THE IMPACT OF MONETARY POLICY ON BANK BALANCE SHEET VARIABLES IN SUB-SAHARAN AFRICA: EVIDENCE FOR A BANK LENDING CHANNEL

MASTER OF ARTS (ECONOMICS) THESIS

By

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DECLARATION

I, the undersigned, hereby declare that this thesis is my own original work which has not been submitted to any other institution for similar purposes. Where other people's work has been used acknowledgments have been made.

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CERTIFICATE OF APPROVAL

The undersigned certify that this thesis represents the student's own work and effort and has been submitted with our approval.

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To my aunt, Dr. Rosie Kizza, my uncle, Professor Peter Nkedi-Kizza, who have been very instrumental in making sure that I attain postgraduate level qualifications.

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ABSTRACT

The present study investigates the impact of monetary policy on bank balance sheet variables in Sub-Saharan Africa (SSA) to test the existence of a bank lending channel. Specifically, the study examines if the interaction of real interest rates and capitalization reduce bank deposits, credit supply, and liquid assets. The study covers 31 SSA countries during the 2000 to 2014 period and groups the countries as Southern African Development Community (SADC), Economic Community of West African States (ECOWAS), Economic and Monetary Community of Central Africa (CEMAC), East African Community (EAC), and countries not grouped (Others). Using the data from these countries, the study estimates dynamic panel data models using system GMM methodology, and the results are group-dependent. Real interest rates significantly reduce bank deposits in ECOWAS, CEMAC, and EAC, while the interaction of real interest rates and capitalization significantly reduce bank credit in SSA and all the economic blocs. Nevertheless, the interaction of real interest rates and capitalization significantly reduce liquid bank assets only in SADC, ECOWAS, CEMAC, and EAC. Thus, the outcome of the study presents a strong case for the existence of a bank lending channel for some of the regional groupings in SSA. In this light, the most relevant implication of the study is that common monetary policy for CEMAC and proposed ones for EAC and ECOWAS may notably be transmitted through a bank lending channel to the economies of member states.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

CEMAC   :   Economic and Monetary Community of Central Africa

CPI   :   Consumer Price Index

EAC   :   East African Community

ECOWAS   :   Economic Community of West African States

GDP   :   Gross Domestic Product

GMM   :   Generalized Method of Moment

IFS   :   International Financial Statistics

IMF   :   International Monetary Fund

LIC   :   Low-income country

OECD   :   Organization for Economic Co-operation and Development

OLS   :   Ordinary Least Squares

REC   :   Regional Economic Community

SADC   :   Southern African Development Community

SSA   :   Sub-Saharan Africa

WDI   :   World Development Indicator

CHAPTER ONE

INTRODUCTION

1.1. Background

Although economists agree that monetary policy affects real output in the short run the underlying transmission mechanisms that operate remain a subject of debate (Kabiro and Nyamongo, 2014; Samba, 2013). On the one hand, for example, existing literature on financial systems recognizes some transmission mechanisms which include the traditional interest rate channel, the balance sheet channel, and the bank lending channel (Gómez-González and Grosz, 2007). Similarly, there is a consensus that in advanced economies, open market operations where debt securities are traded in exchange for cash reserves will have implications beyond the bond market rate (Kayshap and Stain, 2000; Walker, 2012). On the other hand, however, whether commercial banks play any significant role in the transmission of monetary policy, has always been a long-standing question.

The bank lending channel is one of the mechanisms that attribute to banks a vital role in the transmission process of monetary policy to the real economy (Gómez-González and Grosz, 2007). By definition, the theory of bank lending channel states that monetary

policy-induced drain of deposits funds will cause some forms of banking institutions to reduce lending in the face of less developed capital markets (Burgstaller, 2010). However, the Modigliani – Miller financial irrelevance theorem counter-argues that monetary policy stance cannot affect bank lending, simply because the problem of underdeveloped capital markets does not affect commercial banks. On the contrary, it argues that commercial banks can just issue equity securities to raise funds to offset any policy-induced reduction in bank deposit (Samba, 2013; Gómez-González and Grosz, 2007).

In sub-Saharan Africa (SSA), however, it can be argued that the Modigliani – Miller logic is less likely to occur mainly because the region has underdeveloped financial systems. The depth of banking systems in SSA is small regardless of whether one uses mobilized deposit funds or the sum of credit supplied as a measure (Walker, 2012). For example, during the 2007 to 2014 period, average bank credit to the private sector as a percentage of Gross Domestic Product (GDP) was about 33 percent (World Bank, 2015). This statistic is significantly lower than private sector credit for East Asia and the Pacific which averaged 114 percent of GDP over the same period. With the exception of South Africa and Mauritius whose, average private sector credit exceeded 70 percent of GDP during this time; private sector lending is not more than 30 percent of GDP for most SSA countries.

Notably, commercial banks in SSA dominate formal financial systems while private sector enterprises concurrently dependent on these commercial banks for loans to finance their investments (Walker, 2012). The private sector firms are small in size and have limited access to alternative sources of funding due to underdeveloped capital markets (Etudaiye-Muhtar, and Ahmad, 2014; Nana and Samson, 2014). One of the major drawbacks to the activity and growth of these private sector firms is that commercial banks attract low deposits, are highly liquid, and as such extend less credit to the private sector (Etudaiye-Muhtar and Ahmad, 2014; Mlachila et al., 2013; Beck and Cull, 2013). Moreover, commercial bank credit is short-term with about 60 percent of loans having a maturity of less than a year (Walker, 2012; Mlachila et al., 2013).

A huge share of assets held by commercial banks in SSA is in the form of government securities and liquid assets (Iossifov and Khamis, 2009). The existing state of affairs is against a background of increased efforts by monetary authorities in SSA countries to reform financial systems and improve financial intermediation (Ogun, 2014). Amidu (2014) states that excess liquidity in SSA reflects the scarcity of what banks consider creditworthy borrowers, suggesting the existence of a balance sheet channel. In such circumstances, monetary policy actions are thought to be less operational tools for inducing lending conditions and broader monetary aggregates and, by extension, economic activity, and inflation. Nonetheless, given that commercial banks heavily dominate formal financial systems in SSA, this increases the likelihood of a bank credit channel of monetary policy transmission mattering the most (Walker, 2012).

The analysis of commercial banks has received considerable attention following the global financial crisis of 2007 to 2008 (Shrestha, 2013). Many studies have emphasized the significance of balance sheets of banking systems in an economy (Walker, 2012; Amidu, 2014; Adrian and Shin, 2009; Mittnik and Semmler, 2011). It is argued, for example, that the balance sheets of the commercial banks are a mirror image of the economy more especially when the balance sheets of the whole economy are not readily available (Villar, 2006). Along the same vein, a series of crises has also demonstrated that weaknesses in the balance sheets of commercial banks can ignite and propagate financial crises (Shrestha, 2013; Allen et al., 2002). Particularly, commercial banks play a critical role in generating boom and bust cycles in the economy, through expanding and contracting credit flows (Villar, 2006). Furthermore, currency and maturity mismatches in the banking systems results into fragile financial situations (Shirai, 2001).

1.2. Problem Statement and Justification

Recent trends in financial intermediation suggest that there is a less impressive performance of commercial banks in SSA, mainly in the area of credit supply to the private sector. Figure 1 shows that bank loan supply in SSA has been experiencing a consistent decline from the year 2009 to 2014. The trends also indicate that SSA credit extension is relatively lower than that of East Asia and the Pacific, OECD countries, and the Middle East. Regardless of this trend, however, existing literature on banking systems in SSA has not fully examined credit delivery constraints, more especially the effects of monetary policy on balance sheet variables of commercial banks (Amidu, 2014).

4

More importantly, regardless of the fact that commercial banks dominate formal financial systems of SSA, which makes a lending channel a plausible transmission mechanism, the bank credit channel remains an under-investigated subject (Walker, 2012). A majority of the studies that have been conducted in SSA seems to ignore analyses of how monetary policy shocks can be propagated through bank balance sheet assets and liabilities in a region whose formal financial systems are heavily dominated by commercial banks. As if this is no cause for concern, the studies that have attempted to investigate the lending channel tend to attract some methodological and theoretical concerns that render their finding less conclusive.

The scanty published research such as Matemilola et al. (2013), Amidu (2014), Kabiro and Nyamongo (2014), Samba (2013), Walker (2012), and Djiogap and Ngomsi (2012), has made remarkable strides by examining the impact of monetary policy on credit supply. However, with the exception of a study by Samba (2013), the studies have ignored the effects of monetary policy on other real side variables and liability side variables such as liquid bank assets and bank deposits respectively. As such, these studies are wanting in that they do not adopt a multi-asset model as suggested by Shrestha (2013), and Kayshap and Stain (1995).
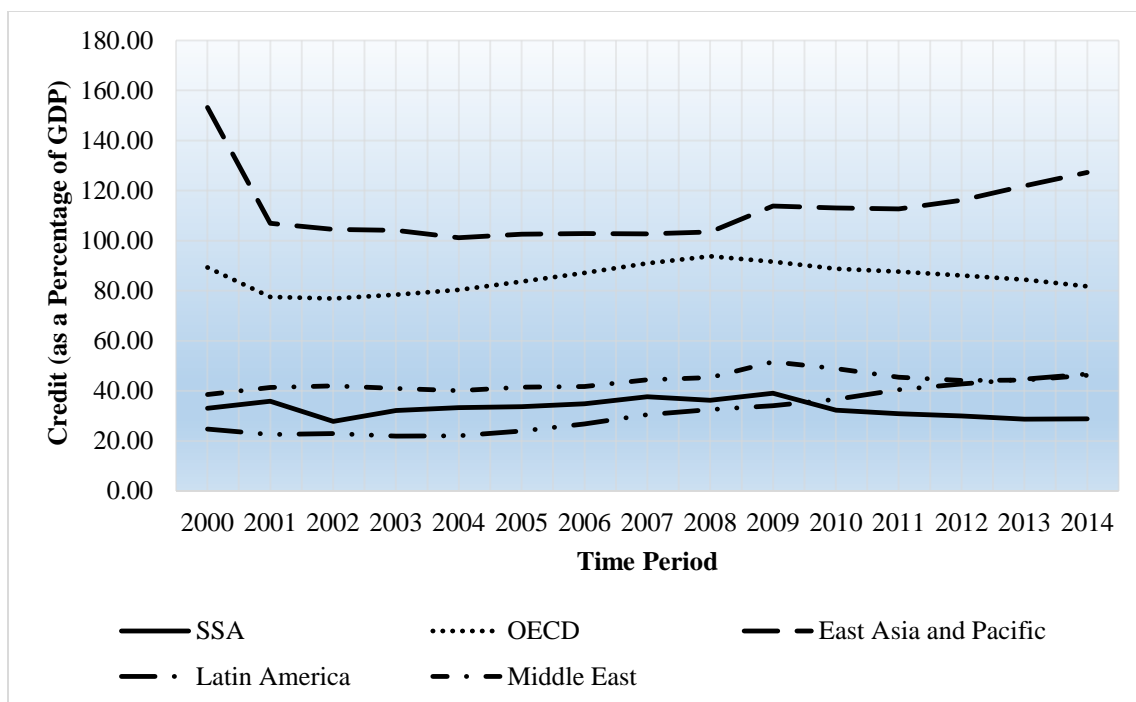
Figure 1: Trends in Bank Credit to the Private Sector (2000 – 2014)
Source: Author using data from World Bank (2015)

Worse still, even Samba (2013) has not investigated the effects of monetary policy working through its interaction with capitalization. Only Walker (2012), and Kabiro and Nyamongo (2014) have done this. Ironically, however, the analyses by Walker (2012), and Kabiro and Nyamongo (2014) are only confined to EAC countries and not SSA as a whole. It is, therefore, debatable that studies in SSA have done less to examine the applicability of Modigliani and Miller (1958) financial irrelevance theorem to commercial banks in the region, as proposed by Gómez-González and Grosz (2007). Furthermore, the models that the studies have used are of closed economy type hence their failure to consider the effects of foreign currency reserve on balance sheets variables of commercial banks, as put forward by Shrestha (2013).

6

Over the past decade, sub-Saharan Africa registered annual growth rate in real GDP of 5.6 percent (World Bank, 2015). This rate was 2.4 percent faster than that of the world economy during the same period. Economic and monetary integration is one of the policy levers that has the potential to increase and sustain this remarkable growth in real GDP (African Union, 2013). Some of the benefits of economic and monetary integration include lower transactional costs due to the elimination of exchange rates within the region, the minimal cost of doing business as interest rates will be lower, economies of scale as new markets immerge, and better control of inflation (Masson and Pattillo, 2005). However, the SSA region remains the least integrated part of the world. In a move to resolve this status quo, 51 heads of states in African signed the Abuja Treaty in 1991, which went into effect in 1994, and whose aim was to form economic and monetary unions in Africa by the year 2028.

So far, the CEMAC is the only noteworthy monetary union that SSA has formulated. Nonetheless, there are proposed monetary unifications for EAC, SADC, and ECOWAS, which were scheduled to be effected in 2015, 2018 and 2020 respectively (Sy, 2010; African Union, 2013). The existing and proposed monetary unifications necessitate the need for a better understanding of the transmission channels of monetary policy for the countries that will form the currency blocs. Given that commercial banks dominate formal financial systems in SSA, this justifies the analysis of the effect of monetary policy stance propagated through bank balance sheet assets and liabilities, on the real economy.

7

Investigating the dynamics of balance sheets of commercial banks is vital for financial stability because imbalances in the core variables can generate boom or bust cycles in the economy. The three key variables in the balance sheets of commercial banks, namely credit, deposits and liquid assets, are also interrelated in that changes in any of them can affect the whole portfolio (Shrestha, 2013). Thus, for a meaningful examination of a bank lending channel, it is imperative that the present study investigates the impact of the interaction effect of monetary policy and capitalization, on bank credit, deposits, and liquid assets.

1.3. Objectives of the Study

The primary aim of this study is to examine the effect of monetary policy on balance sheet variables of commercial banks in sub-Saharan Africa. Specifically, the study:

1. Examines the effect of real interest rates[1]on the balance sheet variables of commercial banks.

2. Investigates the interaction effect of real interest rates and capitalization ratios on the balance sheet variables of commercial banks.

3. Examines if the impact of monetary policy on balance sheet variables of commercial banks is dependent on the groupings.

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[1] Open market operations and policy rates have positive effect on real interest rates and are among the widely used monetary policy tools in SSA (Amidu, 2014; Walter, 2012; IMF, 2010). Nevertheless, since other factors can also influence real interest rates, the present study acknowledges a potential for attribution bias.

1.4. Hypotheses tested

Based on the preceding specific objectives, the study examines the following null hypotheses.

1. Real interest rates do not affect balance sheet variables of commercial banks.

2. There is no interaction effect of real interest rates and capitalization ratios on balance sheet variables of commercial banks.

3. The impact of monetary policy on balance sheet variables of commercial banks is not dependent on the groupings.

1.5. Organization of the Study

The rest of this thesis is organized in the following manner. Chapter 2 is a brief outline of financial systems in SSA while chapter 3 offers a review of theoretical and empirical literature on banking systems. Chapter 4, in turn, describes the methodology adopted for valuation in this study while Chapter 5 discusses estimation results. The study is lastly concluded in Chapter 6.

CHAPTER TWO

AN OVERVIEW OF FINANCIAL SYSTEMS IN SUB-SAHARAN AFRICA

2.0. Introduction

This section provides an outline of trends and issues of financial systems of SSA. The present study is considerably informed by Walker (2012) who provides a panoramic view of financial systems in SSA. Any not-otherwise-referenced figures presented in what follows should be attributed to the World Bank (2015).

2.1. Trends in Financial Systems of Africa

The SSA region has underdeveloped financial systems regardless of whether one measures banking depth using deposit funds, or using the amount of credit supplied. For example, private sector credit as a percentage of GDP registered an average of 33 percent over the 2000 to 2014 period (World Bank, 2015). Within the same period, average private sector credit as a percentage of GDP was 88 percent for high-income countries (See Figure 2). Low-Income Countries (LIC) in Africa had average private sector credit of 11 percent which was lower than average private sector credit of 15 percent for all LIC countries in the world. Of the African countries, only South Africa and Mauritius had average private sector credit of more than 70 percent of GDP over the period (World

Bank, 2015). The majority of SSA countries had average private sector credit of less than 30 percent of GDP.
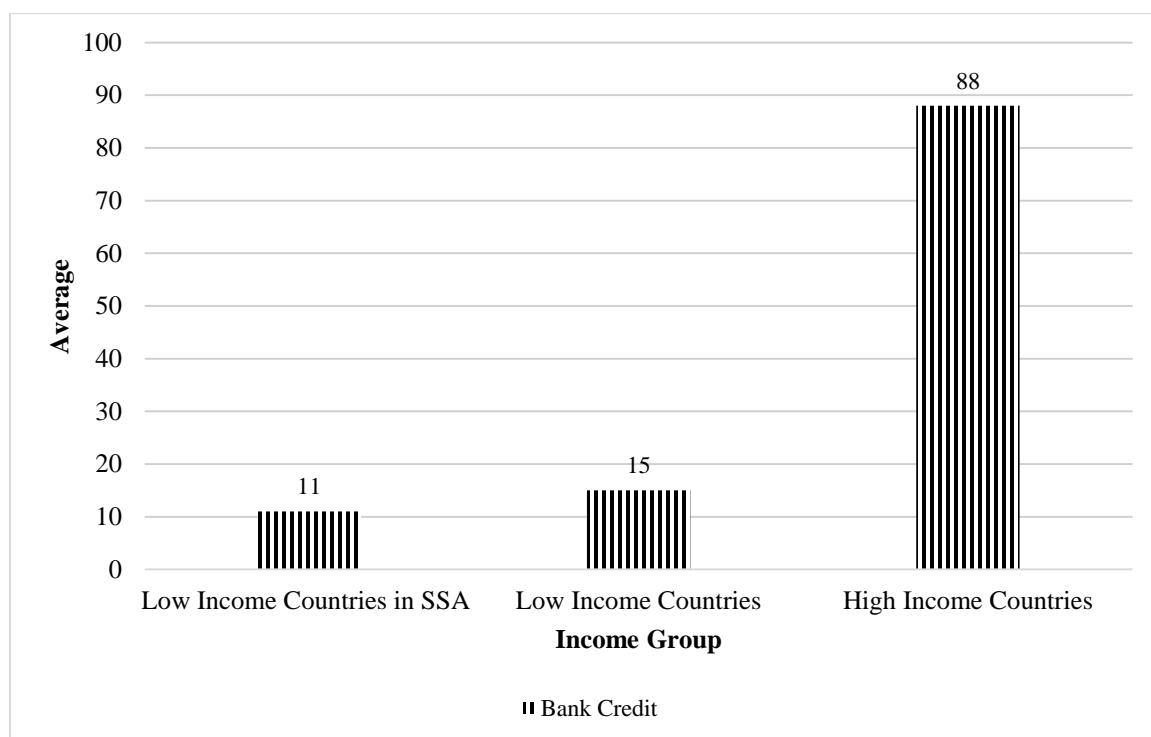
Figure 2: Average Bank Credit for Income Groups (2000 – 2014)
Source: Author using data from World Bank (2015)

Regarding regional groupings, Figure 3 shows that, as a percentage of GDP, bank deposits are relatively high in Southern African Development Community (SADC). The economic bloc registered an average of 44.52 percent during the 2000 to 2014 period. The other regional groupings had average bank deposits of less than 30 percent, and these percentages were lower than the average for SSA. Economic and Monetary Community of Central Africa had the lowest average deposits of 10.65 percent. Similarly, bank credit supply was more pronounced for SADC with a mean of 29.66 percent of GDP while the CEMAC region also had less impressive average credit supply at 7.69 percent of GDP.

11

Moreover, CEMAC accumulated more liquid assets with an average of 38.97 percent of GDP. The banks in East African Community (EAC) are the ones that accumulated less liquid assets with an average of 16.48 percent of GDP.
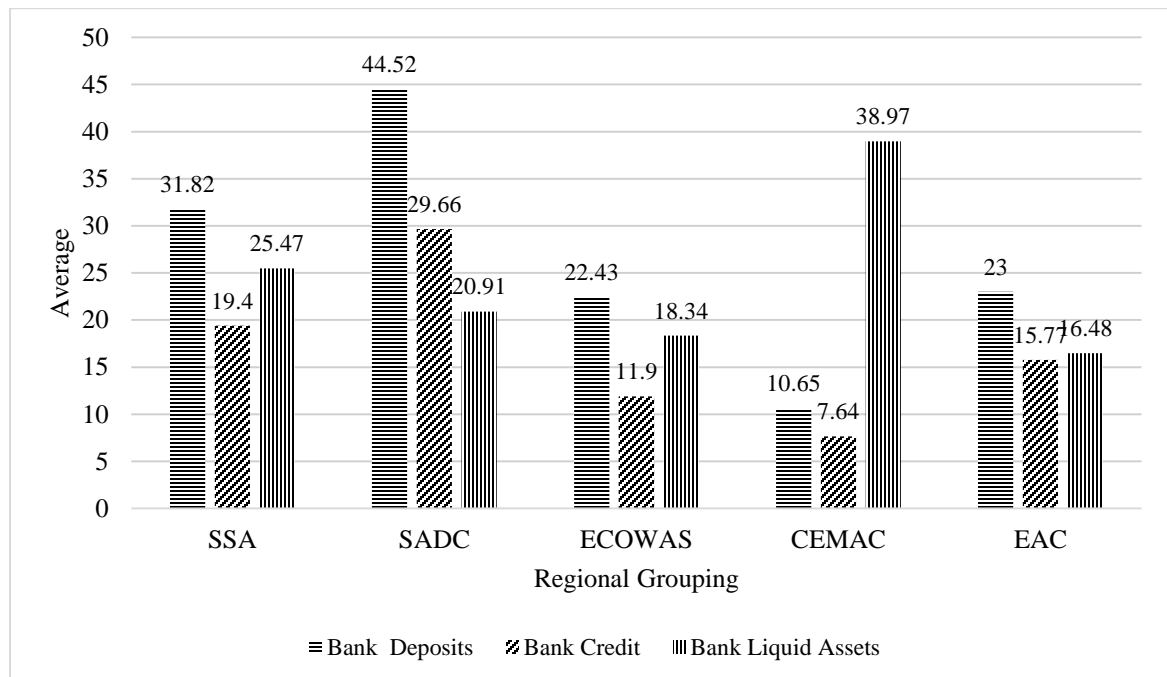
Figure 3: Average Bank Balance Sheet Variables in SSA

Source: Author using data from World Bank (2015) and IMF (2015)

2.2. Institutional and Policy Framework

In SSA, similar factors to those of most LIC countries constrain lending. The first challenge regarding lending is how to determine the creditworthiness of borrowers. This process can be difficult, particularly due to major obstacles associated with obtaining proof of residence documents or valid identities. Issues concerning the weak protection of property rights and unsatisfactory contracting frameworks further compound these pre-contractual challenges. These problems include weak creditor rights, which may or may

not be enforced by courts of questionable reputation; undesirable insolvency frameworks, and a general disrespect for contracts (Walker, 2012).

Both pre-contractual and post-contractual challenges faced by banking institutions result into high intermediation spreads for the small sized banks and financial systems in SSA, which, in turn, translates into substantial overhead costs in relation to size. Intermediation spreads are used as a measure of the efficiency of banking systems, and in SSA are higher and more persistent than those of other parts of the world. The primary cause of high spreads is not only high default risk but also a lack of competition in the banking industry (Mlachila et al., 2013).

Contractual and informational problems also stand in the way of competition by binding borrowers to past money lenders and barring entry of new and potential commercial banks into the industry. As a result, there is a high concentration in most of SSA banking systems, with the three biggest banks in each country enjoying an average market share of at least 73 percent, in contrast to 60 percent market share enjoyed by the three largest banks for the rest of the world (Walker, 2012). The undesirable effects of high and persistent intermediation spreads are reinforced by the fact that high-interest rates introduce adverse selection that pushes out some less risky borrowers out of the market, thereby increasing the risk of lending, and, thus, further reducing banks' willingness to lend (Fry, 1995).

All these challenges result into less efficient intermediation by banks. Commercial banks in SSA lend less to the private sector and hold more liquid assets and government securities than do other regions of the world (Amidu, 2014; Walker, 2012). SSA banks have the lowest level of credit to the private sector as a proportion of total assets of any region in the world, at just under 29 percent in 2014, in contrast to just under 47 percent in the middle east, which has the second lowest proportion of such claims. SSA banks also have, on average, the greatest amount of liquid assets as a share of total assets of any region in the world (Walker, 2012).

Table 1: Characteristics of Commercial Banks in SSA (2000 - 2014)

	By Level of Capitalization (Percentiles)			
	<25	25-50	50-75	>75
Characteristics	Mean	Mean	Mean	Mean
Deposits	17.25	27.31	28.56	54.37
Credit	11.80	21.35	18.58	26.00
Liquid Assets	25.89	26.00	18.25	31.74
Number of Countries	31			

Source: Author using data from World Bank (2015) and IMF (2015)

Table 1 groups banks in SSA according to capitalization ratios. For instance, the fourth column labeled " >75", stands for the group composed of the 25 percent banks with the largest capitalization ratios. The table also shows that well-capitalized banks in SSA, experience more deposits and extend credit to the private sector better. On the contrary, less capitalized banks experience low deposits and extend less credit to the private sector. Nevertheless, both well capitalized and less capitalized banks hold more liquid assets. This status quo suggests that banks in SSA either choose to sit on cash or prefer holding

14

debt and equity securities, as compared to lending to the private sector. According to Fry (1995), this may indicate the crowding out effect of government borrowing. Alternatively, this may suggest the lack of creditworthy borrowers (Amidu, 2014; Walker, 2012).

There are some differences in the Regional Economic Communities (RECs) of SSA which affects financial intermediation. For instance, some RECs came into existence a little later than others. The EAC was reestablished in July 2000 and instituted a customs union in 2005 followed by a common market in 2010. However, the bloc has missed its scheduled deadline for establishing a monetary union in 2015. The population of EAC from its five member states is 135.4 million and the bloc has some institutions which include the East African Development Bank (Masson and Pattillo, 2005). The Treaty of Lagos of May 1975 established ECOWAS which has seven member countries. The primary goal of the REC is to encourage integration and cooperation, so as to increase economic stability and standards of living of its population of 295 million people. The institutions in this REC include The Investment and Development Bank of ECOWAS, and The Economic and Social Council (Sy, 2010; African Union 2013).

In CEMAC and French West Africa, currency determination is tied to the French Franc. As such, the countries in this REC have no independent monetary policy, and this is a possible explanation as to why banks in CEMAC has the least levels of bank deposits and credit supply but have the highest level of liquid assets (see Figure 3). The Lack of

independent monetary union limits the monetary authorities of counties in this region regarding how they can influence credit extension and holding of debt and equity securities (African Union, 2013). Likewise, in SADC there is a currency union which may render the monetary policy for the subset of the region to differ from the rest of the REC. It is also important to note that the behavior of banks after the year 2008 may reflect reactions to the global financial crisis other than policy stimuli. Understanding the effects of the global financial crisis is particularly significant for regions such as SADC which has dominant countries such as South Africa and Mauritius, which are well integrated with world financial markets. Inconsistent development stages of economic growth of the countries in SADC may also pose a challenge to forming a successful monetary union. For instance, South Africa alone account for about 63 percent of GDP in SADC.

The SSA region is still harboring an ambition to form monetary unions notwithstanding the crisis that occurred in 2012 in the European Union euro zone. Even though the EAC does not currently have monetary unification, during the colonial era there was a common East African Shilling for Kenya, Uganda, Tanganyika and Zanzibar when these countries were under British protectorate. This gives hope that a currency union can be feasible in some of the RECs of SSA (Masson and Pattillo, 2005). Nevertheless, Nigeria brings in doubt about the feasibility of a currency unification in West Africa. The size of the Nigerian economy measured by GDP is at 260 billion dollars while the total for all other countries in ECOWAS is at 75 billion dollars. Moreover, Nigeria is an oil exporter while

a majority of other West African countries are oil importers. Another challenge to forming currency union is maintaining a fiscal discipline across the countries in the REC. Politicians are the ones who control budgets and in SSA they have the tendency of extracting rents more especially during elections. Hence there is a potential for lack of coordination between fiscal and monetary policy in the RECs of SSA. The success of currency unions in SSA will also depend on establishing strong political, fiscal, and monetary institutions (African Union, 2013).

The discussion in this chapter makes it more likely that the bank lending channel of monetary policy will matter in SSA. As seen in the sections above, firms rely heavily on commercial bank loans to finance investments, and the banks extend less credit to the private sector. The chapter is imperative because it contextualizes the problem statement that the study aims to address. In particular, chapter two complements chapter one by explaining trends in the data and institutional challenges in SSA that makes it more likely for a bank credit channel to prevail. The chapter that follows discusses the relevant theoretical and empirical literature concerning the bank lending channel.

CHAPTER THREE

LITERATURE REVIEW

3.0. Introduction

There are various theoretical explanations about how commercial banks grant credit to the private sector, attract deposits, and hold liquid assets. In chapter one it was observed that economists agree that monetary policy affects investment and real output in the short run, but explanations regarding underlying transmission mechanisms of monetary policy remain controversial. Furthermore, the study has observed that central in all these arguments are the traditional interest rate channel, balance sheet channel, and bank lending channel. The present chapter is devoted to a theoretical discussion regarding these three transmission mechanisms.

The chapter concludes with a section that reviews empirical literature on macroeconomic and welfare implications of monetary policy acting through various channels. The chapter is important for determining the appropriate model to adopt, and provide guidance on the variables to be used in this study.

3.1. The Traditional Interest Rate Channel

Proponents of the traditional interest rate channel argue that contractionary monetary policy by the central bank, where government bonds and securities are sold in exchange for reserve money, results in rising nominal interest rates and real interest rates (Walker, 2012). The effects of monetary policy on real interest rates are expected to operate under the assumption of sticky prices in the short run. As a consequence of rising real interest rates, both investment and current consumption will reduce leading to falling aggregate demand. Nevertheless, significant conceptual weaknesses characterize the traditional interest rate channel which renders it insufficient as far as explaining monetary policies is concerned. Firstly, it does not adequately explain large changes in GDP and aggregate demand (AD), which are brought about by changes in policy-induced real interest rates (Gómez-González and Grosz, 2007). Similarly, the theory does not acknowledge the role of commercial banks at all in this process. Accordingly, other monetary policy transmission mechanisms such as balance sheet channel and bank lending channel have attempted to compliment the traditional interest rate channel.

3.2. The Balance Sheet Channel

The balance sheet channel, otherwise known as the broad credit channel, is a transmission mechanism that was suggested by Bernanke and Gertler (1989). The mechanism argues that due to underdeveloped capital markets, information asymmetry will exist between the lenders and borrowers, and this will, in turn, widen the gap between internal and external costs of financing of the borrower (Amidu, 2014). The

19

mechanism also stipulates that contractionary monetary policy will increase real interest rates consequently reducing the value of assets that act as collateral, and this will weaken the creditworthiness of borrowers (Gómez-González and Grosz, 2007). Considering that the perceived risky borrower will have to obtain credit at a high cost, investment or consumption projects that could be profitable if entirely financed with internal sources will no longer be profitable when financed partly by external sources. In the final analysis, investment and consumption will reduce, with lower aggregate demand in the economy as a direct consequence. The broad credit channel makes a significant theoretical difference when compared with the traditional interest rate channel. However, it has one major deficiency, namely that, it does not identify the specific role played by commercial banks in the transmission of monetary policy to the real economy.

3.3. The Bank Lending Channel

This transmission mechanism also known as the narrow credit channel acknowledges the specific role played by commercial banks. The theory propounds that contractionary monetary policy through open market operations will instantaneously reduce deposits (Burgstaller, 2010). This development will, in turn, influence commercial banks to identify alternative sources of funds to maintain the prior levels of lending. The understanding is that bank deposits are a relatively less costly source of financing for commercial banks. Therefore, some forms of banks will find it costly or impossible to switch to other sources of funding for loans. Thus, if there exist no alternative sources of finance, and the Modigliani-Miller financial irrelevance logic (Modigliani and Miller,

1958) does not apply to the commercial banks, some banks will not be able to obtain loanable funds. As such, they will not be in a position to maintain their prior levels of lending and loan supply will fall (Gómez-González and Grosz, 2007). In the final analysis, the reduction in lending will translate into reduced investment, consumption and therefore a fall in aggregate demand in the economy.

It is worth noting that the bank lending channel operates on two preconditions. First, there must be some firms which are dependent on loans from commercial banks to finance investment. Second, the central bank must be in a position to shift the supply schedule of loans from commercial banks (Kashyap and Stein, 2000). Evidence shows that in Africa, the majority of private sector firms depend on commercial bank lending to finance investment (Walker, 2012). This, however, does not make much difference because bank credit is short term, and the firms tend to be too small to gain access to security markets considering Africa's lack of well-developed capital markets. It can, therefore, be concluded that the bank lending channel is the most applicable transmission mechanism for SSA where banks dominate the formal financial sector, and firms are dependent on bank loans to finance investments.

3.4. A Motivating Model for Bank Lending Channel

A model that discusses some testable hypotheses can augment the theoretical explanations about the bank lending channel presented in the preceding section. Following González and Grosz (2010), the present study considers a model that was

developed by Kishan and Opiela (2000). The model is of a representative commercial bank which has three assets namely required reserves (RR), bank loan (BL), and government securities (GS). The liabilities against this representative commercial bank include time deposits (TD), demand deposits (DD), and bank capital (BK).The model assumes that the commercial bank does not hold excess reserves such that:

$$RR = \alpha DD \tag{3.1}$$

The central bank determines $\alpha \in (0,1)$ in this equation which is the required reserve ratio, and the policy rate of the central bank r_{ff} is assumed to be inversely related to DD.

$$DD = a_0 - a_1 r_{ff} \tag{3.2}$$

The commercial bank is assumed to exercise market power in the bank credit BC, and time deposit TD markets. By raising its time deposit rate r_{TD} over the average time deposit rate in the market $\bar{r}_{TD}$, it can raise TD (see equation 3.3). Similarly, by reducing its loan rate r_{BC} over the average loan rate in the market, $\bar{r}_{BC}$ it can raise BC (see equation 3.4).

$$TD = b_0 + b_1\left(r_{TD} - \bar{r}_{TD}\right) \tag{3.3}$$

$$BC = d_0 - d_1\left(r_{BC} - \bar{r}_{BC}\right) \tag{3.4}$$

The model also assumes less developed capital markets. It does this by assuming interest rate sensitivity of TD and BC respectively $(b_1, d_1) > 0$, which are dependent on bank size and capitalization. In particular, the model assumes that b_1 positively depends on bank

22

size BS, and capitalization BK (See equation 3.5), because larger and better capitalized commercial banks find it easier to raise funds by issuing time deposits. However d_1 positively depends on bank size alone (See equation 3.6), which reflects the concept that larger banks tend to grant credit to larger firms which are in a better position to obtain alternative sources of funding. Accordingly, larger banks have a demand for BC which is more sensitive to changes in the interest rate than small banks.

$$b_1 = b_1\left(\overset{+}{BS}, \overset{+}{BK} \right) \tag{3.5}$$

$$d_1 = d_1\left(\overset{+}{BS} \right) \tag{3.6}$$

In the model, the commercial banks hold government securities as a buffer stock against liquidity shocks, and the policy rate with fixed spreads is assumed to be related to average market rates of TD, BC and GS.

$$GS = c_0 + c_1 DD - RR \tag{3.7}$$

The average market rates are defined as:

$$\bar{r}_{TD} = e_0 + \phi r_{ff} \tag{3.8}$$

$$\bar{r}_{BC} = g_0 + \phi r_{ff} \tag{3.9}$$

$$\bar{r}_{GS} = f_0 + \phi r_{ff} \tag{3.10}$$

The commercial bank chooses the level of TD, BC and GS that can maximize its profit function given by:

$$\pi(DD, TD, BC, GS) = (\bar{r}_{BC} - \Phi)BC + \bar{r}_{GS}GS - \bar{r}_{DD}DD - \bar{r}_{TD}TD \qquad (3.11)$$

This is subject to the balance sheet constraint:

$$BC + GS + RR = DD + TD + BK \qquad (3.12)$$

In equation (3.11), ΦBC represents losses on loans. Taking the derivative of this constrained optimization problem with respect to DD, TD, BC and GS will obtain the optimal portfolio for the commercial bank. The derivatives of TD, BC and GS with respect to the policy, rate generates some testable implications. In particular if $c_1 < 1$ then the model predicts that an increase in the policy rate will increase TD, decrease BC and have ambiguous effects on GS where the sign of the partial derivative is dependent on the value of the parameters and thus it is an empirical issue.

$$\frac{\partial BC}{\partial r_{ff}} = \frac{a_1 d_1 (1 - c_1)}{b_1 + d_1} < 0 \qquad (3.13)$$

$$\frac{\partial TD}{\partial r_{ff}} = \frac{a_1 b_1 (1 - c_1)}{b_1 + d_1} > 0 \qquad (3.14)$$

$$\frac{\partial GS}{\partial r_{ff}} = a_1 (c_1 - \alpha) \overset{<}{\underset{>}{=}} 0 \qquad (3.15)$$

A more interesting testable hypothesis is the introduction of the dependence of interest rate sensitivity of and on bank size and bank capital.

$$\frac{\left(\dfrac{\partial BC}{\partial r_{ff}}\right)}{\partial BS} = \frac{\left(\dfrac{\partial TD}{\partial r_{ff}}\right)}{\partial BS} = \frac{a_1(1-c_1)\left(b_1\dfrac{\partial d_1}{\partial BS} - d_1\dfrac{\partial b_1}{\partial BS}\right)}{(b_1+d_1)^2} \underset{>}{\overset{<}{=}} 0 \qquad (3.16)$$

$$\frac{\left(\dfrac{\partial BC}{\partial r_{ff}}\right)}{\partial BK} = \frac{\left(\dfrac{\partial TD}{\partial r_{ff}}\right)}{\partial BK} = \frac{a_1 d_1(1-c_1)\dfrac{\partial b_1}{\partial BK}}{(b_1+d_1)^2} > 0 \qquad (3.17)$$

As shown by equation (3.16), the net effect of bank asset size on the sensitivity of BC on r_{ff} is undetermined and depends on parameter values. This is reflective of the idea that two factors play a major role for big banks. Firstly, the big banks may experience less information asymmetry as compared to smaller banks thereby easily obtaining alternative sources of funds TD, when a contractionary monetary policy reduces DD. However, the clients of big banks are bigger firms which tend to be more sensitive to interest rates, which means that if big banks increase r_{BC} due to the higher cost of funding, the big banks will experience reduced demand for loans as compared to smaller banks. Secondly, the sensitivity of BC to r_{ff} is more pronounced for poorly capitalized banks than it is for better-capitalized banks. Better capitalized banks face a lower reduction in bank credit than less capitalized banks. Along the same vein, better-capitalized banks will increase more TD during monetary policy tightening. It may, therefore, be concluded that bank size and capitalization are of the essence when it comes to bank lending.

3.5. Empirical Literature Review

This section discusses empirical studies that have examined the testable hypotheses presented in the preceding sections. There are some macroeconomic and welfare implications of monetary policy acting through various channels. Existing relevant literature broadly classifies the channels of monetary policy transmission into price and credit channels (Cecchetti, 1995; Bernanke and Gertler, 1995). Due to differences in the level of financial sophistication, the intensity of government regulations and macroeconomic and structural conditions, these channels operate in varying ways across countries and regions (Simpasa et al., 2015). Nevertheless, the literature on bank lending channel for SSA and developing countries, in general, is very scanty and sketchy. The major area of interest for most studies has been the issue of the impact of monetary policy on credit supply. The known published studies tend to concern themselves with one aspect or another of the bank lending channel while controlling other variables that affect bank credit supply. Most notably, the studies use non-uniform methods of data analysis and treatment. Thus, as expected, the results indicate inconclusive evidence of the existence of the bank lending channel in SSA.

Using micro-firm level data from Bank-Scope and macro country level data from World Development Indicators databases, Amidu (2014) investigated broad determinants of credit supply in sub-Saharan Africa for the period 2000 to 2007. The study, which employed a two-step system GMM estimator, found that real interest rates significantly reduced bank lending in SSA in general but only for EAC when the study considered

26

regional groupings. The analysis also found that bank size had significant positive effects on credit supply in ECOWAS, EAC SADC and SSA in general. However, the results found significant adverse effects of capitalization only for ECOWAS and EAC where a reduction in capitalization translated into a decrease in credit supply. Macroeconomic condition as expressed through GDP per capita growth was found to influence bank lending significantly only in SSA in general and SADC in particular, but not for other economic blocs.

Samba (2013) investigated the effectiveness of monetary policy for six countries in CEMAC region by employing the vector autoregression approach to 1990 - 2007 quarterly data obtained from International Financial Statistics database. The study particularly examined the existence of the interest rate channel and the bank lending channel of monetary policy transmission. Its results suggested that a traditional interest rate channel was ineffective in the CEMAC area. An examination of bank lending channel showed that only the Central African Republic experienced a persistent decline in bank deposits following a monetary policy stance. The study further identified a rapid fall in bank loans in four CEMAC countries as a result of the contractionary monetary policy. Nevertheless, the study acknowledged that evidence for the existence of bank lending channel in the region was inconclusive due to common identification problems that arise with the use of aggregated data. As one would rightly expect, the study recommended that further studies be conducted to ascertain the existence of a lending channel in CEMAC.

Walker (2012) undertook a study to investigate the existence of bank lending channel in countries of the East African Community (EAC). The study applied differenced GMM technique to micro-level data of five EAC countries obtained from Bank-Scope database, for the period 1993 to 2008. The study found evidence that the credit supply of well-capitalized banks and smaller banks was more responsive to monetary policy shocks than that of better-capitalized banks and larger banks. Furthermore, it established that this particular outcome was of a more economically significant magnitude. The findings alluded to the common supposition that a bank lending channel of monetary policy transmission exists for EAC countries when considered as a whole, and the study considered this as fundamental to a proposed creation of a monetary union. Nevertheless, liquid asset ratios were found to be of less significance in explaining bank credit supply or the extent to which credit supply react to contractionary monetary policy.

Kabiro and Nyamongo (2014) investigated the effectiveness of the lending channel of monetary policy in Kenya. The study employed fixed effect model to bank level data spanning 2006 to 2011 for 35 banks in Kenya. The study divided banks into three categories, namely small, medium and large banks. It was found that the coefficient of the policy rate was negative and statistically significant for the full sample and medium-sized banks but insignificant for small and large banks. It was understood that large and small sized banks do not respond to monetary policy while medium-sized banks do respond. The study also found that bank size significantly increased credit supply for all

28

size categories. However, capitalization was found to increase credit supply significantly only for large banks.

Even though the studies by Amidu (2014), Kabiro and Nyamongo (2014), and Samba (2013) suggest that monetary policy significantly reduce bank credit supply, the present study argues that the three studies did not effectively establish if a bank lending channel of monetary policy operates. Amidu's study and that by Kabiro and Nyamongo made commendable efforts by investigating the direct impact of bank size and capitalization on credit supply. However, a major shortfall of the two studies resides in the fact that unlike the study by Walker (2012), and contrary to advocacy by recent and earlier studies by Simpasa, et al. (2015), and Gómez-González and Grosz (2007), Amidu (2014) and Kabiro and Nyamongo (2014) did not examine the effects of monetary policy working through its interaction with level of capitalization or bank size. Likewise, the study by Samba (2013) made no attempt at all to investigate the response of balance sheet variables to shocks in bank size or capitalization. In other words, studies by Amidu (2014), Kabiro and Nyamongo (2014), and Samba (2013) had serious shortcomings in ascertaining whether the Modigliani-Miller financial irrelevance theorem holds for commercial banks in SSA and CEMAC respectively.

Modigliani and Miller (1958) and Romer and Romer (1990) contend that bank credit supply is robust to monetary policy tightening because, unlike other private sector firms, commercial banks are not affected by less developed capital markets. These authors

postulated that commercial banks are in a position to issue equity securities to raise funds when confronted with a policy-induced drain of bank deposits funds. Put differently, the Modigliani – Miller reasoning states that shocks on the liability side of the commercial banks cannot affect its real side behavior such as credit supply because underdeveloped capital markets do not affect commercial banks' financing (Kashyap and Stein, 1995). Therefore, an effective examination of the bank lending channel requires challenging the Modigliani-Miller financial irrelevance theorem (Gómez-González and Grosz, 2007; Kashyap and Stein, 1995).

Furthermore, the analyses by Amidu (2014) Kabiro and Nyamongo (2014), and Walker (2012) used single asset models by not considering the effects of monetary policy on bank deposits and liquid assets. The bank lending channel states that contractionary monetary policy first affects the liability side of commercial banks adversely by reducing bank deposits, before affecting their real side behavior such as bank credit supply and holding of equity and debt securities (Shrestha, 2013; Gómez-González and Grosz, 2007; Kashyap and Stein, 1995). By not considering the effects on the liability side, the studies by Amidu (2014) Kabiro and Nyamongo (2014), and Walker (2012) did not follow the multi-asset model approach to investigating the lending channel. The multi-asset model was pioneered by Bernanke and Blinder (1992), Tobin (1970), Brainard (1964) and Tobin and Brainard (1963).

Bernanke and Blinder (1992) used aggregated bank balance sheet data and established that monetary policy instantaneously affects the liability side of banking systems, by reducing bank deposits. Similarly, studies by Shrestha (2013), and Kashyap and Stein (2000) have confirmed this outcome using disaggregated data. In the same manner, a study by Bernanke and Blinder (1992) also found that monetary policy instantaneously reduced holding of securities by banks. At the same time, however, it was concluded that monetary policy significantly reduced bank credit supply and aggregate output in an economy, with lagged responses. Consequently, the present study further argues that the studies by Amidu (2014) Kabiro and Nyamongo (2014), and Walker (2012) had partial treatment to investigating the existence of the bank lending channel in SSA.

3.6. Conclusion

This chapter has reviewed the theoretical and empirical literature on bank lending channel to determine the appropriate model and variables to use in the present study. The major conclusion drawn from the discussion is that a successful investigation of the bank lending channel needs to adopt a multi-asset model, examine the interaction effect of monetary policy variable with capitalization or bank size, and address the identification problems associated with the use of aggregated data. As such, the present study has adopted the multi-asset model which Tobin and Brainard (1963), Brainard (1964), and Bernanke and Blinder (1992) founded. Hence the analysis of the present study can be associated with recent advocacy for a multi-asset model by Samba (2013), Shrestha (2013), and Kashyap and Stein (2000).

CHAPTER FOUR

METHODOLOGY

4.0. Introduction

This chapter discusses various analytical tools employed in the study. A brief review of the analytical framework for estimation is presented first before specifying the empirical econometric models. The chapter also discusses the relevant diagnostic tests which the preferred models are subjected to in order to ascertain the reliability of empirical results. Last, this chapter describes variables and sources of data used for estimation purposes.

4.1. Analytical Framework

The study employs dynamic panel data models following Walker (2012), Burgstaller (2010), and Shrestha (2013). Other applications and discussions of the framework include Baltagi (2009), and Greene (2012). Linear dynamic panel-data models include ρ lags of the dependent variable as covariates and have unobserved panel-level effects, which are either fixed or random (Green, 2012; Baltagi, 2009; StataCorp., 2013). The inclusion of a lagged dependent variable as one of the regressors is what signifies dynamic interactions. In general terms, a dynamic panel data model is specified as

$$y_{it} = \alpha y_{i,t-\rho} + x'_{it}\beta + u_{it} \qquad i = 1,\ldots N \qquad t = 1,\ldots,T \qquad (4.1)$$

In this model, i represents a cross-section dimension, t is a time series dimension, x'_{it} is a vector of explanatory variables, α and β are vectors of parameters and y_{it} is the vector of the dependent variable in the model. In the preceding model specification, the assumption is that u_{it} follows a one-way error component model which is decomposed as

$$u_{it} = \mu_i + v_{it} \tag{4.2}$$

Where μ_i the time-invariant individual effects component or panel level effects and v_{it} the idiosyncratic shocks or errors are expected to be identically independently and normally distributed and thus, $\mu_i \sim IIDNormal(0, \sigma_\mu^2)$ and $v_{it} \sim IIDNormal(0, \sigma_v^2)$ respectively, and also independent of each other (Greene, 2012).

The model presented in equation (4.1) and (4.2) has two sources of persistence over time. These are autocorrelation caused by the existence of a lagged dependent variable among the regressors, and the panel level effects μ_i, which illustrates heterogeneity among the cross-section units (Baltagi, 2009). The presence of the heterogeneity component results into endogeneity since $E(u_{it}|x_{it}, y_{it}) \neq 0$. The endogeneity that occurs is problematic because violation of exogeneity assumption results in biased estimates (Greene, 2012). Flannery and Hankins (2013) offer a comprehensive discussion on how OLS estimators are not appropriate in this case due to challenges caused by the inclusion of lagged dependent variable as one of the regressors. By construction, the lagged dependent variable ends up correlating with the panel level effects in the composite error term,

resulting in biased and inconsistent estimates. Baltagi (2009), and Greene (2012), considerably discussed how the use of either fixed effect (FE) estimator or Random effect (RE) estimator would also result in biased and inconsistent estimates. For this reason, Burgstaller (2010) suggests estimating equation (4.1.) using an instrumental variable technique such as the difference Generalized Method of Moments (GMM).

The difference GMM as put forward by Arellano and Bond (1991) uses lagged values and lagged differences to estimate dynamic panel coefficients. This enables it to resolve the endogeneity and fixed effects problem (Etudaiye-Muhtar and Ahmad, 2014). The difference GMM accomplishes this by using the lagged levels of the explanatory variable, which are lagged for two or more periods as instruments (Sala and Trivin, 2014). Arellano and Bond (1991) recommend a generalized method of moments because it also ensures more efficient estimators. The efficiency gains are realized by making use of a larger set of moment condition units (Baltagi, 2009).

It has to be mentioned that although the difference GMM overcomes the challenge of fixed effect and endogeneity, Arellano and Bover (1995) and Blundell and Bond (1998) contend that the instruments used in the estimation become weak as the autoregressive process becomes too persistent or if the ratio of the variance of panel level effect to the variance of idiosyncratic shocks becomes larger (Etudaiye-Muhtar and Ahmad 2014). To overcome this challenge, Blundell, and Bond (1998), propose the use of system GMM. The system GMM uses extra instruments in difference which are presumed to be

uncorrelated with the unobservable fixed effects in the level equation (Etudaiye-Muhtar and Ahmad 2014).

The efficiency gains of the system GMM rest on the validity of the extra moment's condition which requires that the correlation between them and the unobservable fixed effects in the differenced equation be equal to zero (Etudaiye-Muhtar and Ahmad 2014; Matemilola et al., 2013). Furthermore, Blundell and Bond (1998) show that the system GMM is a more efficient estimator in situations where the difference GMM's performance is compromised in a case of persistent data and short sample periods. This, as put forward by Antoniou et al. (2008), is suitable when the coefficient of the lagged dependent variable in equation (4.1) tends towards one, and the ratio of $Var(\mu_i)/Var(v_{it})$ increases. In this regard, the present study uses the one-step system GMM with VCE robust standard errors to estimate the coefficients in the models used.

4.2. Model Specification and Method of Analysis

Following Burgstaller (2010), the study adopts the Blundell and Bond (1998) system GMM estimator to investigate the effects of monetary policy on balance sheet variables of commercial banks in SSA. The empirical model augments equation (4.1) as follows:

$$y_{it} = \alpha y_{i,t-\rho} + x'_{it}\beta + w'_{it}\theta + u_{it} \qquad i = 1,\ldots N \qquad t = 1,\ldots,T \qquad (4.3)$$

In this case y_{it} represents three dependent variables (bank credit, liquid assets, and deposits) as percentages of GDP, in line with Bunda and Desquilbet (2008), Vodová (2011), and Agenor et al. (2004). The lagged dependent variables are denoted by $y_{it-\rho}$ and are included as regressors to signify the presence of dynamic relationships. The vector of monetary policy variables is denoted by x'_{it} and in this case, includes real interest rates as a direct measure of monetary policy stance and an interaction term of real interest rates and capitalization ratio as an indirect measure of monetary policy stance. The vector of control variables is denoted by w'_{it} and in this case includes capitalization ratios, foreign currency reserves, inflation rates, and GDP per capita growth. θ is the vector of the parameter for control variables whereas α, β, μ_i and v_{it} are as defined before. First differencing equation (4.3) eliminates the country fixed effects as follows:

$$y_{it} - y_{i.t-1} = \alpha\left(y_{it-\rho} - y_{it-\rho-1}\right) + \left(x_{it} - x_{it-1.}\right)'\beta + \left(w_{it} - w_{it-1}\right)\theta + \left(v_{it} - v_{i.t-1}\right) \qquad (4.4)$$

$$\Delta y_{it} = \alpha\Delta y_{i,t-\rho} + \Delta x'_{it}\beta + \Delta w'_{it} + \Delta v_{it} \qquad (4.5)$$

The study then applies system GMM estimator (Blundell and Bond, 1998) jointly to equation (4.3) and (4.5) using lagged first differences as instruments. For this type of model, the error terms are assumed to be serially uncorrelated, and the lagged first differences of right-hand side variables are assumed to be orthogonal to country specific fixed effects to obtain consistent GMM estimations.

4.3. Diagnostic Tests

This section outlines the relevant tests that the study uses to ensure the reliability of empirical results. The fist focus is on the Arellano and Bond Autocorrelation test then the Hansen J test of Over-Identification.

4.3.1. Arellano - Bond Autocorrelation Test

The present study employs the tests for autocorrelation of orders one and two (Arellano and Bond, 1991) to ensure that the estimates are efficient. In this test, the null hypothesis is that there is no autocorrelation in differenced residuals. However, first order serial correlation is expected in the first-differenced residuals when the idiosyncratic shocks are independently and identically distributed (Baltagi, 2009; Green, 2012). As such the present study anticipates that at the order of 1 the output reported will present strong evidence against the null hypothesis of no autocorrelation in first-differenced residuals. However, serial correlation in the first-differenced residuals for an order higher than 1 is sufficient proof that the moment conditions used are not valid (Baltagi, 2009). Accordingly, it is only when the null hypothesis is not rejected for an order of at least 2 that the model is declared free from serial correlation in the error terms. Rejecting the null hypothesis entails that there is the presence of serial correlation in the error terms, a situation which results in larger standard errors and less efficient estimators (Wooldridge, 2004).

4.3.2. Hansen J-Test of Over-Identification

The validity of instruments is being evaluated using the Hansen (1982) J test, which is robust to heteroscedasticity but may be weakened with many instruments (Roodman, 2009a, b). In other words, the test examines over-identifying restrictions, and the null hypothesis is that the instruments used are exogenous. Consequently, the instruments used are considered to be valid if the null hypothesis is not rejected. Conversely, if the null hypothesis is rejected, it implies that the overidentifying restrictions are not valid. In this case, the model or the instruments used need to be reconsidered unless we attribute the rejection to heteroscedasticity in the data-generating process (StataCorp., 2013).

4.4. Variable Description, Justification and Expected Results

This section provides a description of the variables used in the study, their expected signs of the coefficients, and the sources from which they were obtained. The discussion is on the dependent variables, the explanatory variables, and the control variables.

4.4.1. Dependent Variables

As mentioned earlier, there are three dependent variables in this study. The first one is bank credit which is measured as a domestic credit to the private sector by banks taken as a percentage of GDP. The variable has been sourced from the World Development Indicators database by World Bank (2015). The choice of the dependent variable is justified by the fact that it has been used in similar studies by Samba (2013), Cottarelli et al. (2003), Hofmann (2004), Boissay et al. (2006), and Kiss et al. (2006).

Bank deposits is the second dependent variable of the study. The study emulates Samba (2013) Shrestha (2013), and Kayshap and Stain (1999) by adopting a multi-asset model that investigates the effects of monetary policy on bank deposits alongside real side variables. According to Gómez-González and Grosz (2007) and Kayshap and Stain (1999), investigating the effects of monetary policy on bank deposits is a necessary step when testing the existence of a bank lending channel. In the footsteps of Shrestha (2013) the study computes deposits as the sum of transfer deposits included in broad money, other deposits included in broad money, and deposits excluded from broad money, as a percentage of GDP. The data on deposits was sourced from IMF's International Financial Statistics (IFS) database.

The third and last dependent variable of the study is bank liquidity. This variable is measured as bank liquidity as a percentage of GDP and has been sourced from the World Development Indicators database by World Bank (2015). The present study follows Shrestha (2013) by estimating the effects of monetary policy on liquid bank assets in a multi-asset model framework.

4.4.2. Independent Variables

The lags of dependent variables have been included as regressors in the models. According to Burgstaller (2010), Akinboade and Makina (2010), and Cottarelli et al. (2003), current values of some bank balance sheet variables influence next year's values. A study by Shrestha (2013) found a positive impact of previous year's bank credit,

deposits and liquid assets on the current values which implies that the expected sign for the coefficients of all the lagged dependent variables in the present study is positive.

Monetary policy stance is the main variable of interest in the model and is being represented by real interest rates (Real Interest), in consent with Burgstaller (2010), Cottarelli, et al. (2003), Boissay, et al. (2006), and Kiss, et al. (2006). The variable has been sourced from WDI database maintained by World Bank (2015). The theory of bank lending channel states that policy-induced increase in real interest rates will result in a reduction in deposits, credit supply and holding of securities (Burgstaller 2010). Accordingly, the present study expects negative to be the sign of the coefficients of real interest rate for all the three balance sheet variables models that concern it.

The interaction term of real interest rates and capitalization ratios (Cap*Real Int.) is included as a measure of the indirect impact of monetary policy on the balance sheet variables of commercial banks, emulating the example of Walker (2012), and González and Grosz (2007). The theory of bank lending channel states that the effect of monetary policy on bank balance sheet variables works through its interaction with levels of capitalization (Khashyap and Stein, 1995). It is expected that the effect of monetary policy stance is minimal for banks which are well capitalized. The anticipated sign of the coefficient of this interaction term is negative.

4.4.3. Control Variables

Capitalization ratios has been included as a control variable following Walker (2012) and González and Grosz (2007). The variable is computed as equity and other shares of depository institution taken as a percentage of GDP following Amidu (2014) and Walter (2012). The data on equity and other shares was sourced from the IFS database compiled by IMF (2015). It is argued that the bank lending channel better explain the effects of monetary policy on the economy in the face of less developed capital markets (Kishan and Opiela, 2000; Kashyap and Stein, 2000). This is the most distinguishing feature of the bank lending channel from all other transmission mechanisms. The expected sign of the coefficient of this variable for the three bank balance sheet variables models is positive.

Foreign currency reserves (Forex) has been included as a control variable in the model. This variable was used in a study by Shrestha (2013) which investigated the effects of foreign currency reserve accumulation on bank credit, liquid assets, and deposits in East Asia. The variable was sourced from IFS database by International Monetary Fund (2015). Findings of Shrestha (2013) show that in the post-crisis period, foreign currency reserves contributed positively to private sector credit. Earlier studies also found that persistent reserve accumulation has implications for the balance sheet of the central bank, the commercial banks and the economy as a whole (Banchs and Mollejas, 2010; Mohanty and Turner, 2006). Hence the present study includes foreign currency reserves as one of the control variables with the anticipation that the sign of its coefficient will be positive.

GDP per capita growth (GDP) has been included as one of the control variables in this study after similar studies by Walker (2012), Cottarelli et al. (2003), Boissay et al. (2006), and Kiss et al. (2006). Substantial evidence supports the hypothesis that macroeconomic environment affects the performance of the banking system, and this, in turn, affects intermediation (Quagliariello, 2007; Baum et al., 2005; Al-Haschimi, 2007; Beck and Peria, 2005; Chirwa and Mlachila, 2004). Quagliariello (2007), for example, used panel data and found that during economic boom, banks expand their lending activities, relax their selection criteria and that this even results in an increase in bad loans. To this effect, it is expected that the sign of the coefficient of GDP per capita growth shall be positive. The present study obtained data on GDP from the WDI database by World Bank (2015).

In this study, inflation is measured as the annual growth rate of the Consumer Price Index as used by Burgstaller (2010), Cottarelli et al. (2003), Boissay et al. (2006), and Kiss et al. (2006). The banking system is less likely to experience an increase in deposit funds, credit supply and holding of liquid bank assets in the face of high inflation because the price of the financial services such as interest rates become less informative (Amidu, 2014). Thus, the expected sign of the coefficient of inflation variable is negative. It is also worth mentioning that inflation and GDP per capital growth are incorporated in the model as controls for loan demand, in order to differentiate between the supply side and the demand side effects of monetary policy on credit supply. This has been done in

harmony with Kabiro and Nyamongo (2014). The present study obtained data on inflation from the WDI database by World Bank (2015).

4.5. Data Sources

The macro panel data used for the study covers the 2000 to 2014 period, and the data was sourced from WDI database of the World Bank, and the IFS database of the IMF. There are 49 countries in SSA but due to unavailability of data for some of the countries, the study has ended up with a sample of 31 countries. The countries have been categorized into five groups, and Table 2 shows the total number of countries in each cluster.

Table 2: Number of Countries Included in Each Group

	SSA	SADC	ECOWAS	CEMAC	EAC	OTHERS
No. of countries in the sample	31	11	4	6	3	7
Total of countries in the region	49	15	7	6	5	16
Percentage of Total	**63**	**73**	**57**	**100**	**60**	**44**

Some groupings such as Common Market for East and Southern Africa (COMESA) and Economic Community of Central African States (ECCAS), have been left out in the categorization due to some serious overlap of countries with other economic blocs.

43

CHAPTER FIVE

EMPIRICAL RESULTS AND INTERPRETATION

5.0. Introduction

This chapter, which is divided into three sections, presents and discusses the results of the descriptive, diagnostic as well as econometric analyses. The first section concerns itself with the analysis of descriptive statistics, the second with diagnostic test results, and the third with the output of regression.

5.1. Descriptive Results

The subsequent Figures 4, 5, and 6 contain summarized reports of average bank balance sheet variables used for regression analyses of 31 SSA countries, for the period 2000 to 2014.

The trends in bank balance sheet variables depicted in Figure 4 suggest less impressive performance of banks in SSA. Average bank deposits and bank credit rose steadily over the period. Nevertheless, average bank liquid assets are found to be substantially higher than average bank loans. Table 8 in Appendix 1 further shows that overall variability in average bank deposits is 32.56 which is relatively greater than variability in average bank liquid assets and average bank credit of 23.31 and 18.62 respectively. This suggests that

deposit funds mobilization is highly unpredictable as compared to the credit supply process which can have implications not only on credit supply but also on the purchase of debt and equity securities.
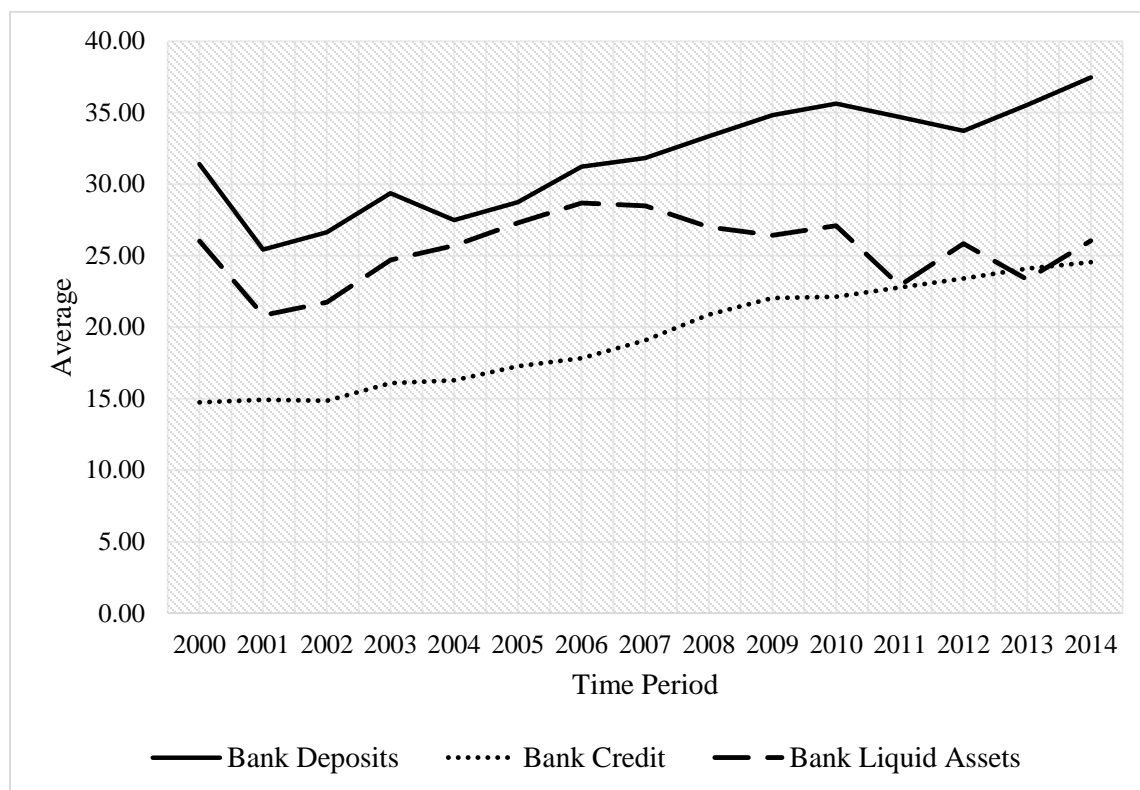
Figure 4: Trends in Bank Balance Sheet Variables in SSA
Source: Author using data from World Bank (2015) and IMF (2015)

Figure 5 shows that average bank credit in SADC is steadily increasing and is substantially higher than that of other regions and the average for SSA. All other regional groupings have average bank credits which are lower than the average for SSA. Average bank loans are the lowest in CEMAC, seconded by ECOWAS. However, Table 9 of Appendix 1 suggests that ECOWAS has relatively more volatile average bank lending

with a standard deviation of 6.02 as compared to CEMAC which has a standard deviation of 3.19.
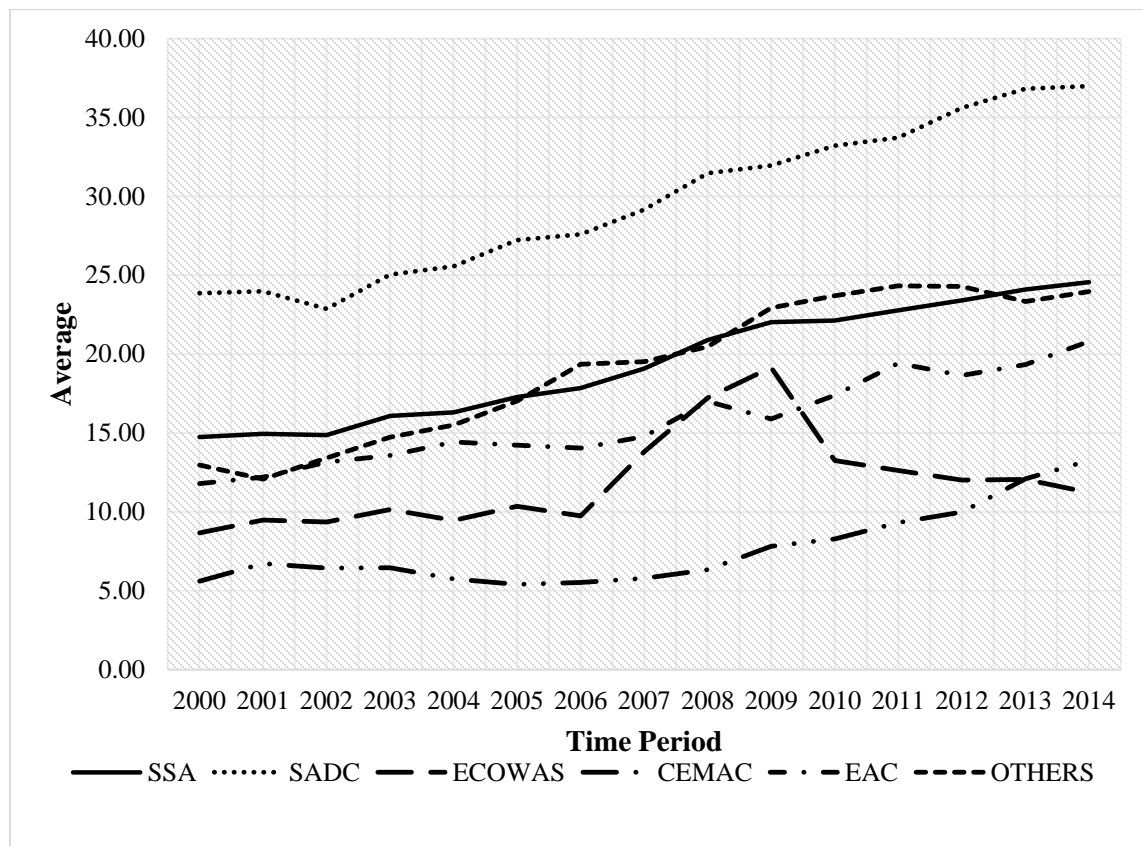
Figure 5: Trends in Bank Credit Supply for Regional Groupings
Source: Author using data from World Bank (2015) and IMF (2015)

Figure 6 shows that average bank deposits are relatively high in SADC as compared to other regions. Nevertheless, Table 10 in Appendix 1 shows that bank deposits in SADC are relatively more volatile with a standard deviation of 40.70, suggesting that deposit funds mobilization in the region is highly unpredictable. This can have negative implications on credit supply. Average deposits are the lowest in CEMAC seconded by

46

ECOWAS. This outcome explains why the two regions also experience low credit supply as depicted by Figure 5.
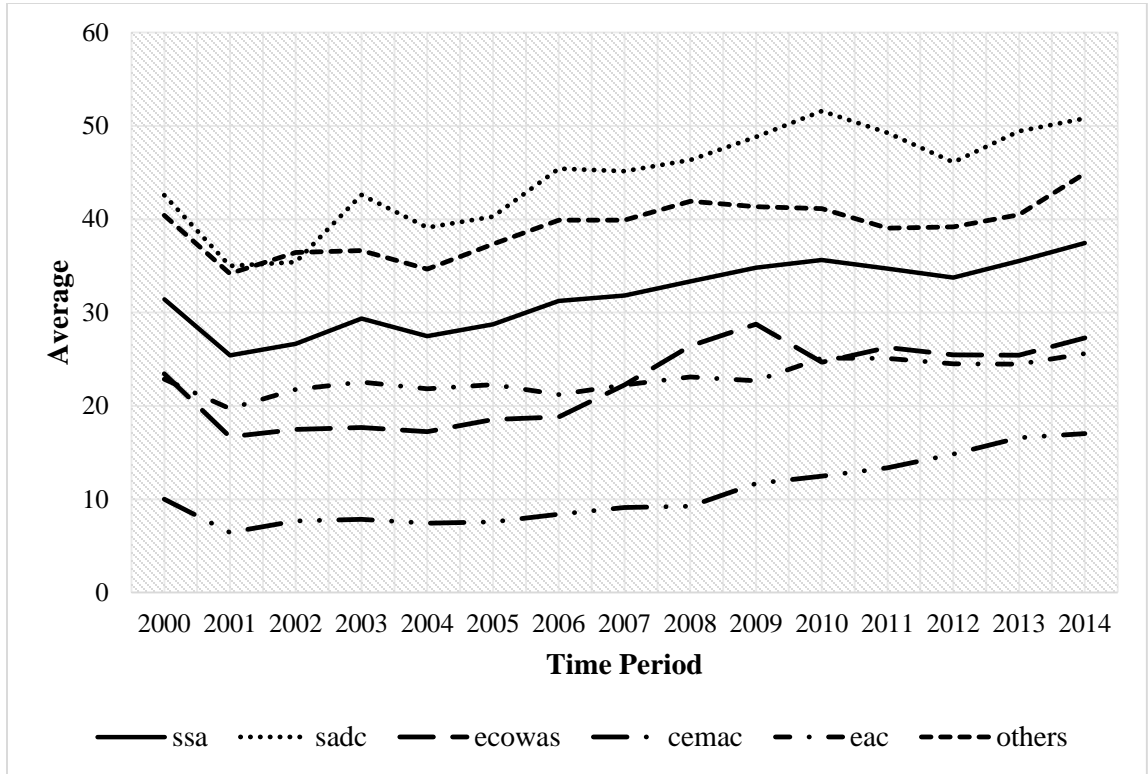
Figure 6: Trends in Bank Deposits for Regional Groupings in SSA
Source: Author using data from World Bank (2015) and IMF (2015)

Table 3 shows that the average foreign currency reserves of 23.14 percent for SADC are higher than that of other regions. Nevertheless, SADC has more variable exchange reserves with a standard deviation of 21.24. Shrestha (2014) found that accumulation of foreign exchange reserves improves financial intermediation of commercial banks. Furthermore, SADC has lowest average real interest rate (RINT) of 7.46 percent as compared to other regions. There is low variability in real interest rates in SADC with a

standard deviation of 9.93. On the other hand, average real interest rates are higher in ECOWAS with an average of 13.13 percent. The high-interest rates negatively affect bank deposits which in turn affect credit supply (González and Grosz, 2007).

Table 3: Summary Statistics of Regressors Used in the Study

	SADC		ECOWAS		CEMAC		EAC		Others	
	Mean	Sd.	Mean	Sd.	Mean	Sd.	Mean	Sd.	Mean	Sd.
Forex	23.14	21.24	13.04	6.62	13.32	10.35	12.27	3.23	11.39	9.80
RINT	7.46	6.93	13.13	12.70	10.34	10.43	8.54	7.42	9.33	17.45
GDP	2.38	3.29	3.39	5.91	2.60	9.62	2.76	2.09	2.49	4.61
Inflation	8.06	6.54	9.97	8.80	3.38	3.61	5.97	4.68	26.33	68.91
Capital	4.76	7.48	0.98	2.25	0.20	1.47	1.75	1.07	2.07	6.12
N	165		60		90		45		105	

All regions have similar average GDP per capita growth except ECOWAS, which has a higher average of 3.39 percent. Nevertheless, GDP per capita growth is more unstable for CEMAC followed by ECOWAS, whose standard deviations are 9.62 and 5.91 respectively. Commercial banks are more likely to increase credit supply during an economic boom (Quagliariello, 2007). CEMAC has the lowest average inflation of 3.38 percent. This outcome agrees with Samba (2013) who also found very low levels of inflation in CEMAC for the period 1980 to 2007. Nevertheless, average inflation is highest in countries which were not grouped seconded by countries in ECOWAS.

The SADC region has high average capitalization ratios of 4.76 percent but which is more volatile. On the other hand, CEMAC and ECOWAS have the lowest and second-lowest average capitalization ratios. High capitalization ratios are expected to offset the adverse effects of monetary policy tightening on credit supply (Kashyap and Stein, 2000).

5.2. Diagnostic Tests Results

Before interpreting the estimation results, it is imperative to evaluate the outcome of relevant diagnostic tests that validate the models. This section presents the results of tests which were conducted to ensure that the estimated models are free from the autocorrelation of second order and have used valid instruments. Table 4 reports the results of the Arellano - Bond test for serial correlation of second order, and the Hansen J test for validity of instruments used.

Table 4: Diagnostic Test Results

Bank Deposits						
	SSA	SADC	ECOWAS	CEMAC	EAC	OTHERS
Arellano Bond Test	-1.00	-1.02	-1.30	-1.32	-0.29	0.25
P-values	0.32	0.31	0.19	0.19	0.77	0.80
Hansen	15.02	0.00	0.00	0.00	0.00	0.00
P-values	1.00	1.00	1.00	1.00	1.00	1.00
Instruments	104.00	121.00	79.00	96.00	69.00	103.00
Bank Credit						
	SSA	SADC	ECOWAS	CEMAC	EAC	OTHERS
Arellano-Bond Test	-0.68	-0.54	-1.24	1.40	-0.64	1.02
P-values	0.49	0.59	0.22	0.16	0.52	0.31
Hansen	13.76	0.00	0.00	0.00	0.00	0.00
P-values	1.00	1.00	1.00	1.00	1.00	1.00
Instruments	104.00	121.00	79.00	96.00	69.00	103.00
Liquid Assets						
	SSA	SADC	ECOWAS	CEMAC	EAC	OTHERS
Arellano Bond Test	0.16	-0.76	-0.52	-0.21	1.43	0.23
P-values	0.87	0.45	0.61	0.84	0.15	0.82
Hansen	16.01	0.00	0.00	0.00	0.00	0.00
P-values	1.00	1.00	1.00	1.00	1.00	1.00
Instruments	104.00	121.00	79.00	96.00	69.00	103.00
N	434.00	154.00	56.00	84.00	42.00	98.00

Note: Instruments refers to the total number of instruments used in the model estimated.

5.2.1. Arellano and Bond Test Results and Lag Length Selection

Prior to testing for autocorrelation, the study determined the lag length of the dependent variable. The study estimated several dynamic panel data models using different lag lengths of the lagged dependent variable and other regressors. However, the study settled for the lag length of one for all the regressors because other lag lengths resulted into autocorrelation of second order and invalidity of the instruments.

The Arellano and Bond test for autocorrelation of second order has the null hypothesis which states that there exists no autocorrelation in differenced residuals. The test statistics reported in Table 4 show that there is no presence of second order serial correlation in all the models reported. The probability values of Z statistics for the models reported are greater than 0.10, which shows statistical insignificance even at 10 percent level. Accordingly, the null hypothesis of no serial correlation in the idiosyncratic shocks cannot be rejected.

5.2.2. Hansen J-Test of Over-Identification

The null hypothesis of the Hansen J test for over-identification restriction states that the instruments used are exogenous and therefore valid. For all the models reported in Table 4, the Hansen J-test statistics have probability values which are greater than 0.10. This implies one cannot reject the null hypothesis which suggests that the models reported have used valid instruments.

51

5.3. Econometric Results

The subsequent section reports the results for estimating the dynamic panel data models using system GMM methodology. The study has investigated three main variables in the bank balance sheets namely bank deposits, bank credit, and liquid bank assets.

5.3.1. Estimation Results for Bank Deposits

Prior to investigating effects of monetary policy on the real side behavior of commercial banks, in this case, credit supply and holding of liquid assets, a preliminary check with bank deposits is required (Samba, 2013; Shrestha, 2013). This is necessitated by the need to verify the underlying premise of the bank lending channel which states that monetary policy will first affect the liability side of commercial banks by reducing deposits before affecting its real side behavior. Bernanke and Blinder (1992) already established that this relationship holds for the aggregate banking sector. However, the present study verifies the outcome in the case of SSA and its economic blocs.

All the six models reported in Table 5 regressed bank deposits against real interest rate and an interaction term of real interest rate and capitalization as a measure of the direct and indirect impact of monetary policy on bank deposits. The models include the lag of bank deposits, capitalization ratio, foreign currency reserves, GDP per capita growth, and inflation, as control variables. The coefficient of real interest rate is found to be statically significant and negative at 1 percent level for ECOWAS, 5 percent level for both CEMAC and EAC, but statistically insignificant for SADC, OTHERS, and SSA. The

significant outcome for EAC and the insignificant outcome for SADC are robust even after controlling for the dominant position of Kenya and South Africa in the two regions respectively (See Table 11 and 12 in Appendix 2). The analysis also finds that ECOWAS has more economically significant results with a 1 percent increase in real interest rate leading to a 12.8 percent reduction in bank deposits. OTHERS has the least economically significant outcome with a 1 percent increase in real interest rates causing a 2 percent reduction in bank deposits.

Table 5: Regional Analysis for Bank Deposits

Dependent Variable: Bank Deposits						
	SSA	SADC	ECOWAS	CEMAC	EAC	OTHERS
Bank Deposits $_{-1}$	1.000^{***}	0.976^{***}	0.762^{***}	0.949^{***}	0.960^{***}	0.984^{***}
	(0.008)	(0.019)	(0.036)	(0.035)	(0.016)	(0.005)
Real Interest $_{-1}$	-0.034	0.076	-0.128^{***}	-0.065^{**}	-0.037^{**}	-0.020
	(0.038)	(0.144)	(0.025)	(0.031)	(0.017)	(0.028)
Capitalization $_{-1}$	0.027	0.037	0.349	-0.264	-0.708^{*}	-0.058
	(0.072)	(0.099)	(0.268)	(0.376)	(0.375)	(0.064)
Cap*Real Int. $_{-1}$	-0.004	-0.044	-0.082^{***}	0.017	0.004	0.002
	(0.010)	(0.039)	(0.016)	(0.019)	(0.019)	(0.003)
Forex $_{-1}$	0.002	0.081	0.253^{**}	0.064^{***}	0.181^{***}	0.100^{**}
	(0.025)	(0.069)	(0.127)	(0.013)	(0.039)	(0.039)
GDP $_{-1}$	0.104^{*}	-0.186	-0.061	0.049^{***}	-0.197^{***}	-0.001
	(0.055)	(0.322)	(0.060)	(0.018)	(0.055)	(0.121)
Inflation $_{-1}$	-0.088^{*}	-0.138^{*}	0.066	0.007	-0.068	-0.012
	(0.048)	(0.071)	(0.054)	(0.059)	(0.044)	(0.010)
Wald Test	83873.98	33.21	13.29	68.42	13.68	21.43
P-value	0.00	0.00	0.00	0.00	0.00	0.00
N	434	154	56	84	42	98

Notes: Robust VCE standard errors are reported in parentheses. ***, **, and * indicate statistical significance at 1, 5, and 10 percent levels respectively.

The conclusion from the analyses is that real interest rates significantly reduce bank deposits in ECOWAS, CEMAC, and EAC but not in SADC, OTHERS, and SSA as a whole. These results are robust even after controlling for the dominant position of South African and Kenya in SADC and EAC respectively. Earlier on, it was pointed out that Samba (2013) investigated the presence of a bank lending channel in EAC and found that only Central African Republic experienced a persistent decline in bank deposits after contractionary monetary policy, but not for EAC countries as a whole. The outcome of the present study, therefore, reinforces the findings of Samba (2013) by observing that contractionary monetary policy also affects bank deposits of EAC countries collectively. Furthermore, the coefficient of the interaction term between real interest rate and capitalization ratio is found to be statistically significant at 1 percent level with a negative sign for ECOWAS. It may, therefore, be deduced that monetary policy does not only directly reduce bank deposits in ECOWAS but also operates indirectly through its interaction with levels of capitalization.

The parameters of other explanatory variables in the six models of Table 5 can be interpreted as follows: in all the six models considered, previous period's bank deposits are found to significantly and positively influence bank deposits of the current year. This outcome is in line with findings of a study by Shrestha (2013), Samba (2013), and Kashyap and Stein (2000).

The coefficient of Capitalization Ratio is only found to be statistically significant for ECOWAS with a negative sign. This outcome seems to suggest that the amount deposited with banks will reduce as capital markets become more important in ECOWAS. The logical explanation for this result is that in the face of well-developed capital markets investment in equity or debt securities will yield better returns as compared to investment in bank deposits.

The coefficient of forex is found to be statistically significant and positive for ECOWAS, CEMAC, EAC, and OTHERS, but not for SADC and SSA as a whole. The significant outcomes are in line with Shrestha (2013) who also found that in East Asian Economies foreign currency reserve accumulation significantly increases bank deposits. Nevertheless, the insignificant result for SADC is very surprising, considering that the region accumulated relatively more currency reserves, according to Table 3.

The coefficient of GDP per capita growth is found to be statistically significant and positive for SSA, CEMAC, and EAC. This implies that during periods of economic boom bank deposits in SSA increase. The outcome is consistent with Shrestha's (2013), conclusion that GDP growth positively influences bank deposits of East Asian Economies for the post-Asian crisis period. The coefficients of inflation are found to be statistically significant at 1 percent level for both SSA and SADC region with negative signs. These results suggest that an increase in average price level triggers a decline in the amount people choose to deposit with the banks in SSA and SADC. The results support

Garcia and Calmes (2005) who discovered a negative relationship between macroeconomic uncertainties such as inflation and bank performance.

5.3.2. Estimation Results for Bank Credit

The most direct test of the theory of bank lending channel is to examine if monetary policy affects bank credit supply through its interaction with the level of capitalization. The estimation results for testing this relationship are presented in Table 6.

Table 6: Regional Analysis for Bank Credit

Dependent Variable: Bank Credit to the Private Sector						
	SSA	SADC	ECOWAS	CEMAC	EAC	OTHERS
Bank Credit $_{-1}$	1.007^{***}	0.999^{***}	0.544^{***}	0.979^{***}	0.928^{***}	0.954^{***}
	(0.010)	(0.010)	(0.142)	(0.030)	(0.039)	(0.025)
Real Interest $_{-1}$	-0.039^{*}	-0.111^{***}	-0.004	-0.003	-0.110^{***}	-0.072^{***}
	(0.021)	(0.033)	(0.028)	(0.008)	(0.037)	(0.022)
Capitalization $_{-1}$	0.073	0.095	0.347^{**}	0.330^{***}	-0.989	0.046
	(0.078)	(0.096)	(0.175)	(0.123)	(0.943)	(0.031)
Cap*Real Int. $_{-1}$	-0.012^{*}	-0.006^{**}	-0.023^{***}	-0.017^{**}	-0.078^{***}	-0.006^{***}
	(0.007)	(0.003)	(0.005)	(0.007)	(0.026)	(0.001)
Forex $_{-1}$	0.024^{*}	-0.004	0.324^{***}	0.038^{***}	0.385^{***}	0.156^{***}
	(0.014)	(0.028)	(0.124)	(0.005)	(0.079)	(0.038)
GDP $_{-1}$	0.101^{***}	0.105	-0.008	0.020	-0.348^{***}	0.147^{***}
	(0.037)	(0.078)	(0.040)	(0.013)	(0.048)	(0.042)
Inflation $_{-1}$	-0.075^{***}	-0.063	0.073	-0.069^{*}	-0.096^{***}	-0.010^{***}
	(0.026)	(0.063)	(0.051)	(0.039)	(0.023)	(0.003)
Ward Test	44930.95	51.65	27.05	11.50	22.22	35.45
P-value	0.00	0.00	0.01	0.04	0.02	0.00
N	434	154	56	84	42	98

Notes: Robust VCE standard errors are reported in parentheses. ***, **, and * indicates statistical significance at 1, 5, and 10 percent levels respectively.

The results in Table 6 show that real interest rates significantly reduce bank credit supply in SSA, SADC, EAC, and OTHERS. The coefficient of real interest rates is negative and weakly significant at 10 percent level for SSA but strongly significant at 1 percent level for SADC, EAC, and OTHERS. Although the coefficient of real interest rates is found to be statistically insignificant for ECOWAS and CEMAC the coefficient of real interest rates for the two regions has expected negative sign. The outcome of the analyses partially agrees with Amidu (2014), who also found that monetary policy significantly reduces credit supply of SSA countries as a whole but only for EAC when regional groupings were considered.

The significant coefficient of real interest rates for SADC and EAC holds even after controlling for the dominant position of South Africa and Kenya in the two RECs respectively (See Table 11 and 12 in Appendix 2). Although this particular outcome seems to be anti-thesis to the common supposition that the two countries which have relatively better developed capital markets will matter in their RECs, the results of the present study agree with Amidu (2014) and Walker (2012). Amidu (2014) found that a change in real interest rates results in a significant decline in bank credit in SADC even after controlling for South Africa. Similarly, Walker (2012) established that monetary policy stance significantly reduce bank loans even after controlling for Kenya.

Table 6 further shows that real interest rates significantly reduce credit supply through its interaction with the level of capitalization in SSA and all regional groupings considered.

57

The coefficient of the interaction between real interest rate and capitalization ratio is weakly significant for SSA at 10 percent level, but strongly significant at 5 percent level for SADC and CEMAC, and very strongly significant at 1 percent level for ECOWAS, EAC, and OTHERS. It may, therefore, be concluded from the results that a bank lending channel operates directly for SSA as a whole, but it also operates indirectly through its interaction with capitalization for all the regional groupings being considered in this study. The significant negative coefficient of the interaction variable holds even after South Africa and Kenya were controlled for by the study (See Table 11 and 12 in Appendix 2). Practically, as far as capitalization is concerned, the results of the study support research findings of a study by Walker (2012) for East African Community (EAC), Sichei (2005) for South Africa alone, and Sichei and Njenga (2010) for Kenya alone. The outcome of the analyses, therefore, clearly suggests the existence of a bank lending channel in SSA and its regional groupings.

5.3.3. Estimation Results for Bank Liquid Assets

The strongest case for the existence of a bank lending channel is made when not only monetary policy results in reductions in bank deposits and bank credit supply but also when there is a decrease in the holding of liquid assets such as securities. Table 7 presents results of investigating the impact of monetary policy on liquid bank assets. Monetary policy seems to have significant direct impact on liquid bank assets only in ECOWAS. The coefficient of real interest rate is found to be statistically significant at 1 percent level in this REC. Similarly, it is very economically significant with a magnitude

of 25.6 percent for this region. However, the study has found that after controlling for the dominant position of South Africa, monetary policy has significant direct impact on liquid bank assets in SADC (See Table 11 in Appendix 2). Even though the study has found no direct bearing on the other RECs, real interest rates have significant adverse effect on liquid bank assets through their interaction with capitalization in SADC, ECOWAS, CEMAC, and EAC.

Table 7: Regional Analysis for Bank Liquid Assets

Dependent Variable: Bank Liquid Assets

	SSA	SADC	ECOWAS	CEMAC	EAC	OTHERS
Liquid Assets $_{-1}$	0.822***	0.895***	0.599***	0.488***	0.746***	0.789***
	(0.049)	(0.024)	(0.093)	(0.044)	(0.040)	(0.056)
Real Interest $_{-1}$	-0.050	-0.033	0.030	-0.299	0.256***	-0.057
	(0.150)	(0.071)	(0.052)	(0.252)	(0.097)	(0.050)
Capitalization $_{-1}$	0.036	0.057	0.317**	-1.362	3.338***	0.325**
	(0.384)	(0.095)	(0.143)	(1.310)	(0.453)	(0.163)
Cap*Real Int. $_{-1}$	-0.016	-0.024**	-0.050***	-0.147**	-0.134***	-0.002
	(0.025)	(0.010)	(0.016)	(0.072)	(0.032)	(0.007)
Forex $_{-1}$	-0.007	0.055	0.011	0.430**	-0.406***	-0.132
	(0.098)	(0.037)	(0.120)	(0.175)	(0.126)	(0.103)
GDP $_{-1}$	-0.121	-0.219*	-0.089	0.027	0.011	-0.298
	(0.179)	(0.131)	(0.110)	(0.120)	(0.232)	(0.240)
Inflation $_{-1}$	0.071	0.137***	0.078	2.274**	0.187**	-0.024***
	(0.059)	(0.047)	(0.050)	(0.883)	(0.086)	(0.006)
Wald Test	16020.98	16.60	15.54	19.32	14.33	16.64
P-value	0.00	0.01	0.03	0.01	0.04	0.01
N	434	154	56	84	42	98

Notes: Robust VCE standard errors are reported in parentheses. ***, **, and * indicates statistical significance at the 1, 5, and 10 percent levels respectively.

The coefficient of the interaction term of capitalization and real interest is found to be statistically significant at 5 percent, 1 percent, 5 percent and 5 percent levels, for the four

regional groupings respectively. The significant outcome for the coefficient of the interaction term is also quite robust even after controlling for the dominant position of Kenya in EAC region (see Table 12 in Appendix 2). However, the coefficient becomes statistically insignificant for SADC after controlling for the dominant position of South Africa in this economic bloc (see Table 11 in Appendix 2). The analyses also find that CEMAC has the more economically significant result, with a one percent increase in real interest rates interacting with capitalization, resulting in a 14.7 percent reduction in liquid bank assets. The outcome of this analysis is in line with Shrestha (2013) and Kashyap and Stain (2000) as far as the significant impact of monetary policy on liquid bank assets is concerned. The outcome, therefore, reinforces the findings in Table 5 and Table 6 and presents a strong case for the existence of a bank lending channel of monetary policy transmission in the majority of SSA regional groupings.

5.4. Conclusion

This chapter has presented results of estimating empirical panel data models using system GMM methodology. The objective was to investigate the impact of monetary policy on balance sheet variables of commercial banks. The results show that the impact of monetary policy on the balance sheet variables is group dependent. On the one hand, the results demonstrate that real interest rates significantly reduce bank deposits only in ECOWAS, CEMAC, and EAC. On the other hand, however, the results indicate that the interaction of real interest rates and capitalization reduces bank credit supply in SSA and all its RECs considered by the study. It has been established that the interaction of real

interest rates and capitalization significantly reduce liquid assets of banks only in SADC, ECOWAS, CEMAC, and EAC. Furthermore, the study has established that the impact of monetary policy stance on the bank balance sheet variables is robust for EAC and SADC even after controlling for the dominant position of Kenya and South Africa in the two economic blocs respectively.

CHAPTER SIX

CONCLUSION AND POLICY IMPLICATIONS

6.1. Summary

This study set out to investigate the effects of monetary policy on the main balance sheet variables of commercial banks in sub-Saharan Africa, namely bank deposits, credit supply, and liquid bank assets. In other words, the study aimed at testing the existence of a bank lending channel of monetary policy transmission in sub-Saharan Africa and its regional groupings. More specifically, the study examined if real interest rates affect the balance sheet variables directly and if they also do so via their association with capitalization. More than that, the study investigated if the impact of monetary policy on the balance sheet variables of commercial banks is group dependent. The study estimated dynamic panel data models using system GMM methodology.

The results suggest that the effects of monetary policy in SSA are dependent on the groupings. It has been found that real interest rates significantly reduce bank deposits only in ECOWAS, CEMAC, and EAC, and not the rest of the grouping. However, the interaction effect of real interest rates and capitalization significantly reduce bank credit supply to the private sector in SSA and all of its regional groupings considered in this

study. Nevertheless, the interaction effect of real interest rates and capitalization significantly impact liquid assets of banks only in SADC, ECOWAS, CEMAC, and EAC. Accordingly, the outcome of the study presents a strong case for the existence of a bank lending channel for a majority of sub-Saharan Africa's regional economic blocs. This result still holds even after controlling for the dominant position of South Africa in SADC and Kenya in EAC.

6.2. Policy Implications of the Results

The most relevant implication of the outcome of this study is that a lending channel in sub-Saharan Africa is a viable transmission mechanism when regional groupings are considered. The findings give us grounds to believe that the common monetary policy for CEMAC may be transmitted through a bank lending channel to the economies of member states. Furthermore, proposed common monetary policy for regional groupings such as EAC and ECOWAS, once formed, will notably be transmitted through a bank lending channel to the economies of member countries, when the countries are treated as an aggregate. However, the same cannot be said with certainty for SADC simply because monetary policy stance is found not to have a significant effect on bank deposits. Proving the existence of a bank lending channel requires that monetary policy stance should first of all reduce deposits before reducing credit supply, holding of securities, and aggregate output.

63

6.3. Limitations of the Study

The major limitation of the present study is that it was not able to test the effect of treasury bills rates on the balance sheet variables of commercial banks as suggested by Walker (2012), due to the unavailability of data for some countries. Treasury bills rates are considered as one of the important indicators for monetary policy stance in the context of the bank lending channel. However, the use of real interest rates as a proxy of the stance of monetary policy does not negate the conclusions of the present study because this indicator has been widely employed in similar studies. Nevertheless, the present study suggests that in future, when data on treasury bills rate becomes widely available for SSA, studies need to include treasury bills rate in the models so as to reinforce the evidence the present study has found on the existence of a bank credit channel.

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Appendix 1: Summary Statistics of Variables that have been used in the Study

Table 8: Summary Statistics of Commercial Bank Balance Sheet Variables in SSA

	Bank Credit		Bank Deposits		Bank Liquid Assets	
Year	Mean	Sd.	Mean	Sd.	Mean	Sd.
2000	14.73	16.16	31.41	35.55	26.02	26.56
2001	14.93	16.61	25.43	28.12	20.84	20.08
2002	14.86	14.81	26.64	28.93	21.74	23.50
2003	16.08	16.97	29.37	34.46	24.70	26.34
2004	16.29	17.30	27.48	30.03	25.70	26.32
2005	17.26	18.10	28.73	31.86	27.29	25.06
2006	17.84	18.27	31.23	34.86	28.67	27.03
2007	19.07	19.00	31.82	33.85	28.49	25.43
2008	20.87	19.80	33.34	34.17	27.01	24.94
2009	22.03	19.51	34.82	33.69	26.41	20.69
2010	22.13	19.78	35.62	35.69	27.08	21.71
2011	22.77	20.11	34.69	32.63	22.90	17.97
2012	23.40	20.97	33.74	28.01	25.85	27.06
2013	24.10	21.61	35.53	31.83	23.34	16.45
2014	24.55	20.35	37.46	34.77	26.03	20.50
Total	19.40	18.62	31.82	32.56	25.47	23.31
N	465		465		465	

Table 9: Summary Statistics of Bank Credit for Regional Groupings in SSA

	SADC		ECOWAS		CEMAC		EAC		Others	
Year	Mean	Sd.	Mean	Sd.	Mean	Sd.	Mean	Sd.	Mean	Sd.
2000	23.85	21.20	8.67	5.43	5.59	2.29	11.79	12.00	12.96	14.84
2001	23.97	23.34	9.48	6.31	6.71	3.42	12.20	11.18	12.06	12.26
2002	22.87	19.91	9.35	5.05	6.43	3.61	13.14	10.91	13.40	12.66
2003	25.04	23.96	10.15	4.96	6.46	3.38	13.57	9.90	14.73	12.64
2004	25.55	24.28	9.46	4.62	5.75	3.19	14.43	11.01	15.49	12.33
2005	27.23	25.15	10.35	5.32	5.40	3.46	14.22	10.31	17.02	12.86
2006	27.58	25.21	9.74	4.37	5.52	3.56	14.03	7.58	19.35	13.84
2007	29.14	26.29	13.79	8.38	5.78	3.53	14.77	7.09	19.52	14.17
2008	31.46	26.71	17.23	11.82	6.32	3.13	16.99	7.24	20.46	15.55
2009	31.95	25.46	19.15	13.21	7.80	2.99	15.89	7.83	22.92	17.29
2010	33.21	25.16	13.24	3.66	8.28	2.80	17.38	8.48	23.70	19.49
2011	33.72	25.31	12.62	3.61	9.32	3.06	19.41	9.64	24.32	20.79
2012	35.60	26.91	12.01	4.17	9.98	3.12	18.65	9.38	24.28	19.86
2013	36.82	28.27	12.05	5.09	12.10	3.56	19.33	10.75	23.32	19.77
2014	36.98	25.89	11.21	4.37	13.24	2.81	20.80	11.74	23.95	18.83
Total	29.66	24.87	11.90	6.02	7.64	3.19	15.77	9.67	19.17	15.81
N	165		60		90		45		105	

Table 10: Summary Statistics of Bank Deposits for Regional Groupings in SSA

	SADC		ECOWAS		CEMAC		EAC		Others	
Year	Mean	Sd.	Mean	Sd.	Mean	Sd.	Mean	Sd.	Mean	Sd.
2000	42.58	45.53	23.44	11.89	10.01	4.05	22.86	8.90	40.40	43.53
2001	34.99	26.79	16.70	6.60	6.43	3.49	19.70	9.86	34.16	44.82
2002	35.41	28.12	17.48	6.96	7.66	3.55	21.76	9.87	36.44	46.02
2003	42.60	42.41	17.68	7.56	7.85	3.60	22.56	10.32	36.64	43.65
2004	39.11	35.35	17.24	7.08	7.45	3.90	21.82	11.21	34.67	39.40
2005	40.27	39.14	18.54	7.79	7.56	4.22	22.28	10.58	37.32	39.65
2006	45.41	45.00	18.83	8.84	8.40	4.16	21.20	8.46	39.90	38.66
2007	45.14	43.88	22.25	9.08	9.13	3.88	22.25	8.40	39.90	37.68
2008	46.34	43.34	26.42	11.20	9.25	4.09	23.11	8.11	41.91	39.36
2009	48.80	45.34	28.77	11.16	11.70	4.61	22.70	9.23	41.34	33.17
2010	51.59	48.76	24.69	11.58	12.48	4.75	25.12	9.61	41.13	33.40
2011	49.25	44.22	26.25	13.37	13.36	5.48	25.09	10.32	39.05	30.87
2012	46.09	35.61	25.48	12.58	14.85	6.31	24.50	11.05	39.19	29.94
2013	49.42	42.03	25.43	13.99	16.58	6.23	24.46	11.33	40.48	32.81
2014	50.79	44.93	27.29	14.23	17.04	6.50	25.62	11.89	44.90	39.37
Total	44.52	40.70	22.43	10.26	10.65	4.59	23.00	9.94	39.16	38.15
N	165		60		90		45		105	

Appendix 2: Estimated Models after dropping South Africa and Kenya

Table 11: Analysis of SADC after dropping South Africa

	Bank Deposits	Bank Credit	Bank Liquidity
Bank Deposits $_{-1}$	1.001***		
	(0.008)		
Bank Credit $_{-1}$		1.009***	
		(0.012)	
Liquid Assets $_{-1}$			0.835***
			(0.048)
Real Interest $_{-1}$	0.044	-0.116***	-0.152**
	(0.077)	(0.034)	(0.076)
Capitalization $_{-1}$	0.078	0.041	-0.060
	(0.150)	(0.075)	(0.248)
Cap*Real Int. $_{-1}$	-0.002	-0.008***	-0.034
	(0.025)	(0.003)	(0.025)
Forex $_{-1}$	-0.003	0.017	0.140
	(0.061)	(0.022)	(0.136)
GDP $_{-1}$	-0.103	-0.001	-0.347
	(0.190)	(0.058)	(0.283)
Inflation $_{-1}$	-0.092	-0.059	0.148*
	(0.079)	(0.064)	(0.086)
Ward Test	5.30e+08	425.93	38680282.86
P-value	0.00	0.00	0.00
Hansen	0.00	0.00	0.00
P-values	1.00	1.00	1.00
Arellano Bond Test	-0.76	-0.35	-0.51
P-values	0.44	0.73	0.61
N	140	140	140

Notes: Robust VCE standard errors are reported in parentheses. ***, **, and * indicate statistical significance at 1, 5, and 10 percent levels respectively.

Table 12: Analysis of EAC after dropping Kenya

	Bank Deposits	Bank Credit	Bank Liquidity
Bank Deposits $_{-1}$	0.685***		
	(0.006)		
Bank Credit $_{-1}$		0.490***	
		(0.039)	
Liquid Assets $_{-1}$			0.626***
			(0.111)
Real Interest $_{-1}$	-0.154***	-0.046***	0.121
	(0.005)	(0.014)	(0.111)
Capitalization $_{-1}$	-1.036***	0.261***	0.765***
	(0.078)	(0.014)	(0.078)
Cap*Real Int. $_{-1}$	-0.046***	-0.054***	-0.126**
	(0.004)	(0.009)	(0.060)
Forex $_{-1}$	0.143***	0.300***	0.154**
	(0.004)	(0.010)	(0.078)
GDP $_{-1}$	-0.425***	-0.388***	-1.090***
	(0.006)	(0.018)	(0.027)
Inflation $_{-1}$	-0.037***	0.071***	0.730***
	(0.011)	(0.012)	(0.124)
Ward Test	2.62	11.50	0.04
P-value	0.11	0.00	0.84
Hansen	0.00	0.00	0.00
P-values	1.00	1.00	1.00
Arellano Bond Test	-1.41	-1.41	-1.41
P-values	0.16	0.16	0.16
N	28	28	28

Notes: Robust VCE standard errors are reported in parentheses. ***, **, and * indicate statistical significance at 1, 5, and 10 percent levels respectively.

Appendix 3: List of Countries Included in the Sample

SADC (Southern African Development Community)

1. Botswana
2. Comoros
3. Lesotho
4. Malawi
5. Mauritius
6. Mozambique
7. Namibia
8. Seychelles
9. South Africa
10. Swaziland
11. Zambia

ECOWAS (Economic Community of West African States)

1. The Gambia
2. Ghana
3. Nigeria
4. Sierra Leone

CEMAC (Economic and Monetary Community of Central Africa)

1. Cameroon

2. Central African Republic

3. Chad

4. Republic of the Congo

5. Equatorial Guinea

6. Gabon

EAC (East African Community)

1. Kenya

2. Tanzania

3. Uganda

OTHERS (Other Countries in sub-Saharan Africa)

1. Angola

2. Burundi

3. Cabo Verde

4. The Democratic Republic of Congo

5. Eritrea

6. São Tomé and Príncipe

7. Sudan