio of loan loss reserve to gross loans (expressed as a percentage) (Brewer & Saidenberg, 1996; Distinguin, Roulet, & Tarazi, 2013; Sarkar & Sensarma, 2016). Loans are an important part of bank assets and can be large relative to other asset classes.

Banks therefore use the loan balance as a basis for making a provision for potential losses to assets. Banks keep the reserve in anticipation of shocks to asset value. The reserve is itself recorded as an asset in the balance sheet of the firm and it reflects movements in the assets of the bank and asset quality. A high reserve helps banks to absorb losses better and this makes banks with a higher reserve less prone to bankruptcy. A higher ratio is desirable, however to present the result consistently, the inverse is taken by multiplying it by minus 1.This measure is stated formally as:

$$\text{LLR} = -\frac{\text{Loans Loss Reserve}}{\text{Total Assets}}$$

- **Ratio of Equity to Total Assets (CAP)**

Equity to asset ratio is used as a measure of capital risk. Capital Risk is a measure of how much of the bank's assets come from owners' equity. The franchise value theory discussed in the preceding chapter stated that banks with high owners' equity will take less risk following fears that shareholders will suffer high losses (Jiménez et al., 2013; Konishi & Yasuda, 2004; Ren & Schmit, 2006).It is measured by the ratio of equity to the asset of the bank (expressed as a percentage).

Generally, a high ratio is preferred for several reasons. One of such reasons is the fact that a high equity ratio serves to signal potential shareholder that the bank is worth investing in because many investors deem the company to be a good investment. Another reason is that a higher ratio signals potential creditors that the business is sustainable in the long term and so it is less risky to lend to. The equity ratio is a sign of leverage since higher equity ratio means lower leverage. Thus banks with a higher equity ratio have a better credit rating.

Also, equity financing is usually much cheaper compared to debt financing and as result banks with higher equity ratios will have less financing cost. All of these factors are favourable to owners of equity capital. The reverse is unfavourable and undesirable and so the reverse will pose higher risks for suppliers of equity capital. In order to present the interpretation of the result consistently with other measures of risk-taking above, natural logs are taken and the inverse by multiplying it by minus 1.This is stated formally as:

$$\text{CAP} = -ln\frac{\text{Equity}}{\text{Total Assets}}$$

This will make a higher ratio undesirable and a lower ratio more desirable. Thus a higher ratio will be interpreted as higher capital risk.

3.6.2.Independent Variables

- **Monetary Policy**

Monetary policy is a key variable of interest in this study. In chapter two it was shown that monetary policy comes in various forms including inflation trend, inflation targeting, policy rate and open market operations. Inflation targeting is comparatively new among the range of tools available to monetary policy authorities; as a result, only a few countries in Africa such as Ghana and South Africa have adopted this tool (Roger, 2010).

Moreover, for these countries, the monetary authorities have not abandoned the use of monetary policy rate. For this reason, this measure is not used. Open market operation and inflation trends are other measures that can be used as proxies for monetary policy; however, these measures are not always entirely because of monetary policy stance. That is, there are other factors that influence these measures besides the existing monetary policy such as expectations and speculation. Inflation is influenced by expectations, something that cannot be effectively controlled by the monetary policy stance. In addition, open market operations by the way they are conducted can be in response to, or influence speculation.

For this study, the monetary policy rate is considered a desirable measure for monetary policy. The monetary policy rate is an explicit statement by the monetary authorities. It signals interest rates in the economy- something that directly affects bank performance. Moreover, this has been used by several authors as the proxy for monetary policy in various research (Fiador & Biekpe, 2015; Galí & Monacelli, 2005; Matemilola et al., 2015).Monetary policy rates have different names in different countries. Examples of such names are the (re)discount rate, bank rate and repurchase (repo) agreement rates. In those countries, the monetary policy authorities intend them to perform the same function as the policy rate. These rates were used to proxy monetary policy stance in this study.

- **Exchange Rates**

The conceptual model presented in chapter two argued that exchange rates can influence risk-taking both directly and through the monetary policy (Bjørnland, 2009; Jääskelä & Jennings, 2011).It was also established in that chapter that there is a bi-directional relationship between monetary policy and exchange rates. Exchange rates were measured using the annual real effective exchange rates while changes in exchange rates have been measured by changes from the previous year to the current year (Kohlscheen, 2014).Data on exchange rates were obtained from the World Bank.

- **Bank Size**

Bank size has been found to influence bank risk-taking across time and contexts (García-Kuhnert et al., 2013; Laeven et al., 2015; Rahman et al., 2015; Terraza, 2015).Bank size has been measured in different ways. Two of such ways include total asset and capitalisation. Another is the total deposit over a period. The study uses the natural log of total assets following Bhagat, Bolton, & Lu (2015), Ioannidou et al.(2015) and Stolz & Wedow (2011) as a proxy for bank size. This has the advantage of reducing the possibility of heteroscedasticity and to pull in extreme values (García-Kuhnert et al., 2013).We can talk about percentage changes- a desirable way to describe the effects of changes in size on bank risk-taking. A positive sign is expected for this variable..

- **Profitability**

This study proxies profitability by ROA since this is readily obtainable and is the preferred measure of profitability in the literature and has been justified in the preceding chapter (Dong, Firth, Hou, & Yang, 2014; Iannotta et al., 2007).Other potential proxies exist such as the Return on Equity (ROE), but this is less preferred because it is difficult to obtain reliable data on ROE for non-listed firms. A positive sign is expected for this variable...

- **Competition**

This study follows Sarkar & Sensarma (2016) and Delis & Kouretas (2011) to measure competition using the Concentration Ratio (CR) in the banking industry. The Concentration Ratio measures how much of total industry assets are owned by a selected number of big banks. It measures industry dominance. This study uses the ratio of assets owned by the three largest banks (known as CR3).A high ratio signifies low competition because it means that few banks control a significant portion of the industry; they have market power. It is expected that high competition will lead banks to take more risks in a bid to remain competitive in the market. A negative sign is expected for this variable..

Table 3.1.Variables

Variable	**Measurement**		**Sign**	**Data Source**
Default Risk (ZSCORE)	The buffer that a bank has to be able to withstand shocks to its earnings.	$-\ln\left(\frac{\mathrm{ROA} + \mathrm{CAP}}{\sigma_{\mathrm{ROA}}}\right)$		BankScope
Credit Risk (NPLR)	Ration of Non-Performing Loans to Total Loans	$ln\frac{NPL}{Total\ loans}$		BankScope
Capital Risk (CAP)	Ratio of Shareholders' equity to total Bank Assets.	$-ln\frac{\mathrm{Equity}}{\mathrm{Total\ Assets}}$		BankScope
Asset Risk (LLR)	Ratio of loan loss reserves to total loans	$-\frac{\mathrm{Loans\ Loss\ Reserve}}{\mathrm{Total\ Assets}}$		BankScope
Liquidity risk (LTD)	Ratio of liquid assets to total deposits and short-term borrowing	$-\frac{\mathrm{Total\ Loans}}{\mathrm{Total\ Deposits\ and\ Short\_term\ borrowing}}$		BankScope
Bank Size (SIZE)	Natural log of Total Assets	ln (Total Assets)	+	BankScope
Profitability (ROA)	Ratio of Profit after tax to Total assets	$\frac{\mathrm{Profit\ after\ Tax}}{\mathrm{Total\ Assets}}$	-	BankScope
Cost Efficiency (COSTEFF)	Operating cost to Operating income.	$\frac{\mathrm{Total\ Expenses}}{\mathrm{Total\ Revenue}}$	-	BankScope
Monetary Policy(MPR)	Natural log of Central Bank Policy Rate		-	IMF
Competition (CR3)	Total assets of the three largest banks as a proportion of the industry's total assets		+ -	World Bank
Exchange Rate(EXCH)	Natural log of Real effective Exchange Rate		+	World Bank
Inflation Rate(INF)	Natural Log of the Inflation rate (CPI)		+	World Bank
GDP growth(GDP)	Annual growth rate of GDP		+	World Bank
Financial Openness	Kaopen Index		-	Chinn & Ito (2006)

- **Cost Efficiency**

Cost efficiency is measured by the ratio of expense to revenue or cost to income (expressed as a percentage).It tells us how many dollars it costs to generate a dollar in revenue. A high ratio signals low efficiency and this is expected to reduce profit and increase risk (Kar, 2012; Karim, Chan, & Hassan, 2010).It is plausible to expect that banks that are cost efficient are likely to be taking less risk. A negative sign is expected for this variable..

- **Financial Openness**

Financial openness has been used to explain bank risk-taking in previous studies (Luo et al., 2016).It indicates the level of regulation in the financial system of a country. This study measures financial openness with the Kaopen index developed by Chinn & Ito (2006).A negative sign is expected for this variable. Table 3.1 shows a summary of variables.

3.7.Chapter Summary

In this chapter, issues regarding the empirical methods and strategies that were adopted for the study were discussed. The study adopts the positivist research paradigm. The data was obtained from BankScope, IMF, World Bank and Chinn & Ito, (2006) and the time scope of the study was 15 years. The sample size is 534 banks in 37 sub-Sahara African countries. The models were estimated using the LSDV and the PCSE techniques.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1.Overview of Chapter

In this chapter, the results that were obtained following the methodology described in the previous chapter are presented. Each set of results are accompanied by interpretations and discussion of the findings. The discussions are begun with an account of summary statistics. Further, the results of pairwise correlation estimation between variables and the regression results are discussed. Additionally, findings of various diagnostic tests are discussed. The aim in each case is to adduce valid answers to the research questions.

4.2. Summary Statistics

Table 4.1 shows the descriptive statistics for all the variables used in the study. The table presents information on the number of observations, the mean and standard deviation and the minimum and maximum values for each variable. This allows us to see the upper and lower bounds of each variable in the dataset as well as the averages and dispersion of the variables. For brevity, only a few variables are discussed. The study included 534 banking organisations listed in the BankScope database from 37 countries in Sub-Sahara Africa for a period of 15 years starting from 2001 to 2015.The data is unbalanced and contains gaps.

The table also shows that data on some variables were unavailable for some banks and countries in some years and this accounted for some variables having fewer observations this also shows in the regression tables. Similar to Kuranchie-pong, Bokpin, & Andoh, (2016) and Pathan, (2009) it can be seen that some of the variables such as exchange rates, policy rate and cost efficiency recorded outliers. To deal with the extreme values, some variables were winsorised and others were log-transformed. Additional descriptive statistics are shown for variables that were winsorised or log-transformed.

Table 4.1.Summary Statistics

Variables	Mean	SD	Min	Max
Inflation	9.684	20.95	-35.84	359.9
GDP Growth	5.399	4.502	-36.70	63.38
Competition	69.73	18.97	23.32	100
Financial Openness	-0.348	1.436	-1.895	2.389
Monetary Policy Rate	10.81	7.435	2	70
Profitability	1.201	6.247	-160.1	78.37
Capitalization	16.24	15.87	-46.03	99.85
Overall/Default Risk	13.915	15.93	.0185	313.27
Cost Efficiency	66.78	47.59	0.141	732.9
Size	1210417	6578848	88.8754	124e+08
Asset Risk	6.364	8.041	100	-0.240
Liquidity Risk	42.57	51.87	-0.0800	896.9
Exchange Rate	103.8	53.73	54.11	827.20
Winsorised Variables				
Cost Efficiency	61.98	19.31	35.47	98.09
Inflation	7.647	4.832	1.298	16.19
Log transformed Variables				
Capital Risk	2.548	0.678	4.604	-1.619
Monetary Policy Rate	2.189	0.613	0.693	4.248
Exchange rate	4.602	0.229	3.991	6.718
Credit Risk	7.672	1.757	0.693	11.59
Size	12.15	1.659	4.487	18.64
Profitability	0.571	0.989	-6.908	4.361
Overall/Default Risk	-2.216	0.888	-3.987	5.747

Source: Research Data, 2017

The mean (Standard deviation) of Competition is 69.73 (18.97) which shows that most banking sectors in Africa are weakly competitive. Indeed, the results of this study support for this conclusion in the data. The data shows that a majority of the countries in the sample have had concentration ratios (CR3) above 50% for most of the sample period. Another observation is that, with the exception of a few countries like Nigeria and Ghana whose banking sector became more competitive over time, many others were becoming less competitive. This could be explained partly to be as a result of regulatory factors which led to bank mergers and acquisitions over the period. The mean (Standard deviation) of bank assets is USD1,210,417 (USD 6,578,848).This shows that there is significant heterogeneity between banks in terms of size as can be seen from the minimum and maximum value.

It can be observed from the data that a good number of banks in the sample have had fluctuations in the value of their assets especially at the beginning of the sample period. Many of these banks recovered shortly but this was short-lived. This can be interpreted to mean that there is high risk for equity holders in Africa's banking sector. Because the asset values are in the United States Dollar, the fluctuations can be said to represent depreciation of local currencies. Foreign banks are more likely to be concerned about this development. The mean (Standard deviation) of Monetary policy rate was 10.81% (7.435%).This shows that the average country in sub-Sahara Africa had a tight monetary policy regime compared with rates elsewhere. High policy rates are used to control inflationary tendencies and signal the cost of loanable funds. Fiador (2015) reported that during the period of this study many countries in Africa had high inflation rates. This is shown by the range and mean of the inflation in table 4.1.This could explain why the policy rates were high as found.

Countries that belong to economic blocs had the lowest policy rates and they mostly maintained the same rates. Generally, it is believed that low policy rates lead to financial crisis (Altunbas et al., 2010, 2012, 2014); this could explain why banks in the region were not significantly impacted by the financial crisis of 2007.It can also be observed in the data that from 2001 to 2005, policy rates were generally falling but rose sharply in the year preceding the crisis. The rates fell again in the year the crisis begun but started rising until 2009 and has since been falling. Perhaps, the rates did not fall low enough to make it hurt banks in Africa. Another observation made from the data is that compared to the period before the financial crisis, countries in the sample have lower policy rates after the crisis. These rates are declining year after year.

Moreover, businesses in Africa have complained about high cost of borrowing and this is serving as a motivation for central banks to revise the rate downwards. Banks in the region should be concerned with this development as it could be a signal of impending crisis in the banking sector or the entire financial sector. Especially because the regression results also show that low policy rates causes default and liquidity problems for banks in sub-Sahara Africa and also as was found by Altunbas et al.(2014), Gambacorta (2009), Ioannidou et al., (2015) and others for US and European banks.

The mean (Standard deviation) of the exchange rate was 103.08 (53.73) suggesting that the currencies of the sampled countries have appreciated on average relative to the base year, 2010.This reflects the managed exchange rate regimes in place in some countries and the appreciation in the euro, which they are pegged to. The data showed that countries that belong to currency blocs had more stable currencies overall. The Democratic Republic of Congo had the worst performing currency and recorded outliers. Generally, however, many countries experienced relatively stable currencies and saw appreciations often. It was also observed that toward the end of the study period, the sample countries were experiencing weakening of their currencies. The regression results also show that banks in countries with stronger currencies are more stable and they take less credit risk. This explains partly why the crisis of 2007 did not have any significant impact on the region; confirms an observation that was made earlier about the monetary policy effect.

4.3.Correlation Analysis

This section reports the correlation coefficients of the variables that were included in the study in Table 4.2. A brief mention and discussion of a few important relationships is appropriate. Coefficients that are significant at 10 percent are shown with a star. Monetary policy shows a negative and significant correlation with the default risk, liquidity risk and capital risk. The sign of the correlation coefficient is interpreted to mean that expansionary policy rates are associated with high risk-taking in terms of default, liquidity and capital risk. This strengthens the conclusions of the regression results discussed later.

4.4 Testing the Assumptions of the OLS

4.4.1 No Multicollinearity

In section 4.3, correlation matrix was examined. The results in table 4.2 show that no pair of variables have a correlation coefficient greater than 0.5 and so there is no Multicollinearity in the data. Thus the models specified do not suffer from Multicollinearity. This implies that the standard errors of the model estimates are not inflated and are not biased.

Table 4.2.Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Inflation	1.00													
2. GDP Growth	-0.06*	1.00												
3. Competition	0.07*	-0.12*	1.00											
4. Exchange Rates	0.27*	-0.10*	0.02	1.00										
5. Monetary Policy Rate	0.48*	0.08*	-0.03*	0.44*	1.00									
6. Profitability	-0.00	0.01	0.02	-0.05*	-0.00	1.00								
7. Cost Efficiency	0.01	-0.00	0.01	-0.01	-0.06*	0.04*	1.00							
8. Asset Risk	0.01	0.03*	-0.03	-0.01	0.01	-0.01	-0.06*	1.00						
9. Default Risk	-0.02*	-0.04*	-0.04*	-0.01	-0.02*	0.05*	-0.02	0.03	1.00					
10. Size	-0.01	-0.07*	0.04*	-0.03	-0.06*	-0.00	0.02	-0.01	-0.02	1.00				
11. Credit Risk	-0.02	-0.08*	0.07*	-0.04	-0.00	-0.03	0.00	0.06	0.04	-0.03	1.00			
12. Liquidity Risk	0.00	0.01	-0.02	0.00	-0.06*	-0.00	0.06*	0.25*	-0.00	-0.03	-0.00	1.00		
13. Financial Openness	-0.03*	-0.02*	-0.28*	-0.04*	0.15*	0.02	0.00	0.02	-0.07*	-0.07*	-0.06*	0.03	1.00	
14. Capital Risk	-0.04*	-0.01	-0.06*	-0.03	-0.17*	-0.04*	-0.01	-0.00	-0.37*	-0.10*	0.02	-0.06*	0.14*	1.00

Source: Research Data, 2017

4.4.2 Homoscedasticity

This section examines each of the models for homoscedasticity. This assumption is required to ensure that the LSDV estimators are efficient, unbiased and consistent. If this assumption is violated, the model is said to be heteroscedastic, that is, the error processes are not stationary. This test is performed using the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity. The null hypothesis is that each of the models has a constant variance. The results of the test are shown in table 4.3. The results show that, at 10% significance level, most of the model specifications are heteroscedastic. Even though models are still unbiased and consistent in the presence of heteroscedasticity, they are no longer efficient. This was remedied by reporting robust standard errors for each model.

Table 4.3 Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

H0: Constant Variance

Model	Default Risk	Credit Risk	Asset Risk	Liquidity Risk	Capital Risk
Objective 1					
Chi2(1)	17.57	12.1	134.01	215.34	3.35
Prob>Chi2	0.0000***	0.0005***	0.0000***	0.0000***	0.0672**
Objective 2					
Chi2(1)	14.33	0.45	250.67	3.28	0.04
Prob>Chi2	0.0002***	0.5030	0.0000***	0.0703*	0.8514
Objective 3					
Chi2(1)	22.07	12.45	141.05	215.27	2.03
Prob>Chi2	0.0002***	0.0004***	0.0000***	0.0000***	0.1540

Source: Research Data, 2017

4.4.3 No autocorrelation

This section tests for first order autocorrelation using the Wooldridge test for autocorrelation. The results are presented in table 4.4.The null hypothesis is that there is no first order autocorrelation. If the assumption of no autocorrelation is violated, LSDV estimators are still unbiased but are not efficient. The results show that there is first order autocorrelation. To correct for this violation, robust standard errors are reported.

Table 4.4 Wooldridge test for autocorrelation

H0: No first order autocorrelation

Model	**df**	**F-Statistic**	**Prob>F**
Objective 1			
Default Risk	F(1,64)	46.027	0.0000***
Credit Risk	F(1,35)	9.9111	0.0034***
Asset Risk	F(1,51)	18.665	0.0001***
Liquidity Risk	F(1,43)	36.315	0.0000***
Capital Risk	F(1,64)	44.563	0.0000***
Objective 2			
Default Risk	F(1,33)	56.003	0.0000***
Credit Risk	F(1,14)	3.799	0.0716*
Asset Risk	F(1,27)	28.343	0.0000***
Liquidity Risk	F(1,20)	4.362	0.0497**
Capital Risk	F(1,33)	53.302	0.0000***
Objective 3			
Default Risk	F(1,64)	83.047	0.0000***
Credit Risk	F(1,35)	9.805	0.0035***
Asset Risk	F(1,51)	18.391	0.0001***
Liquidity Risk	F(1,43)	37.019	0.0000***
Capital Risk	F(1,64)	42.654	0.0000***

Source: Research Data, 2017

4.4.4 Exogeneity

Exogeneity is a required condition for optimal LSDV estimates. The exogeneity condition requires that no explanatory variable is correlated with a corresponding error. If this condition does not hold, then there is said to be endogeneity within the model. Based on economic theory, this study expected that monetary policy and exchange rate will be endogenous. In order to establish this, a test of endogeneity was conducted using the Durbin and Wu-Hausman tests for endogeneity. The results are presented in table 4.5.The null hypothesis of the tests is that the variables are exogenous. The results of the tests in table 4.5 show that with the exception of two specifications, all models are exogenous. Thus, we fail to reject the null hypothesis.

Table 4.5 Test of Endogeneity

H0: Variables are Exogenous

Model	Durbin(score) Chi2(1)	Prob>Chi2	Wu-Hausman F (v1,v2)	Prob>F
Objective 1				
Default Risk	0.7082 (1)	0.4000	0.6979 (1,565)	0.4038
Credit Risk	0.0820 (1)	0.7745	0.0793 (1,262)	0.7784
Asset Risk	0.0402 (1)	0.8410	0.0393 (1,376)	0.8429
Liquidity Risk	1.489 (1)	0.2223	1.4521 (1,292)	0.2292
Capital Risk	0.3873 (1)	0.5337	0.3815 (1,565)	0.5370
Objective2				
Default Risk	2.4432 (1)	0.1180	2.4152 (1,565)	0.1207
Credit Risk	0.0922 (1)	0.7614	0.0892 (1.262)	0.7655
Asset Risk	1.8154 (1)	0.1779	1.78136 (1,376)	0.1728
Liquidity Risk	7.0166 (1)	0.0081***	6.96319 (1,292)	0.0087***
Capital Risk	16.5651 (1)	0.0000***	16.7899 (1,565)	0.0000***
Objective 3				
Default Risk	.7764(1)	0.3782	0.7626 (1,563)	0.3782
Credit Risk	0.001(1)	0.9895	0.0001 (1,260)	0.9897
Asset Risk	0.0155(1)	0.9008	0.0150 (1,374)	0.9023
Liquidity Risk	1.4765 (1)	0.2243	1.4295 (1,290)	0.2328
Capital Risk	0.1514(1)	0.6972	0.1486 (1,563)	0.7001

Source: Research Data, 2017

4.5.Regression Results

4.5.1.Result 1: Monetary Policy and Risk-taking

Table 4.6 report the empirical results of the relationship between monetary policy and risk-taking among banks in sub-Sahara Africa. In each model, a positive coefficient shows that monetary policy rate moves in the same direction as risk-taking and a negative coefficient shows otherwise. Results for the LSDV regression and the PCSE regression are presented next. The discussions are based on the LSDV results for brevity because the findings are qualitatively similar across techniques.

Table 4.6 Monetary Policy and Risk-taking (LSDV)

	Default Risk	Credit Risk	Asset Risk	Liquidity Risk	Capital Risk
Cost Efficiency	-0.0063***	0.0158***	-0.0536***	-0.2176***	-0.0039***
	(0.0012)	(0.0038)	(0.0166)	(0.0826)	(0.0010)
Monetary Policy	-0.1701***	0.5726***	-1.3753**	9.0468***	-0.3337***
	(0.0505)	(0.1703)	(0.6101)	(3.1338)	(0.0422)
Financial Openness	-0.0449***	0.0655	-0.0615	-5.1076***	-0.0414***
	(0.0157)	(0.0509)	(0.2477)	(1.4591)	(0.0131)
GDP Growth	-0.0024	0.0225	0.0231	-0.7438*	-0.0124**
	(0.0070)	(0.0254)	(0.0794)	(0.4162)	(0.0057)
Inflation	0.0191***	0.0087	0.0286	-0.8871	-0.0033
	(0.0068)	(0.0217)	(0.0832)	(0.6766)	(0.0055)
Competition	-0.0021*	0.0183***	0.0184	-0.0445	-0.0037***
	(0.0012)	(0.0040)	(0.0129)	(0.0708)	(0.0010)
Profitability	-0.0889***	-0.1896	-0.1046	-0.3366	-0.1178***
	(0.0287)	(0.1236)	(0.3175)	(2.0692)	(0.0234)
Size	-0.1190***	0.2927***	-0.0865	-2.6745***	-0.0883***
	(0.0079)	(0.0270)	(0.0967)	(0.4914)	(0.0064)
Observations	1,044	588	706	589	1,044
R-squared	0.9138	0.9425	0.4187	0.4512	0.9497
Adjusted R-squared	0.9094	0.9393	0.4142	0.4434	0.9497

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Research Data, 2017

4.5.1.1. Result 1a: Default Risk

The objective of this study is to examine the relationship and impact of monetary policy on bank risk-taking in sub-Sahara Africa. The monetary policy variable has a negative sign and is statistically significant in explaining default risk-taking. A one percent decrease in monetary policy rate will result in a decrease of 0.1701 percent of the default risk of banks. Thus if monetary policy rates double banks' default risk will increase by 17%.This finding corroborates earlier findings by Altunbas, Gambacorta, & Marques-Ibanez, (2010), and Gambacorta (2009).Low policy rates are thus associated with low interest rates. This can be explained in two ways. Firstly, when interest rates are low managers have a high incentive to take up more risk to be able to meet some targeted nominal return. That is to say that, they tend to pursue multiple activities or increase the scale of existing activities to achieve high returns on assets. This will lead them to incur more debts and then sooner or later reality dawns on them only to find that they have overestimated their borrowing capacity.

There is also an illusion that arises with banks being highly levered. High leverage improves capitalisation and could seem to the bank that they are capable of venturing into risky business. Moreover, the franchise value theory suggests that when the shareholders have less to lose, firms are more likely to assume higher risks. Since, bank z-score also shows the buffer a bank has to withstand shocks to its earnings; this can also be explained to mean that when interest rates are low banks' earnings will fall hence a low return on assets. This feeds into the z-score equation to imply higher overall or default risk.

Table 4.7 Monetary Policy and Risk-taking (PCSE)

	Default Risk	Credit Risk	Asset Risk	Liquidity Risk	Capital Risk
Cost Efficiency	-0.0036***	0.0109***	-0.0479**	0.2020*	-0.0033***
	(0.0011)	(0.0038)	(0.0189)	(0.1214)	(0.0009)
Monetary Policy	-0.0897**	0.5248***	-0.5194	-10.1452***	-0.3579***
	(0.0432)	(0.1687)	(0.6504)	(2.8904)	(0.0361)
Financial Openness	-0.0347**	0.0955*	-0.4511	4.3631**	-0.0213
	(0.0166)	(0.0497)	(0.3052)	(1.7204)	(0.0139)
GDP Growth	-0.0036	0.0285	0.0380	0.7193	-0.0124***
	(0.0056)	(0.0224)	(0.0705)	(0.4656)	(0.0047)
Inflation	0.0149***	0.0133	-0.0500	1.1727**	0.0014
	(0.0052)	(0.0199)	(0.0758)	(0.5247)	(0.0044)
Competition	-0.0048***	0.0199***	-0.0075	0.0567	-0.0046***
	(0.0011)	(0.0042)	(0.0139)	(0.1237)	(0.0009)
Profitability	-0.0867***	-0.1674	0.2689	-0.0549	-0.1180***
	(0.0256)	(0.1294)	(0.2621)	(2.4501)	(0.0223)
Size	-0.1253***	0.3079***	-0.0824	2.8205***	-0.0832***
	(0.0077)	(0.0284)	(0.1205)	(0.5227)	(0.0066)
Observations	1,044	588	706	589	1,044
R-squared	0.9199	0.9424	0.3736	0.4130	0.9518
Number Of Banks	446	292	294	245	446

Corrected Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: Research Data, 2017

4.5.1.2. Result 1b: Credit Risk-taking

This study finds that the relationship between monetary policy and credit risk-taking is positive and significant. A one percent increase in monetary policy rate will increase banks' credit risk by 0.5726 percent. Put differently, if monetary policy rates double from their current average to about 22%, banks credit risks (in this case non-performing loans ratio) will increase by about 60%.This means that in periods of high monetary policy rates, there is an increase in nonperforming loans, hence high credit risk. This can be explained in two ways.

Firstly, high interest rates lead to high borrower default because of increased cost of borrowing. This directly increases the NPLR. Secondly, because high interest rates signal high borrower default risks, risk-averse banks will reduce lending. As the denominator decreases, the NPLR is increased. At least one of these must occur for credit risk to increase or one both may occur but at different magnitudes. From the perspective of the borrower, as interest rates increase (particularly for flexible rates); they tend to be unable, or less likely to meet their loan obligation due to higher cost.

This is consistent with Forssbæck (2011), Tabak et al., (2014), Adhikari & Agrawal (2014) and Agoraki, Delis, & Pasiouras, (2011). Forssbæck (2011) used NPLR and inverse Z-Score as proxies for risk-taking and their work included real interest rate- a proxy of monetary policy measure- and found similar results. The coefficients of monetary policy rate are smaller for default risk than for credit risk suggesting that the in periods of rising policy rates, credit risk increases faster than the rate at which default risk increases in periods of falling policy rates. In order words, as policy rates increases, banks' credit risk rises faster than the rate at which their default risk declines.

It can be shown that the signs of the results for default risk and credit risk and the interpretation are logically consistent. To see this, let us say that as was explained in the case of the latter, there will be fewer borrower defaults when policy rates are lower. On the other hand, it was explained in the case of the former that in a period of low policy rate banks will be more aggressive in order to meet targeted nominal returns; for instant by undertaking more income generation activities such as giving out more loans [1] .As they do these, the denominator of the NPL ratio become bigger hence having less credit risk. Thus default risk and credit risk will move in opposite directions for any given change in the monetary policy rates.

4.5.1.3.Result 1c: Asset Risk

The results show that there is an inverse relationship between monetary policy rate and bank asset risk. The results in table 4.6 show that when monetary policy rate is reduced by 1%, asset risk rises by 1.37%.This can be explained by similar factors as in default risk. As monetary policy rates decline, the value of banks assets will increase and so any adverse event will impact more on banks. In other to create a buffer against this uncertainty, banks will keep higher loan loss reserves.

4.5.1.4.Result 1d: Liquidity Risk

The result for liquidity risk suggests that there is a direct relationship between monetary policy and liquidity risk. The results in table 4.6 show that when monetary policy rate is reduced by 1%, liquidity risk reduces by 9.0468%.This means that when monetary policy rates are low, the liquid assets of banks smaller relative to the total deposits. When this happens, banks will be able to meet liabilities better. In periods of low monetary policy rates,

[1] Holding all of our arguments in the case of default risk

banks will give more loans because consumers will demand more loans because of lower interest rates; this tends to decrease liquid assets. Also banks borrow more because it is cheaper for them to also borrow; they borrow short-term and might lend long-term which will deteriorate their liquidity position.

4.5.1.5.Result 1e: Capital Risk

The results in table 4.6 also show that the monetary policy rate is inversely related with capital risk. That is, when monetary policy rate is reduced by 1%, capital risk rises by -0.3337%.This is expected since in periods of low policy rates, interest rates are low and so debt is cheaper. Banks will therefore substitute debt for equity financing. This increased leverage however has adverse implications for the solvency of banks thus higher capital risk for equity owners.

4.5.2.Result 2: Exchange Rate and Risk-taking

Our second objective was to find the relationship and impact of exchange rate on bank risk-taking in sub-Sahara Africa. The empirical results of the relationship between exchange rate and risk-taking among banks in sub-Sahara Africa are shown in Table 4.8.In each specification, a positive coefficient shows that the real exchange rate moves in the same direction as risk and a negative coefficient shows otherwise.

4.5.2.1. Result 2a: Default Risk

The results in table 4.8 show that exchange rate has an inverse relationship with bank default risk and is statistically significant in explaining bank default risk. This means that when the real exchange rate decreases banks' default risk increases, ceteris paribus. From the table, it can be seen that a 1% decrease (appreciation) in the real exchange rate causes banks' default risks to increase by 0.2042%.Thus, banks in countries with stronger currencies have higher default risks than those in countries with weak currencies. From the perspective of foreign banks, a strong host country currency will increase the value of the banks' asset in terms of the currency of the banks' home country. This increased value of the banks' assets makes banks underestimate their risks hence increasing their risk appetite. This is particularly expected in sub-Sahara Africa because of the dominance of foreign banks (and the so-called pan-African banks) in most countries.

Also, for a bank whose operating currency is strong, there is an incentive to borrow from abroad in a foreign currency because it will be cheaper to repay that loan. Higher borrowing will increase the probability of default. The regression estimates show that a doubling of the domestic exchange rate will cause default risks to increase by 20%.

Table 4.8.Exchange Rate and Risk-taking (LSDV)

	Default Risk	Credit Risk	Asset Risk	Liquidity Risk	Capital Risk
Cost Efficiency	-0.0009	0.0040	-0.0161	-0.1024	0.0022**
	(0.0013)	(0.0057)	(0.0238)	(0.0975)	(0.0010)
Exchange Rate	-0.2042***	1.1944***	-2.3464***	-5.2074*	-0.4726***
	(0.0548)	(0.2613)	(0.8716)	(2.8478)	(0.0555)
Financial Openness	-0.0513***	-0.0795	-0.2998	-3.6721***	-0.0358***
	(0.0189)	(0.0713)	(0.3385)	(1.2115)	(0.0137)
GDP Growth	0.0072	0.0252	0.0518	-0.0216	-0.0072
	(0.0075)	(0.0347)	(0.1185)	(0.3528)	(0.0054)
Inflation	0.0028	0.0396*	-0.1097	0.2849	-0.0260***
	(0.0055)	(0.0238)	(0.0908)	(0.3326)	(0.0040)
Competition	-0.0025	0.0160**	0.0538**	0.0545	-0.0035***
	(0.0017)	(0.0062)	(0.0209)	(0.0867)	(0.0012)
Profitability	-0.1278***	0.0551	0.1679	-1.9719	-0.1382***
	(0.0308)	(0.1813)	(0.4220)	(1.4321)	(0.0239)
Size	-0.0857***	-0.0065	0.1739	-1.0991	0.0102
	(0.0153)	(0.0676)	(0.2471)	(0.8842)	(0.0145)
Observations	599	281	406	320	599
R-squared	0.9269	0.9429	0.4071	0.6258	0.9666
Adjusted R-squared	0.9260	0.9414	0.3967	0.6174	0.9662

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Research Data, 2017

Table 4.9.Exchange Rate and Risk-taking (PCSE)

	Default Risk	Credit Risk	Asset Risk	Liquidity Risk	Capital Risk
Cost Efficiency	0.0011	0.0009	-0.0338	0.0828	0.0018*
	(0.0013)	(0.0056)	(0.0331)	(0.1141)	(0.0011)
Exchange Rate	-0.1547***	0.9383***	-0.9473	3.6401	-0.3885***
	(0.0537)	(0.2333)	(0.8444)	(2.9286)	(0.0508)
Financial Openness	-0.0464**	0.0425	-0.7063	-1.1529	-0.0536***
	(0.0214)	(0.0698)	(0.5483)	(1.3047)	(0.0153)
GDP Growth	0.0027	0.0284	0.0440	0.1046	-0.0068*
	(0.0054)	(0.0321)	(0.0767)	(0.2324)	(0.0040)
Inflation	0.0106**	0.0416*	-0.0592	-0.4217	-0.0235***
	(0.0050)	(0.0231)	(0.0853)	(0.3753)	(0.0038)
Competition	-0.0060***	0.0181***	0.0067	-0.0508	-0.0049***
	(0.0017)	(0.0068)	(0.0234)	(0.1098)	(0.0012)
Profitability	-0.0951***	0.0181	0.5020	1.9172	-0.1299***
	(0.0294)	(0.2018)	(0.3445)	(1.6255)	(0.0226)
Size	-0.0955***	0.0900	0.0012	1.5464	-0.0139
	(0.0155)	(0.0617)	(0.2542)	(0.9677)	(0.0145)
Observations	599	281	406	320	599
R-squared	0.9260	0.9423	0.3283	0.5775	0.9641
Number Of Banks	238	137	163	121	238

Corrected Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Research Data, 2017

4.5.2.2.Result 2b.Credit Risk

Table 4.8 show a positive and significant relationship between exchange rate and credit risk. This means that banks take higher credit risks when the domestic currency depreciates. Thus a stronger local currency will lead to less credit risks. From the table it was found that a 1% increase in the real exchange rate will lead to 1.1944% increase in credit risk. That is, a doubling of the exchange rate will result in 120% increase in the credit risk of banks. This is explained by assuming that banks borrow from abroad to lend on the domestic market. Also, it is assumed that the foreign currency is stronger than the local currency as is the case for Africa. When the domestic currency depreciates, they can make more loans in the domestic market with a given amount of foreign currency. On the other hand depreciation of the domestic currency will cause interest rates to rise (Cheung, Chinn, & Pascual, 2005; Engel, 2013); as cost of borrowing goes up, the probability of borrower default is increased. This is similar to the finding in table 4.6.

4.5.2.3.Result 2c: Asset Risk

This study finds that there is an inverse and statistical and economic significant relationship between exchange rates and asset risk. The result suggests that when the real exchange rate decreases by 1% bank asset risk increases by 2.3464%.Thus currency appreciation has the effect of making banks assume higher asset risk. This is likely due to the fact in periods of currency appreciation, foreign currency denominated assets become smaller in terms of the operational currency. Correspondingly, the loan loss provision is decreased and this explains the high asset risk. To illustrate this, consider a bank operating in Ghana that has USD100 worth of foreign currency denominated assets and a GHS/USD exchange rate of GHS4/USD. If the bank keeps a loan loss reserve of 10%, the reserve will be GHS40.If the cedi appreciates such that the exchange rate is GHS3/USD, the bank's reserve will be reduced to GHS30.

Given the above illustration, if a management expects the currency to appreciate, they will hold a smaller reserve and if they expect depreciation, they will keep a higher reserve. This analogy will remain valid if the bank were to consider its total assets in terms of domestic currency. To illustrate this, assume that the bank had GHS300 worth of assets in the domestic currency initially; this will be USD75 and so the bank's reserves in USD will be USD7.5.When the GHS appreciates to GHS3/USD, the new value of the assets in USD will be USD100 and the reserve will be increased correspondingly to USD10.In the second instant the USD has effectively depreciated hence a higher reserve.

4.5.2.4.Result 2d: Liquidity Risk

This study finds that is an inverse relationship between liquidity risk and the exchange rate. In order words, banks are less liquid when the domestic currency appreciates resulting in higher liquidity risk; that is they tend to be less likely to be able to meet their current liabilities when they become due. The result suggests that when the real exchange rate decreases by 1% bank liquidity risk increases by 5.2074%.

4.5.2.5.Result 2e: Capital Risk

This study finds that there is an inverse relationship between exchange rate and bank capital risk. The result suggests that when the real exchange rate decreases by 1% bank capital risk increases by 0.4726%.That is, when the domestic currency depreciates, banks equity to asset ratio falls. In other words, bank gearing is lower when the domestic currency depreciates and increases when the currency appreciates. This means that when the domestic currency is weak, shareholders prefer equity financing for two reasons. Firstly, equity financing is generally cheaper. Secondly, when the domestic currency is weak, interest rates tend to rise and so debt is expensive. Consequently, financing cost will increase. Shareholders stake in the bank will face greater uncertainty in this case as external claims on the bank's assets increases. For foreign shareholders, appreciation of the domestic currency means that their share falls in terms of foreign currency.

4.5.3. Result 3: Do Bank Characteristics Influence the Impact of Monetary Policy on Bank Risk-taking?

This study proceeds to investigate the moderating effects of bank characteristics on the impact of monetary policy on bank Risk-taking in Africa. This was achieved by interacting the monetary policy rate with bank size and bank profitability. The results are shown in table 4.8.the answer to the question three is yes, bank characteristics particularly size moderates the impact of monetary policy on risk-taking. First, the moderating effect of bank size is examined. This study finds that size is important in moderating the impact of monetary policy. The interacted term is statistically significant for all risk types thus confirming the conclusion. The result suggest that the impact of monetary policy rate on bank risk is diminished for bigger banks for default risk, liquidity risk, asset risk and capital risk but amplified for credit risk. This finding is partly consistent with Delis & Kouretas (2011) who found that in the euro area interest rates impacted risk of bigger banks less than smaller banks. In the case of Delis & Kouretas (2011) they examined asset and credit risks only.

In the case of profitability, the result show that the risks of more profitable firms were impacted less by monetary policy for all types of risks except capital risk. For capital risk, more profitable banks were impacted more by the monetary policy rate. These relationships were however only statistically significant for asset risk and capital risk.

Table 4.10 Do bank characteristics moderate the effect of monetary policy on risk-taking? (LSDV)

	Default Risk	Credit Risk	Asset Risk	Liquidity Risk	Capital Risk
Cost Efficiency	-0.0040***	0.0067*	-0.0482***	-0.1313	-0.0005
	(0.0011)	(0.0037)	(0.0168)	(0.0893)	(0.0008)
Monetary Policy	-1.0274***	3.3318***	-3.7665***	-18.2373***	-1.5377***
	(0.1078)	(0.3229)	(1.1858)	(6.9154)	(0.0776)
Monetary Policy *	0.0864***	-0.2767***	0.1983*	2.6637***	0.1286***
Size	(0.0086)	(0.0283)	(0.1055)	(0.7423)	(0.0065)
Monetary Policy *	0.0002	0.0163	0.1621*	0.0999	-0.0244***
Profitability	(0.0068)	(0.0413)	(0.0896)	(0.4102)	(0.0046)
Financial Openness	-0.0299**	0.0094	-0.0158	-4.5141***	-0.0184*
	(0.0148)	(0.0483)	(0.2522)	(1.3617)	(0.0106)
GDP Growth	0.0098	-0.0220	0.0558	-0.3599	0.0030
	(0.0071)	(0.0251)	(0.0798)	(0.3904)	(0.0045)
Inflation	0.0130**	0.0171	0.0033	-1.1122	-0.0118***
	(0.0064)	(0.0196)	(0.0859)	(0.7315)	(0.0045)
Competition	0.0035**	0.0037	0.0291**	0.1163	0.0048***
	(0.0014)	(0.0040)	(0.0139)	(0.0780)	(0.0009)
Profitability	-0.1250***	-0.0668	-0.7781**	-1.6308	-0.0654**
	(0.0411)	(0.2463)	(0.3846)	(1.9615)	(0.0268)
Size	-0.1982***	0.5440***	-0.2212	-4.9705***	-0.2136***
	(0.0115)	(0.0376)	(0.1369)	(0.8943)	(0.0076)
Observations	1,044	588	706	589	1,044
R-squared	0.9207	0.9501	0.4235	0.4618	0.9638
Adjusted R-squared	0.9200	0.9493	0.4160	0.4534	0.9635

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Research Data, 2017

Table 4.11 Do bank characteristics moderate the effect of monetary policy on risk-taking? (PCSE)

	Default Risk	Credit Risk	Asset Risk	Liquidity Risk	Capital Risk
Cost Efficiency	-0.0012	0.0026	-0.0436**	0.0968	-0.0002
	(0.0010)	(0.0039)	(0.0197)	(0.1284)	(0.0008)
Monetary Policy	-0.9206***	3.0429***	-2.7258**	22.2212***	-1.3762***
	(0.0983)	(0.3317)	(1.3329)	(8.1926)	(0.0793)
Monetary Policy * Size	0.0882***	-0.2545***	0.1899	-3.2330***	0.1130***
	(0.0081)	(0.0288)	(0.1193)	(0.8123)	(0.0069)
Monetary Policy * Profitability	-0.0086	0.0156	0.1473*	-0.0372	-0.0260***
	(0.0064)	(0.0426)	(0.0799)	(0.4832)	(0.0038)
Financial Openness	-0.0233	0.0657	-0.3894	4.0530**	-0.0081
	(0.0154)	(0.0486)	(0.3014)	(1.6268)	(0.0116)
GDP Growth	0.0071	-0.0079	0.0638	0.3184	-0.0004
	(0.0055)	(0.0226)	(0.0713)	(0.4437)	(0.0039)
Inflation	0.0093*	0.0191	-0.0706	1.4050**	-0.0060
	(0.0048)	(0.0189)	(0.0789)	(0.5482)	(0.0038)
Competition	0.0010	0.0065	0.0017	-0.1239	0.0032***
	(0.0012)	(0.0042)	(0.0154)	(0.1274)	(0.0009)
Profitability	-0.0830**	-0.1059	-0.3019	1.1507	-0.0577**
	(0.0352)	(0.2562)	(0.3246)	(3.4555)	(0.0246)
Size	-0.2136***	0.5450***	-0.2154	5.6792***	-0.2012***
	(0.0107)	(0.0379)	(0.1734)	(0.9460)	(0.0084)
Observations	1,044	588	706	589	1,044
R-squared	0.9271	0.9482	0.3787	0.4257	0.9630
Number Of Banks	446	292	294	245	446

Corrected Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Research Data, 2017

4.6. Chapter Summary

This chapter presented and discussed the results of the study. This study also presented the results of diagnostic tests, which showed that the specifications and results were robust. Next the study examined the moderating role of bank size and profitability on the effect of monetary policy on bank risk-taking. The results show that low monetary policy rates causes banks to take more default risk, asset risk and capital risk and less credit and liquidity risk. Secondly, appreciation of the domestic currency causes banks to take more default risk, asset risk, liquidity risk and capital risk and less credit risk. There is generally an insulation effect for size and profitability of the impact of monetary policy on risk-taking.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1. Overview of Chapter

This is the concluding chapter of this report. This chapter summarises this report and makes conclusions from the findings in the previous chapter. The study also made recommendations for practice and policy and suggestions for future research.

5.2. Summary of Report

The principal purpose of this study was to examine the relationship between monetary policy, exchange rate and bank risk-taking on bank risk-taking in sub-Sahara Africa. In line with this purpose, the objectives were to determine the impact and relationship between monetary policy and bank risk-taking in sub-Sahara Africa; determine the impact and relationship between exchange rate movements and bank risk-taking in sub-Sahara Africa; to determine the role of bank size in moderating the effect of monetary policy on bank risk-taking in sub-Sahara Africa. In order to achieve these objectives and fulfil the purposes, this study obtained and analysed data from BankScope, the World Bank, IMF and Chinn & Ito (2006).Data on five hundred and thirty four (534) banking institutions from thirty seven (37) sub-Sahara African countries from 2001 to 2015 were analysed. Five measures of risk-taking, bank Z-Score and the non-performing loans ratio (NPLR), loan loss reserves to gross loans, ratio of liquid asset to total deposit and short term borrowing and the ratio of equity to asset, were used to measure default risk-taking, credit risk-taking, asset risk-taking, liquidity risk-taking and capital risk-taking respectively. The main method of estimation was the Least Square Dummy Variables (LSDV).This study also estimated the models using the PCSE technique for robustness.

5.3 Summary of Findings

This study finds that exchange rate explains risk-taking. The results also show that monetary policy explains bank risk-taking in sub-Sahara Africa but bank characteristics are important in moderating the effect of monetary policy on bank risk-taking. A low central bank policy rate is associated with higher risk-taking behaviour for default, asset and capital risk and lower risk-taking for credit and liquidity risk-taking.

5.4. Conclusions

Monetary policy and the exchange rate are important explanatory factors of bank risk-taking. A low monetary policy environment could trigger bankruptcy and banking crises because it increases bank default risks. Similarly, a strong domestic currency is largely associated with higher risk-taking by banks. Finally, we conclude that the effects of monetary policy and exchange rate on bank risk-taking do differ across risk types and bank characteristics moderate the effect of monetary policy.

5.5. Recommendations

It is recommended that central banks in Africa should slow down their pace of monetary policy expansion. Even though it is a good intention to ease monetary conditions to reduce cost of borrowing and grow the economy, this could generally threaten the stability of the financial system. Such an intention should be carried out gradually over a long time.

5.6. Suggestions for Future Research

The following are recommended for future research:

- Explore the relationships we explored using alternative measures of risk-taking and alternative methods of estimation.
- Explore the role of exchange rate in bank risk-taking further.
- Future research should determine an ideal level of monetary policy that will balance the objectives of monetary policy and bank risk-taking.
- Explore the impact of the following on bank risk-taking in sub-Sahara Africa: corruption, religiosity, competition, bank size, performance, leverage and capital, corporate governance and disclosure.
- Focus on Latin America and Sub-Sahara Africa.
- Use country level data.
- Explore the question of context further. Focus on the differences between countries based on bank and industry characteristics.
- Determine how the relationships have changed over time, if they have.

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