ADJUSTMENT OF COMMERCIAL BANKS' INTEREST RATES AND THE EFFECTIVENESS OF MONETARY POLICY: EVIDENCE FROM ANGLOPHONE WEST AFRICA

LAMIN BANGURA

Student No: 609B0079

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF COMMERCE (FINANCIAL MARKETS)

DEPARTMENT OF ECONOMICS AND ECONOMIC HISTORY

RHODES UNIVERSITY, GRAHAMSTOWN

SUPERVISOR: PROFESSOR MESHACH J. AZIAKPONO

2011

ABSTRACT

Most central banks use short-term interest rates as their main instrument of monetary policy. It is assumed that a change in policy rate will influence interest rates set by commercial banks, but this is not usually the case. Commercial banks adjust their interest rates in response to changes in policy rate with lags, which make their interest rates sticky. Stickiness in commercial banks interest rates have been seen as an obstacle to the smooth transmission of monetary policy decisions. Despite the importance of the transmission process, little attention has been given to a systematic measurement of the degree of response of commercial banks' interest rates to changes in monetary policy stance in the Anglophone West African countries, specifically within the West African Monetary Zone (WAMZ) economies. Against this backdrop, this study explores the interest rate adjustment dynamics using monthly interest rate series on discount rate, treasury bill rate, commercial banks' deposit and lending rates from 1989 to 2009 (for Gambia, Nigeria and Sierra Leone) and from 2000 to 2009 (for Ghana). Specifically, the study set out to examine how lending and deposit rates respond to changes in the official rates and to see whether there is a convergence among the rates over time. Also, to examine the relative adjustment of commercial bank lending rates to changes in the official rate when there is disequilibrium. The analyses were twofold: a full sample period and a rolling window analysis. Following Cottarelli and Kourelis (1994), the study employed cointegration technique and an asymmetric error correction model to obtain the short-run and long-run parameters from which the error correction coefficients, mean adjustment lags and asymmetric mean adjustment lags were estimated.

The results for the entire sample period revealed that the long-run pass-through in Nigeria was 81% and 67% for lending rates and deposit rates respectively. In Ghana, it was 66% and 69% for lending and deposit rates respectively. While in Sierra Leone, long-run pass-through was 62% and 72% for lending and deposit rates respectively. In Gambia, it was 50% and 40% for lending and deposit rates respectively. On the other hand, the short-run pass-through was found to be lower compared to the long-run pass-through: in Nigeria it was 66% and 47%; in Gambia, 26% and 29%; in Sierra Leone, 30% and 13%; and in Ghana, -6% and 35% for lending and deposit rates respectively in each country. The pass-through estimates for the rolling windows were mixed for short-run and long-run pass-through.

The mean adjustment lags suggest that the speed of adjustment of Lending rates for full sample period were two, two, seven and twelve months in Nigeria, Ghana, Sierra Leone and Gambia respectively. While for deposit rates they were five, six, seven and eighteen for Ghana, Nigeria, Gambia and Sierra Leone respectively. The average speeds of adjustment for the rolling windows were four and five months for lending and deposit rates respectively. Weak evidence of convergence was found in lending and deposit rates in the short-run and long-run pass-through among the countries.

However, the results suggest that the magnitude and speed of the pass-through amongst the countries on average were high compared to emerging Asian countries. Significant asymmetric adjustments were found in the lending rates for Gambia and Sierra Leone, while in Gambia and Nigeria there were asymmetries in deposit rates. Based on the evidence provided, interest rate pass-through is high in Nigeria and Ghana compared to Gambia and Sierra Leone and this calls for the harmonization of financial policies on the part of the financial authorities in the WAMZ. Viewed solely from an interest rate pass-through, the lack of convergence among the countries suggests that WAMZ is far from ready for a monetary union. The relatively low pass-through in some of the countries suggests rigidity in the banking system which may be due to underdevelopment of the system. Thus efforts geared toward strengthening the banking system and the financial system as whole would further enhance the prospect of a monetary union among them.

DECLARATION

Except for the references, which are specifically indicated and acknowledged, this thesis is wholly my own work and has not been submitted to any other University or College for degree purposes.

ACKNOWLEDGEMENTS

I am indebted to the almighty God for his grace and provision, and to my parents and family members for their support while doing this work. My sincere gratitude to Professor Meshach Jesse Aziakpono for his guidance, valuable comments, support, understanding, and for seeing me through this academic hurdle. I would also like to extend my appreciation to Alhaji Alusine Kamara and Mr. Albert Leigh for their financial support. My gratitude to Mrs. Remie V. Juana for her invaluable support and encouragement. I am very grateful to all the staff in the Economics Department at Rhodes University and my classmates. Thanks to my close friends Solomon, Brian and Gideon for a wonderful time in Grahamstown. Furthermore, I would like to express my deepest appreciation to Mr. and Mrs. Sylvester Meheux, Dr. Abdul B. Kamara, Dr. James Juana, Dr. Victor Bagla, Dr. Robert D. Korsu and my colleagues at Guaranty Trust Bank (SL) Limited for the support and encouragement they gave me through my studies. This thesis is dedicated to my mother and late father Regimental Sergeant Major (RSM) Bangura T.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE:
INTRODUCTION

1.1 CONTEXT OF THE RESEARCH

The banking sector of the financial system in an economy plays an important role in transmitting the monetary policy stance of the central bank. A well-functioning banking sector will contribute to economic growth, welfare and smooth business cycles. Banks act as conduit through which monetary impulses from the central bank are transmitted to the rest of the economy. By implication, the activities of banks and their position as intermediaries make them relevant in the transmission process of monetary policy impulses of the central bank to the rest of the economy (Fuentes and Ahumada, 2003: 1). A key aspect of the monetary policy transmission process is the speed at which changes in policy interest rate is reflected in commercial banks' deposit and lending interest rates. The effectiveness of the central bank's monetary policy depends largely on how commercial banks adjust their range of lending and deposit interest rates to changes in the central bank's policy interest rate[1]. The magnitude and speed of these adjustments in lending and deposit rates determines whether these tools of monetary policy are effective or not.

The relevance of the banking sector in the transmission of the central bank's monetary policy stance can be seen via two important channels: the traditional interest rate channel and the credit channel. According to Fuentes and Ahumada, (2003: 1), monetary policy is effective through the interest rate channel when the central bank's adjustments to short-term interest rate have an impact on the real interest rates charged by commercial banks to their customers and, ultimately, on investment and consumption in the economy. The interest rate channel becomes effective if commercial banks quickly transmit the changes in the monetary policy interest rate to their customers, otherwise, ineffective or interest rates are sticky. The effectiveness of the central bank's monetary policy is crucial for the stabilization of inflation and influencing of other economic activities in the economy, and this largely depends on how commercial banks' interest rates respond to shocks from the central bank's monetary policy rate. It is worth noting that if monetary policy is to be effective, changes in the monetary policy rate should be transmitted to other interest rates quickly, and the magnitude of the change should be large enough to influence investment, consumption and aggregate demand

[1] Note that the terms policy, official and policy-controlled rates are used interchangeably in this study.

in the economy (Aziakpono and Wilson, 2010: 3).

A critical and most important issue in the monetary policy transmission mechanism is the 'pass-through', which is defined as the degree and speed of adjustment with which a change in the monetary policy interest rate is passed on to commercial banks retail interest rates in the economy (Aydin, 2007: 1). If the interest rate pass-through (hereinafter IRPT) is equal to one, it implies that the interest rate channel is effective and the IRPT is complete. On the other hand, if the IRPT is less than one, it implies that the interest rate channel is ineffective and the IRPT is incomplete or sluggish. A high IRPT would suggest a developed, competitive and efficient financial system while a low IRPT suggest the opposite. Also, IRPT can either be long-term or short-term pass-through. In most cases, long-term and short-term IRPT in most advanced economies[2] are often found to be complete. The stickiness of retail interest rates with respect to changes in policy interest rate has been seen as a serious impediment to the smooth transmission of monetary policy impulses to the rest of the economy. Therefore, it is important for central bankers and policymakers to have a comprehensive understanding of the nature of IRPT since it can have important implications not only for monetary policy, but to keep track of the level of competition and soundness of the financial system (Aydin, 2007: 1; Aziakpono and Wilson, 2010: 3).

Several explanations have been proposed in the literature concerning the variations in the magnitude and speed of IRPT across countries and over time. Among these are: the structure of the financial system (Cottarelli and Kourelis, 1994); monetary policy regime whether market-oriented or controlled (Gidlow, 1998; Egert *et al.,* 2007) and the transparency of monetary policy (Kaketsis and Sarantis, 2006; Kleimeier and Sander, 2006; Gambacorta, 2008; Liu *et al.,* 2008); the degree of competition amongst financial intermediaries (Cottarelli and Kourelis, 1994); the stages of financial market development, concentration within the banking sector, and the degree financial market openness (Cottarelli and Kourelis, 1994; Borio and Fritz, 1995; Mojon, 2000; Weth, 2002); asymmetric information (Stiglitz and Weiss, 1981); menu cost (Rotemberg and Saloner, 1987; Hannan and Berger, 1991; Hofman and Mizen, 2004); switching cost (Fried and Howitt, 1980; Ausubel, 1991; Cottarelli, Ferri and Generale,1995; Angeloni *et al.,* 1995; Berlin and Mester, 1997); adverse selection (Lowe and Rohling, 1992); risk sharing (Fried and Howitt, 1980; Lowe and Rohling, 1992); consumer irrationality (Fried and Howitt, 1980; Lowe and Rohling, 1992); implicit contract

[2] Cottarelli and Kourelis (1994) conducted a comprehensive study for 31 countries and provided evidence, though mixed, of complete long-term and incomplete short-term pass-through.

between banks and their customers as a result of a long standing relationship (Berger and Udell, 1992; Allen and Gale, 2004); and economic policy and regulation of the economy (Wang and Lee, 2009).

Policymakers and economists have long realized the importance of the interest rate channel in transmitting the monetary policy stance of the central bank to the rest of the economy. De Bondt (2002: 6) noted that commercial banks' interest rates[3] play a crucial role in the transmission of the central bank's monetary policy stance, especially the speed and the extent to which commercial banks adjust their interest rates to changes in official rates. A quicker and fuller IRPT of monetary policy interest rates to retail interest rates strengthens monetary policy transmission process. Economists such as Cottarelli and Kourelis (1994), Mojon (2000) and de Bondt (2005) have proposed arguments that retail interest rates are characterized by lower variance than policy controlled interest rates. In this line of thought, Bernanke and Gertler (1995) argued that banks are no neutral conveyors of monetary policy. Therefore, banks typically may not fully adjust their interest rates when policy interest rate changes. However, it is clear that commercial banks may react quickly or slowly to changes in policy interest rate. The preceding arguments are further strengthened by Aziakopono, Wilson and Manuel (2007: 2) who assert that if "the response of the retail interest rates is too small to be noticed or delayed or sluggish, monetary policy may not achieve its desired goal, irrespective of the size or magnitude of the change in the official rate".

The monetary policy transmission process has been the subject of theoretical and empirical research in industrial economies. Consequent on the findings of a comprehensive study by the Bank for International Settlement (BIS) in 1994, the debate on the issue of interest rate stickiness has sharpened, not only in developed economies but also in emerging and developing economies. A major challenge faced by policymakers and economists in developing countries is that the monetary policy transmission processes in the context of developing economies are not well-understood and are still uncertain. Several attempts have been made to unravel the monetary policy transmission process in developing countries but these studies focused on Asia and Latin America economies (Acheampong, 2005). As far as Sub-Saharan Africa is concerned, empirical studies examining the extent to which commercial banks' interest rates respond to changes in official rates remain few. The few known attempts that have been made in Africa include the works of Jankee (2004) -

[3] Note that commercial bank interest rates and retail interest rates are used interchangeably in this study.

Mauritius; Acheampong (2005) - Ghana; Aziakpono (2006) - SACU[4] countries; Aziakpono, Kleimeier and Sander (2007) - SADC[5] countries; Aziakpono, Wilson and Manuel (2007) - South Africa; Aziakpono and Wilson (2010) - South Africa; and Samba and Yan (2010) - CAEMC[6]).

Consistent with the findings of Hannan and Berger (1991) and Neumark and Sharpe (1992), Jankee (2004) and Acheampong (2005) find asymmetries in deposit and lending rates adjustments in Mauritius and Ghana respectively. On the other hand, Aziakpono, Wilson and Manuel (2007); Aziakpono and Wilson (2010) and Samba and Yan (2010) find high speed of adjustment of retail interest rates to changes in the official rate in South Africa and the CAEMC region respectively. It is clear that the speed and magnitude of interest rate adjustment in the context of emerging and developing African countries is unclear and requires further investigation. Also, it is evident that the available studies concentrated on Southern African economies and much is not known about the developing West African economies. To this end the study aims to unveil the dynamics of retail interest rate adjustments (interest rate pass-through) in four of the five Anglophone West African economies[7] which make up the second West African Monetary Zone (hereinafter WAMZ).

1.2 OBJECTIVES OF THE RESEARCH

The main goal of the study is to analyse the dynamic adjustment of commercial banks' interest rates in response to changes in policy-controlled interest rate amongst four of the five Anglophone West African countries[8]. To achieve this, the following specific objectives are pursued:

- To provide an overview of the financial systems and monetary policy frameworks and their implications for the monetary policy transmission mechanism in the WAMZ economies;
- To examine how lending and deposit rates adjust to changes in the central bank's policy controlled interest rate and to see whether there is convergence in the pass-

[4] SACU stands for Southern African Customs Union.
[5] SADC stands for Southern African Development Community.
[6] CAEMC stands for Central African Economic and Monetary Community.
[7] The countries are Gambia, Ghana, Nigeria and Sierra Leone.
[8] The Republic of Liberia was not included due the unavailability of data and collapsed of the financial system as result of prolong civil war which starts in the late 1980's.

through from policy-controlled interest rate to retail interest rates among the countries under investigation;

- To examine the relative adjustment of commercial banks' interest rates to changes in official rates when they are either above or below their equilibrium levels; and
- To recommend policies for monetary integration among member countries.

1.3 MOTIVATION FOR THE STUDY

West African economies have a history of economic grouping which dates back as far as 1975 with the formation of the Economic Community of West African States (ECOWAS). Subsequent to this, the first West African Monetary Zone[9] was established by the Francophone countries, with the exception of Guinea in 1994. In April 2000, the heads of states of Gambia, Ghana, Guinea, Nigeria, and Sierra Leone signed a declaration for the establishment of the second West African Monetary Zone with the aim of launching a single currency (ECO) in 2009, later postponed to 2015. Against this backdrop, the study focuses on WAMZ economies for a number of reasons: First, these countries have undergone series of World Bank sponsored financial liberalization programmes since the late 1980s and early 1990s, and the outcomes of these liberalizations are perceived to be mixed. Second, the financial systems are dominated by rapidly growing banking sectors and sundry of non-bank financial institutions. Finally, the banking sectors have been in a state of almost continuous evolution since the late 1980s while the non-bank financial markets are growing. Even though previous PT studies[10] have provided sufficient evidence that the financial structures of the economy are very crucial for the speed and magnitude of IRPT and the effectiveness of monetary policy in the economy, much is not known as far as the WAMZ economies are concerned.

Researchers[11] have argued that the interest rate channel of monetary policy transmission is ineffective in countries where the financial system is underdeveloped and dominated by commercial banks. This may lead one to ask: Is this argument true for the WAMZ economies in which the financial systems are underdeveloped and dominated by the banking sector?

[9] The first West African Monetary Zone was established in 1994 and it is called West African Economic and Monetary Union (WAEMU) and its members include: Benin, Burkina Faso, Ivory Coast, Guinea-Bissau, Mali, Niger, Senegal and Togo.
[10] Studies such as Cottarelli and Kourelis (1994); Sander and Kleimeier (2004)
[11] See Montiel (1991);

Anecdotal evidence[12] shows that the interest rate channel of monetary policy transmission may be relevant for developing countries such as those of the WAMZ but this is insufficient in explaining interest rate rigidities. Therefore, a comprehensive analysis is required to unveil the dynamics of IRPT in the WAMZ. Moreover, Mishkin (1996: 1) asserts that monetary policy affects the economy or macroeconomic variables through monetary transmission channels. For the monetary authorities to achieve the intended outcome of monetary policy strategy, they need to understand the relationship between operating instruments of monetary policy and their ultimate goals (for example, economic growth, price stability, interest rate stability, stability in financial markets and employment). Mishkin further suggests that the monetary authorities must have an accurate assessment of the timing and effects of their policies on the economy, thus requiring an understanding of the mechanism through which monetary policy affects the economy.

There are a number of reasons that could lead one to believe that this study contributes to the existing literature. First, no study has been done on the dynamic adjustment of retail interest rates to changes in policy interest rates within the WAMZ. This is the first attempt made to unveil the dynamic adjustment and importance of IRPT for the WAMZ economies. Second, the use of more than one cointegration test to check for the existence of a stable equilibrium relationship among the interest rates series in the empirical analysis will help identify the short-run and long-run stickiness/rigidities and also the symmetric or asymmetric behaviour among the variables. An analysis of the PT process and its convergence over time among the WAMZ economies is therefore highly relevant at this time when the region is considering the launch of a single currency by 2015.

1.4 THE METHOD OF THE STUDY

The research objectives will be addressed using empirical analysis of monthly monetary policy rate (i.e., Discount or Treasury bill rates), commercial banks deposit and lending rates data from 1989 to 2009 (for Gambia, Nigeria and Sierra Leone) and from 2000 to 2009 for Ghana. The data for the various countries are sourced from the International Monetary Fund (IMF) International Financial Statistics (IFS) with the exception of lending rate for Ghana, which was sourced from the download facility of the Central Bank of Ghana (BOG).

To examine the dynamics of retail interest adjustment to a given change in the official rates in each of the four countries under investigation, the study will employ cointegration techniques

[12] See International Monetary Fund Country Report (2009)

and an asymmetric error correction model used by Cottarelli and Kourelis (1994) which have been followed by a number of authors, such as Toolsema *et al.* (2002); de Bondt (2002, 2005); Sander and Kleimeir (2004); Kwapil and Schaler (2010) and Aziakpono and Wilson (2010), to study pass-through within and amongst countries. According to Aziakpono, Wilson and Manuel (2007: 8) "the benefit of this method derives from the fact that it can be used to test for differences in adjustment in interest rates when they are above or below their equilibrium levels. In addition, it can be used to determine how long it takes for retail interest rates to adjust to changes in the official interest rate". An important point to note about the study is that four cointegration techniques are used to identify long-run relationship among the interest rates series.

A detailed analysis of the relationship between policy rate and retail interest rates will be conducted using the rolling regression technique in an error correction framework. The point of the rolling regression technique is to measure the dynamic adjustment of interest rates over time. These results should provide long run and speed of adjustment parameters, which will indicate whether the monetary policy transmission has been stable over time in each of the countries under consideration. A comparison will then be made between the various parameters across the countries in the sample. This would help in identifying whether convergence has occurred or not.

1.5 ORGANISATION OF THE STUDY

The structure of the study takes the following form. Chapter two will review the theoretical and empirical literature on interest rates stickiness and IRPT in developed, emerging and developing countries. Chapter three will present an overview of the various countries' financial systems and monetary policies frameworks. Also, an analysis will be done on the recent trends and development of the financial markets to identify factors that may be crucial for IRPT in each country. The fourth chapter describes the methodology and empirical framework used to unveil the dynamic adjustment of commercial banks' interest rate in response a change in policy interest rate within the WAMZ. The variables, their sources and econometrics techniques will also be described. In what follows, chapter five presents and discusses the results of the analysis for the entire sample period and the rolling windows. Finally, chapter six provides the summary of the findings and discusses the policy implications. These include the limitations, recommendations and possible areas for future research work.

CHAPTER TWO:
THEORETICAL ISSUES AND LITERATURE REVIEW

2.1 INTRODUCTION

The chapter examines the theoretical issues and empirical literature regarding the relationship between the central bank's official interest rate and the retail interest rates in developed, emerging market and developing economies. Some of the key issues discussed include the monetary policy transmission mechanism and its implication for monetary policy in Section 2.2, followed by a description of monetary policy transmission process in context of developing countries and the interest rate channel of the monetary policy transmission mechanism. In Section 2.3, interest rate pass-through is described and the theories or determinants of interest rate pass-through are also discussed. The empirical review in Section 2.4 looks at the current state of discussions on the interest rate pass-through literature with reference to developed, emerging/transition and developing economies. Section 2.5 summarizes and concludes the chapter.

2.2 MONETARY POLICY TRANSMISSION MECHANISM AND ITS IMPLICATIONS FOR MONETARY POLICY

Most monetary policy decision starts with the monetary authorities adjusting the official interest rate. Official interest rate (price of funds) changes for a number of reasons, and one key reason for such changes might be to stabilize the economy when there is a shock. Short-term official interest rates, which in some countries are set by the central bank and in others by the ministry of finance, are the main instrument of monetary policy. It is worth noting that central banks have the capacity to influence money market conditions by an upward or downward adjustment in the policy interest rate and this sets in motion other outcomes. Therefore, *ceteris paribus*, it is expected that other interest rates, like the interbank market rate and ultimately retail interest rates, follow suit and finally influence investment and consumption decisions in the economy. The process through which monetary policy is transmitted and ultimately affects inflation and aggregate output is called the monetary policy transmission mechanisms (MPTM). According to Samba and Yan (2010: 31) "monetary transmission mechanism describes the ways in which monetary policy impacts aggregate demand and prices by influencing the investment and consumption decisions of firms, households, and financial intermediaries".

The monetary policy decisions of the central bank do not operate in isolation, they steer economic activities in the economy through monetary transmission channels (such as interest rate, bank lending, balance sheet, asset prices, exchange rate, and expectation channels). It is worth noting that, the effectiveness of any of these channels depends on the magnitude and speed at which these channels transmit monetary impulses and also depends on factors such as the economic regulation, legal, and financial structure of the economy. Thus, the success of a monetary policy strategy largely depends on a comprehensive understanding of how these channels work and the relationship between operating instruments of monetary policy and the ultimate goals[13] (Buigut, 2009: 2). Therefore, Mishkin (1996: 1) suggests that it is imperative for the monetary authorities to have an accurate assessment of the timing and effects of their policies on the economy. Thus, this requires a comprehensive understanding of the mechanisms through which monetary policy affects the economy.

Researchers[14] have argued that the monetary policy transmission process is complex and involves a number of stages. Faure (2006: 9) summarized the process into six stages: First, a change in the central bank's lending rate is transmitted to the private bank-to-bank interbank market. Second, the private bank-to-bank interbank market transmits the change to other market interest rates. Third, changes in market interest rates are transmitted to asset prices, exchange rates and expectations. Fourth, these changes in asset prices, exchange rate and expectations are then transmitted to aggregate demand. Fifth, changes in aggregate demand are transmitted to money supply. Sixth, changes in money supply are finally transmitted to prices. It should be noted that the scope of this study is limited to the first and second stages of the transmission process which is relevant for the traditional interest rate channel. Further analysis on the transmission process is provided in Section 2.2.2 of this chapter.

Economic theory suggests that monetary policy actions (changes in interest rates or money supply) should influence economic activities in the short or medium term. For instance, when the central bank changes its monetary policy stance (policy rate), it is expected that other variable interest rates (for example retail interest rates) should respond immediately to such changes for the policy instrument to be effective. However, this is not usually the case; retail interest rates do not necessarily change at once, nor one-to-one with official rates. The central question that might emerge is, Why is it that retail interest rate neither responds immediately nor one-to-one when policy interest rate changes? Although this question is answered in

[13] Some of the ultimate goals of monetary policy are output, growth, employment and price stability.
[14] Bernanke and Gertler (1995); Mishkin (1996); and Faure (2006).

detail in Section 2.3.1 of this chapter, Mahadeva and Sinclair (2005: 18) provide some insight thereto by asserting that the transmission mechanism of monetary policy depends upon how spending decisions of firms and households respond to the interest rates they face. Additionally, they state that unless there is strong competition, commercial banks are not interest rate takers in the deposit and loan markets, therefore, retail rates on loans and deposits are set by them. They suggest that changes in official interest rates are influenced by several factors such as: current levels or forecasts of inflation; current levels or forecasts of the output gap[15]; market's expectations of future policy rates; and official interest rate changes abroad[16]. However, Bernanke and Gertler (1995: 27) suggest that the mechanism through which monetary policy actions are transmitted to the real economy is something of a 'black box', and attempts to understand this mechanism have given rise to a large body of both theoretical and empirical literature.

Empirical studies have shown that the transmission mechanisms of monetary policy are not only important for the conduct of monetary policy in developed countries but also in emerging and developing economies (Scholnick, 1996; Ramlogan, 2004; Baugnet *et al.*, 2007; and Samba and Yan, 2010). Highlighting the importance of the transmission mechanism and its implication in transitional and developing economies, Ramlogan (2004: 435-436) suggests that in countries where financial markets are at early stages of development, the channels of transmission are important for the following reasons:

- During the early stages of development of financial markets, the link between the financial and real sectors of the economy is likely to change hence it is important to determine which of the financial aggregates monetary policy impacts upon.
- Furthermore, an understanding of the transmission mechanism assists policymakers in deciding which market disturbances warrant changes in monetary policy and which do not.
- Finally, knowledge of the transmission mechanism may help promote higher investment and a faster pace of economic growth if it leads to a better choice of target variables.

Therefore, the impact of monetary policy on the real economy depends on how changes in policy rates are transmitted to retail interest rates (Toolsema *et al.*, 2002: 2). It may be that a

[15] Output gap refers to the difference between the economy's level of real income, and its estimated potential.
[16] The factors that influence the transmission mechanism or IRPT are discussed in section 2.3.1 of this chapter.

small change in the monetary policy stance in the form of a change in short-term interest rates could translate to large changes in output. This mechanism is referred to as the accelerator or amplification effect of monetary policy (Bernanke and Gertler, 1995; Hubbard, 1994). It is therefore important for the monetary authorities to better understand how monetary policy transmission mechanism works. Against this backdrop, the next section explores the interest rate channel of monetary policy in developing economies.

2.2.1 Monetary Policy Transmission Mechanisms in Developing Countries

The monetary transmission mechanisms in the context of developing countries have been the focus of recent debates in monetary policy literature. To invigorate the discussion on monetary policy transmission process in the context of a developing country, the description of developing economies by Montiel (1991: 84) is restated thus, developing countries are characterized by: underdeveloped financial markets with a limited portfolio of financial assets available to the private sector; lack of organized securities markets; underdeveloped money markets in which the central bank conducts open market operations; interest rates that are controlled and fixed by applicable legal norms; and equity markets that are small or nonexistent. An obvious question to ask is: Does this assertion by Montiel (1991) still hold for developing economies, taking into consideration the level of globalization, economic growth, the series of World Bank supported financial liberalization programmes in the late 1980s and early 1990s, and fast changing financial systems? Insights to the above question in terms of the WAMZ economies are reserved for chapter three of this study.

However, Ghatak and Sanchez-Fung (2007: 127) provide some insights on how the transmission mechanism of monetary policy in developing countries should be analysed. They stress that transmission mechanism of monetary policy in developing countries has been based on measuring the impact of financial liberalization on credit availability. Early studies on monetary policy transmission have viewed transmission mechanism in developing countries from two perspectives: The McKinnon (1973) and Shaw (1973) view; and the Structuralist view[17] (Montiel, 1991: 85; Ghatak and Sanchez-Fung, 2007: 127). The McKinnon–Shaw approach assumes that liberalization of interest rates is crucial since it facilitates the movement of idle resources to more productive use. This approach argues that an increase in interest rates as a result of financial liberalization will increase output and decrease inflation in the short-run, which in turn, boosts savings, causing an increase in bank

[17] See Taylor (1982) and Wijnbergen (1982, 1983).

loans to firms, thereby increasing investment and leading to an increase in real output. In contrast to this view, the structuralist approach places more emphasis on the effects of financial liberalization in the unorganized money market. The main point of argument in the latter approach is that financial liberalization policies may lead to an increase in the marginal cost of funds in the unorganized money market. Additionally, the structuralists argue that a monetary policy tightening will increase interest rates leading to a drop in the available funds in the unorganized money market (or informal loan markets), causing an increase in the marginal cost of funds, thereby lowering investment and decreasing real output (Ghatak and Sanchez-Fung, 2007: 128). The schematics below show the transmission mechanism of the McKinnon–Shaw and structuralist views as follows:

McKinnon–Shaw view:

$$FL \Rightarrow i \uparrow \Rightarrow s \uparrow \Rightarrow BL \uparrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$$

Where FL indicates financial liberalization leading to an increase in interest rates ($i\uparrow$), which in turn increase financial savings ($s\uparrow$), causing an increase in bank loans ($BL\uparrow$), thereby increasing investments ($I\uparrow$) and real output ($Y\uparrow$).

Structuralist view:

$$FL \Rightarrow i \uparrow \Rightarrow ILM \downarrow \Rightarrow MCF \uparrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

Where FL indicates financial liberalization increase interest rates ($i\uparrow$), leading to a fall in the informal loan market (or unorganized money market) ($ILM\downarrow$), causing rise in the marginal cost of funds ($MCF\uparrow$), thereby decreasing investments ($I\downarrow$) and reducing real output ($Y\downarrow$).

It is worth noting from the above classification that in the McKinnon–Shaw approach, the main channel of transmission is through the direct effect of the controlled interest rates on savings. While the structuralist approach emphasizes that interest rates should be market-determined (Montiel, 1991: 86).

In another scenario, by developing a model that takes into consideration the dynamics of financially repressed developing economies, Montiel (1991) explored how actions of central banks are transmitted to domestic aggregate demand (or rest of the economy). He modelled households, government and the central bank, and the financial system in a standard Mundell–Fleming framework that incorporates several important features of an

underdeveloped financial system[18]. From his study, he argued that changes in monetary policy affect the central bank's takings and the fiscal consequence of these changes represent a separate channel through which the effects of policy on demand are transmitted (Montiel, 1991: 106). Additionally, he derived a general equilibrium for which he argued that its effects are derived from the consequences of policy changes for the economy's stock of foreign assets, the parallel market premium and expected rate of inflation. Moreover, these variables affect domestic demand and changes in their values that ultimately result to an additional channel through which monetary policy influences aggregate demand.

Ramlogan (2004) using vector autoregression (VAR) analysis shows that the interest rate channel plays a relatively insignificant role in explaining output variability in each of the four Caribbean countries [19], while the credit and the exchange rate channels are more important in transmitting monetary impulses from the financial sector to the real sector. However, Ramlogan argued that, in countries with relatively underdeveloped money market, the money market ceases to be the principal conduit of monetary policy shocks. His findings are in line with Carpenter (1999) who developed an IS-LM model to examine monetary policy transmission mechanism in developing countries and are also consistent with the findings of Montiel (1991).

Alternatively, Sander and Kleimeier (2006) document that the bank lending channel of the Common Monetary Area (CMA) is homogeneous, and the pass-through is often fast and complete, while deposit markets are more heterogeneous by showing differing degrees of interest rate stickiness and asymmetric adjustment in some countries. Additionally, Wijnbergen's (1982) results show that an expansionary monetary policy may often lead to stagflation in South Korea. Other recent researches have also found different results, complicating the understanding of monetary transmission in developing countries. For instance, Samba and Yan (2010) find evidence of complete short-term pass-through for lending rates in the CAEMC area. These studies will be discussed further under the empirical review in Section 2.4. Therefore, it is worth noting that the channels identified to be effective in developed economies, such as those in the Euro area and US may not be relevant for developing countries like those in the WAMZ (Montiel, 1991; Ramlogan, 2004; Buigut,

[18] These features include curb market, bank deposits, domestic currency, foreign currencies, land and physical capital.
[19] The countries include Barbados, Guyana, Trinidad and Tobago, and Jamaica.

2009; and Ghatak and Sanchez-Fung, 2007). The next section examines the interest rate channel of monetary policy transmission mechanism.

2.2.2 The Interest Rate Channel of the Monetary Policy Transmission Mechanism

As noted earlier theoretical and empirical literature on monetary policy transmission has identified several channels (interest rate, bank lending, balance sheet, asset prices, exchange rate, and expectation channels) through which monetary policy stance of the central bank is transmitted to the rest of the economy. While theory offers a wide array of different channels of monetary policy transmission, this study only considers the interest rate channel. The traditional interest rate channel is considered to be the first link in the monetary policy transmission process, and it is the most important channel in the transmission mechanism owing to the fact that it cannot be isolated from the other channels of the monetary policy transmission mechanism (Baugnet *et al.,* 2007: 2; Ozdemir, 2009: 8; Wang and Lee, 2009; Samba and Yan, 2010).

The interest rate channel, otherwise referred to as the traditional interest rate channel, is the core link in the monetary transmission mechanism and has been a key tool in the Keynesian IS-LM framework, which indicates that a change in the monetary policy stance, for instance an expansionary monetary policy, may affect aggregate demand in the economy. This has been a key emphasis of the of the Keynesian monetary transmission mechanism in the IS-LM and AD/AS models. Mishkin (1996: 2) provides a schematic, which shows the effect of an expansionary monetary policy as follows:

$$\textit{Expansionary monetary policy} \Rightarrow i_r \downarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$$

The above schematic implies that an expansionary policy leads to a fall in real interest rates ($i_r\downarrow$), which in turn lowers the cost of capital, causing a rise in investment spending ($I\uparrow$), thereby leading to an increase in aggregate demand and a rise in output ($Y\uparrow$).

Mishkin (1996: 2) noted that a key characteristic of the interest rate transmission mechanism is its emphasis on real interest rate as opposed to nominal interest rates. Additionally, it is not the real short-term interest rate but the real long-term interest rate that has a significant impact on spending. The fact that real interest rates as opposed to other rates affects spending paves the way for another view of how monetary policy can stimulate the economy during deflationary periods (i.e., when nominal interest rate is at zero). Furthermore, Mishkin (1996:3-4) argues that the interest rate transmission can still be effective even when interest

rate is at zero. However, when nominal interest rate is at zero, a commitment to future expansionary monetary policy can raise the expected price level ($P^e\uparrow$) and hence expected inflation ($\pi^e\uparrow$), thereby lowering the real interest rate ($i_r\downarrow$) even when the nominal interest rate is fixed at zero and stimulating spending through the interest rate channel as the schematic below depicts:

$$\textit{Expansionary monetary policy} \Rightarrow P^e\uparrow \Rightarrow \pi^e\uparrow \Rightarrow i_r\downarrow \Rightarrow I\uparrow \Rightarrow Y\uparrow$$

The above mechanism indicates that monetary policy can still be effective when real interest rates have already been driven down to zero by the monetary authorities. It should be noted that the way the interest channel functions in a given economy depends on the financial structure and the macroeconomic environment.

2.3 INTEREST RATE PASS-THROUGH

Interest rate pass-through, which is the extent to which changes in policy controlled interest rates are reflected in short-term and long-term retail interest rates, is measured by the degree and speed of adjustment from policy rate to retail interest rates. According to Ozdemir (2009: 7), interest rate pass-through is defined as "the degree and the speed of adjustment of retail interest rates to money market rates". Therefore, it is worth noting that most central banks use short-term interest rate as the main instrument of monetary policy. As indicated earlier, changes in the short-term interest rates are the first stage in the transmission of monetary policy process.

Empirical literature on interest rate pass-through hold the same view that most of the central banks use short-term money market rates as a major monetary policy tool (Wang and Lee, 2009; Manna *et al.*, 2001). Manna *et al.* (2001) further argue that during the transmission process, the interest rate fluctuation becomes an important indicator to monetary policy. Moreover, de Bondt (2002: 5) provides a useful insight on the PT process by commenting that retail interest rate pass-through process is an important link in the process of monetary policy transmission, and the pass-through process is an important issue to address because a quicker and fuller PT of official and market interest rates to retail bank rates strengthens monetary policy transmission.

Interest rate PT analyses have been extensively used by several researchers, especially in the Euro area[20]. Stemming from the BIS (1994) report and the early work of Cottarelli and Kourelis (1994), pass-through analyses have been widely applied in financial markets. They could be used to examine how fast and how completely changes in monetary policy rates are passed on to bank lending and deposit rates. Furthermore, PT analysis can reveal information about competition in banking markets and asymmetries across countries under a single monetary policy (Sander and Kleimeier, 2006: 2-3).

In Africa, some studies have also applied PT analysis. One such study is Aziakpono (2006) who uses pass-through analyses to measure financial integration among the SACU countries. Sander and Kleimeier (2006) also made use of the PT analyses in the CMA countries of the SACU during the period from 1991 to 2005. Also, Aziakpono, Kleimeier and Sander (2007) investigate banking market integration in the member countries of the SADC using a principal component as well as pass-through analyses. Recently, Samba and Yan (2010) use pass-through analysis to examine the degree of responsiveness of deposit and lending rates to changes in policy rates in the CAEMC area from 1990 to 2007. With regards to the WAMZ economies, there is to date, to the best of our knowledge, no study that has employed the method to investigate retail interest rate transmission among these countries. Therefore, a study of this nature is timely for the proposed launch of the single currency in the WAMZ in 2015.

2.3.1 Theories of Interest Rate Stickiness and Determinants of Interest Rate Pass-Through

Given the importance of interest rate pass-through and its significance in the monetary policy transmission process in an economy, Economists and policymakers alike in last two decades have been challenged by the manner with which retail interest rates adjust to changes in policy interest rates. The sluggish adjustment of retail interest rates to changes in policy controlled interest rate have undermined the conduct of monetary policy in most countries and even in the Euro zone using a common currency. Consequently, an obvious question that monetary authorities faced is: Why is it that retail interest rates neither adjust immediately, nor one-to-one when monetary policy rate changes? Answering this question has posed a major challenge to monetary authorities with regards to the effectiveness of their policies.

[20] Borio and Fritz (1995); Toolsema, *et al*. (2002); de Bondt (2004); and Sander and Kleimeier (2004; 2006).

Attempts to answer the above question have given rise to a myriad of studies seeking to provide convincing explanations for stickiness in retail interest rates adjustment. Although a host of literature has tried to explain the reasons for such stickiness in lending and deposit rates, an early and insightful explanation of interest rates stickiness was provided by Stiglitz and Weiss (1981). They used a credit rationing model to explain stickiness in retail lending rates. On the other hand, Hannan and Berger (1991) and Neumark and Sharpe (1992) found that in the US there are two sources of asymmetries in interest rates which are: collusive pricing arrangements and adverse customer reaction. Another noteworthy contribution from Lowe and Rohling (1992) argues that theories used to explain price stickiness in the goods and labour markets can also be applied in financial markets to explain stickiness in retail interest rates. Consequently, they propose four theoretical explanations which are based on adverse selection or equilibrium risk sharing, switching costs, risk sharing and consumer irrationality. Also, Cottarelli and Kourelis (1994) provide some explanation for the stickiness of interest rates. In their cross country[21] study, they found a number of differences in the speed and magnitude of PT among countries and argue that the financial structure[22] of the economy accounts for the stickiness in retail interest rate PT. Recent empirical literatures have shown that factors such as: the structure of the financial system; degree of competition; bank concentration; asymmetric information; monetary policy regimes; ownership structure of banks; the degree of financial market openness and economic policy and regulation in the economy are all crucial for the PT from policy rate to lending and deposit rates. Note that the explanations here of these factors are brief, as a detailed description will be provided in the next section.

Considering the volume of researches on the monetary policy transmission mechanisms, specifically IRPT, since the implementation of single currency in the wider Euro Zone and the differing explanations advanced for the stickiness of retail interest rates, the natural question that emerges is: What factors are crucial for explaining retail interest rate stickiness in financial markets? In what follows, some factors that account for retail interest rate stickiness (or determinants of IRPT) that are found in financial markets are discussed.

[21] The study involves 31 countries including developing countries.

[22] Financial structure such as the: degree of development of the money and financial markets; degree of competition within the banking system, between banks and other financial intermediaries; the existence of constraint on capital movements; and ownership structure of financial intermediaries.

2.3.1.1 Adverse Selection

It is a common phenomenon in financial markets that one party often does not have enough information about the other party to make accurate decisions. This information vacuum could be referred to in financial markets as information asymmetry. For instance, in banking, a borrower (client) has a better knowledge of his/her potential returns and risk profile of his/her investment project whereas the lender (bank) does not. The lack of information between the two parties poses a potential problem between the parties before and after the transaction. It is possible that potential borrowers who are likely to be high risk are the ones who most actively seek out a loan and are thus most likely to be selected (adverse selection). When confronted with situation like this, lenders, in protecting against extending bad credits, may decide not to extend any loan even though there are good borrowers with good credit risk in the market place (Lowe and Rohling, 1992: 4–6).

Lowe and Rohling (1992: 4) argue that asymmetric information in financial markets introduces adverse selection and moral hazards[23]. An increase in interest rate by a bank will reduce expected returns on the borrowers' investments. Considering the risk and return principles in finance, which states "the higher the risks the higher the returns", borrowers with less-risky investments will refrain from loan. This adversely changes the mix of potential borrowers (adverse selection). On the other hand, borrowers with high-risk investment will seek loan despite the increase in interest rate, and this ultimately leads to moral hazards.

Furthermore, Lowe and Rohling (1992: 4) argue that one major issue attributed to asymmetric information is that an increase in the interest rate charge by a bank does not necessarily translate to a proportionate increase in the banks' expected returns. There is always an inverse relationship between the probability of loan defaults and banks' expected returns. Therefore, if interest rate increases, it will lead to a rise in the probability of loan default, and this would result in a fall in the banks' expected returns. Faced with this situation, the bank will decide not to increase its interest rates, even if its cost of funds increases. Therefore banks will be forced to set their interest rate below the prevailing market rate and ration credit. As such, the interest rate charged by the bank becomes more rigid with

[23] "Moral hazard is the risk (hazard) that the borrower might engage in activities that are undesirable (immoral) from the lenders point of view, because they make it less likely that the loan will be paid back. It is problem created by asymmetric information after the transaction occurs". For details see Mishkin, (2007).

upward stimulus. It is therefore worth noting that such price rigidity can only hold in markets where credits are rationed.

2.3.1.2 Switching Costs

When a customer decides to change from one bank to another, there are costs involved, which are called switching costs[24]. The higher these costs are, the more difficult it is for the customer to switch from one bank to another. In the bank loan market, banks are not only concerned about the potential expected returns on a loan transaction, but also the risk profile and potential behaviour of their customers. Therefore, it is imperative on the bank to obtain the necessary information about the characteristics of its customers. The process of collecting such information is costly, and the banks in most cases pass this cost onto the customer concerned in the form of a once-off fee. This means that, for future loan transactions, such fees are not applicable to the customer since the bank already has the necessary information on the customers' risk profile. With this in mind, a customer would not readily switch from one bank to another. Lowe and Rohling (1992: 6) note that there are regular search and application costs involved, and these costs are often more significant in banking than other goods markets.

Switching costs therefore apply to markets with high search costs and transaction costs. Since the additional costs make switching from one bank to another costly for customers, they will in some cases accept whatever interest rate the bank offers, even though such rates may be higher than the current market rates. Thus, interest rate becomes sticky (Lowe and Rohling, 1992: 6). Also, Fried and Howitt (1980: 486) argue that when the lending rate is higher than the marginal cost of funds, customers seldom change banks because of the switching costs. Additionally, Ausubel (1991: 69) argues that, even though there are other reasons for the stickiness of credit card rates, search/switch costs may lead to sticky interest rates.

2.3.1.3 Risk Sharing

In financial markets investors are exposed to several risks such as interest rate risks, credit risks, liquidity risks and systemic risks. Interest rate risk, according to the Bank for International Settlement (BIS, 1997: 6) "is the exposure of a bank's/firm's financial condition to adverse movements in interest rates". Changes in interest rates affect the earnings and

[24] Switch/search costs include: information cost of discovering bank with lowest rate; cost of time, effort and emotional energy in filling out applications, and cost of learning different rates and conditions on the new loan.

underlying performance of both banks and their customers. Therefore, it is beneficial for both the bank and its customers to engage in a mutually beneficial arrangement of sharing risk resulting from adverse movement in interest rates. Fried and Howitt (1980: 472) suggest that banks and their customers should have an equilibrium risk-sharing arrangement and by means of such arrangements they both can share the risks associated with the uncertain future. Furthermore, they describe the risk-sharing arrangements as an insurance contract in which one party (bank, less risk-averse) agrees to compensate the other party (customer) by bearing risk which the customer is exposed to for a fee. Borrowers regard the fee as an insurance premium and would hesitate to change banks because of such arrangements.

As a result of the risk-sharing arrangement, the bank will now charge stable interest rates and the customer will also be willing to compensate the bank in the form of either additional fees or higher average interest rate. The ultimate result of such an arrangement is stickiness in lending rates (Fried and Howitt, 1980: 472). Also, Fried and Howitt (1980: 472) note that the arrangement between the banks and their customers is usually based on maintaining a continuous relationship, and those long-established customers are less likely to receive variable interest rates than others to be rationed. The kind of arrangement between banks and their customers could also be referred to as a sort of implicit contract between the bank and its customers (Berger and Udell, 1992; Allen and Gale, 2004).

2.3.1.4 Consumer Irrationality

Lowe and Rohling (1992) noted that switching costs alone cannot fully explain interest rate stickiness in financial markets. Ausubel (1991: 71) argues that there is a class of borrowers who repeatedly believe that they will pay the outstanding balance before the due date but fail to do so, and these customers, who are insensitive to interest rate changes, are the class of borrowers that the banks prefer. Further, Lowe and Rohling (1992: 12) argue that high risk credit card borrowers, on the other hand, are more likely to be interest rate sensitive because they fully intend to borrow on their cards. A credit card rate reduction will only attract customers who fully intend to borrow (i.e., the high risk customers). This "reverse" adverse-selection problem makes banks less likely to compete on credit card rates and thus rates are likely to be sticky, especially in the downward direction (Lowe and Rohling, 1992: 12).

The four theories discussed above are proposed by Lowe and Rohling (1992) as a way of explaining interest rate stickiness in the financial market. These four theories, though they

provide the basis for most empirical studies on the interest rates rigidities, only present a succinct explanation by focusing on banks and their clients. They ignore economic factors other than bank-client relationships, such as level of competition and concentration in the banking industry, financial structures of the economy, menu costs and ownership structure of banks. However, in an attempt to provide a more holistic discussion on the subject of retail interest rate stickiness and the determinants of interest rate pass-through, the discussion continues with other determinants of interest rate pass-through.

2.3.1.5 Menu Costs

Menu costs are costs incurred by firms as a result of changing prices, creating new adverts, updating price lists, brochures, publishing and distributing new catalogues to its customers, and making its sales staff aware of the changes in price when underlying cost and demand condition changes or when inflation erodes existing prices (Madsen and Yang, 1998: 296–297). Owing to the fact that these activities are time consuming and costly, firms do not often alter their prices, which thus contributes to price stickiness. Rotemberg and Saloner (1987: 919) noted that the reason why prices do not respond to changes in underlying conditions is that there may be fixed costs attached to changing prices. Thus, in the presence of fixed costs of price changes, the monopolists sluggishly adjust prices.

It is usually costly to change prices and as a result, banks may delay before responding to policy rate changes. In situations where banks expect that the change in policy rate is temporary, or expect a reversal in the policy rate change within weeks, they might leave their own rates unchanged (Cottarelli and Kourelis, 1994: 591). Additionally, the level of change in policy rate can also determine whether commercial banks will react to such changes. As noted by Mahadeva and Sinclair (2005: 19), "there may also be a narrow range within which official rates can move while provoking no retail interest rate response". It should be noted that menu costs have been one of the key arguments for retail interest rate stickiness in banking lending and deposit rates.

2.3.1.6 Structure of the Financial System

The structure of the financial system has been one of the crucial parameters of the smooth transmission of monetary policy stance in an economy. It could affect the way in which retail

interest rates adjust to policy rates. For instance, empirical evidences[25] have shown that the structural differences within the Euro zone have jeopardized the conduct of monetary policy. One early influential study of the relative importance of the financial structures in the pass-through process is Cottarelli and Kourelis (1994). Despite the fact that this study provides the basis for most pass-through studies, a notable contribution is revealing that stickiness in lending rates is attributed to the financial structures of an economy. The authors indicate that structural variables, such as those reflecting the degree of competition within the banking system, the extent of money market development and openness of the economy, ownership structure of the banking system, and the degree of development of the financial system, are crucial in determining the speed of IRPT. Note that the above financial structure variables are discussed in detail under a separate heading in the ensuing sections.

2.3.1.7 Degree of Competition and Bank Concentration

Competition in the banking sector is highly desirable for the effective transmission of monetary policy impulses. Competition among banks or between banks and non-bank financial markets result in profit-maximizing behaviour, and such behaviour warrants banks to quickly adjust their retail interest rates in response to changes in market conditions. Also, Egert *et al.* (2007: 212) noted that weak competition among banks, or between banks and non-bank financial intermediaries, reduces the speed of adjustment of retail interest rates to changes in deposit rates. Alternatively, higher banking concentration reduces IRPT since banks adopt oligopolistic behaviour, which leads to asymmetric adjustment of retail interest rates. High banking concentration may possibly lead to lower degree of competition in financial markets and therefore stickiness in PT from policy rate to retail rates (Cottarelli and Kourelis, 1994: 605). However, Cottarelli and Kourelis (1994: 613) note that if banks in highly concentrated financial markets are subject to threat of new entry, they behave competitively.

2.3.1.8 The Ownership Structure of Banks

The ownership structure of the banking system in economy could also influence the magnitude and speed of adjustment of retail interest rates to changes in policy rates. Ownership of the banking sector can either be state-owned or private-owned. In an economy where the banking system is dominated by state-owned banks, the PT is expected to be

[25] Cottarelli and Kourelis (1994); Mojon (2000); de Bondt (2005)

stickier since these banks are not under pressure to make profit. Also, the existence of political constraints (such as protecting the interest of the Government) and inefficiency could also adversely impact the speed of PT (Cottarelli and Kourelis, 1994: 613; Aziakpono and Wilson, 2010: 13).

2.3.1.9 Degree of Financial Market Openness and Development

The advent of financial innovations such as derivatives and other structured products, coupled with the rapid growth in the level of globalization of financial markets and the increasing integration between domestic and global financial markets, have made it challenging for monetary authorities to achieve domestic objectives of monetary policy. In economies with globalized and integrated financial systems, price development in other financial markets can trigger changes in the price of financial assets in the domestic market. These price developments can potentially render the tools of monetary policy being ineffective and the PT to be sluggish (Kuang, 2008: 5). Also, Kuang (2008: 15) argue that financial globalization weakens the level of IRPT especially in small economies that lack the ability to influence global interest rates and market conditions.

On the other hand, Aziakpono and Wilson (2010: 13) argue that the responses of domestic banks to changes in policy rate depend on the liquidity position of the banks and the level of dependency of banks on the central bank's accommodation facilities. If the financial system is open enough for domestic banks to access external sources of financing their liquidity needs, it would reduce their reliance on the central bank's accommodation facilities. Therefore, in an open financial system, retail interest rates adjust sluggishly compared to when the financial system is closed. However, Cottarelli and Kourelis (1994: 607) contend that interest rates adjust quickly to changes in policy rate in more sophisticated financial environments.

2.3.1.10 Asymmetric Information

The adjustment of retail interest rates is usually affected by imperfections in financial markets. These imperfections create market disequilibrium information, also called information asymmetries. Asymmetry of market information is crucial for the speed of pass-through since it can prevent banks from not reacting to an increase or decrease in policy rate

(Acheampong, 2005: 6). Empirical studies[26] have provided sufficient evidence to show that the presence of information asymmetry in financial markets has contributed immensely to the sluggishness or incompleteness of the PT process. Also, Stiglitz and Weiss (1981)[27] provide further insight into the issue of information asymmetry by arguing that banks compensate for taking risks by creating a wide margin between lending and deposit rates, a margin which is insensitive to small changes in official rates. However, Lowe and Rohling (1992: 4) comment that the information gap between banks and the risk profile of their customers introduces information asymmetry that leads to moral hazards and adverse selection problems in financial markets.

Aziakpono and Wilson (2010: 13) note that asymmetric adjustments of interest rates in financial markets can be explained using two competing hypotheses – the collusive pricing behaviour of banks and the adverse customer reaction hypotheses attributed to Hannan and Berger (1991); Neumark and Sharpe (1992); and Scholnick (1996). Note that these two concepts are crucial for this study and therefore discussed under a separate heading in the next section.

2.3.1.11 Adverse Customer Reaction and Collusive Pricing Arrangements

As already noted, rigidity in the PT is the reason for asymmetries in financial markets. Neumark and Sharpe (1992) following Hannan and Berger (1991) were the proponents of asymmetries in retail bank interest rates. From their respective studies on the US market, they were able to propose two competing hypotheses to explain asymmetry: collusive behaviour of banks and adverse customer reaction. They suggest that, in highly concentrated markets, it is difficult for banks to alter their collusive price arrangements. For instance, increases in deposit rates imply an extra payment by the bank for deposits. This implies rigidity in increasing deposit rates. Alternatively, Scholnick (1996) extended the collusive price arrangement to lending. For instance, a decrease in lending rate will result in lower revenue to the bank because of the loss of interest income by the bank. This means lending rate will be more rigid downward as banks perceive a loss of revenue. Wang and Lee (2009: 1237) summarized the concept by indicating that collusive pricing arrangement implies rigidity in increasing the deposit rate and decreasing the lending rate. The customer reaction, on the other hand, implies greater rigidity in a deposit rate decrease and increase in the lending rate.

[26] Studies such as Gambacorta (2002); Madsen and Yang (1998); Scholnick (1996); and Hannan and Berger (1991) have shown asymmetry in interest rate adjustment is important for the pass-through process.
[27] See Stiglitz and Weiss (1981) for details on how the model was used.

Following Hannan and Berger (1991) and Neumark and Sharpe (1992), Scholnick (1996) finds evidence of collusive pricing arrangement in Malaysia and Singapore. He shows that deposit rates in both countries are more rigid when below equilibrium than when above it and further states that banks in both countries tend to adjust their deposit rates downward more rapidly than upward. Lim (2001), using a multivariate asymmetric error-correction model, also provides evidence of upward adjustment rigidity in deposit rate and downward rigidity in lending rate in Australia[28].

2.3.1.12 Monetary Policy Regimes

The structure of the monetary policy regime is crucial for the level of PT in an economy. For instance, in economies where monetary policy is conducted by means of a direct control of interest rates and credit allocation, retail interest rates will only change when the authorities adjust set rates. Thus, retail interest rates become rigid. On the other hand, in liberalized and deregulated economies, interest rates and credit allocation are determined by market forces which make interest rates to be more flexible and adjust quickly to changes in monetary policy stance (Aziakpono and Wilson, 2010: 12). Also, economies that adopt more transparent monetary policies (such as inflation targeting) experience high speed of adjustment than economies with restrictive policies.

2.3.1.13 Economic Policy and Regulation in the Economy

The speed of pass-through from policy rate to retail interest rates according to Wang and Lee (2009: 1270) largely depends on economic policies and regulations in an economy. Cottarelli and Kourelis (1994: 612) show that stickiness in lending rates is strongly influenced by not only structural parameters of the financial system, but also its regulatory environment. Regulatory measures such control on the foreign flow of capital from foreign financial markets reduce competitiveness in the domestic banking sector and this results in retail interest rate stickiness

[28] His results suggest that banks adjust their loan and deposit rates, in response to a change in the bank-bill rate, at a faster rate during periods of monetary easing (negative changes) than during periods of monetary tightening (positive changes).

2.3.1.14 Money Market Volatility, Inflation and Macroeconomic Conditions

Studies[29] have shown that money market rate volatility and inflation are crucial for the size and speed of interest rate pass-through of official rate to retail interest rates. For instance, Sander and Kleimeier (2004) show that lower money market volatility impacts the size and speed of interest rate pass-through positively while higher money market volatility negatively impacts interest rate pass-through. Also, pass-through is faster when inflation is higher, but in low inflation monetary policy regime pass-through is expected to be slow. It has been shown that financial reform and more transparent monetary policies[30] stimulate the speed of adjustments of interest rate more than restrictive policies (Aziakpono and Wilson, 2010: 30). Moreover, in periods of high interest rates volatility, higher inflation and rapid economic growth, banks pass on changes in policy rate to lending and deposit rates faster (Egert *et al.*, 2007: 212).

The above explanations form the basis for clarifying retail rate stickiness in financial markets as there is no consensus in the existing literature. However, it is worth noting that available empirical evidences have provide differing reasons for retail interest rates stickiness across different markets within the same country (Lowe and Rohling, 1992; Hannan and Berger, 1991; Neumark and Sharpe, 1992; Aziakpono, Wilson and Manuel 2007), and across countries (Cottarelli and Kourelis, 1994; Borio and Fritz, 1995; Mojon, 2000; Wang and Lee, 2009; Kwapil and Scharler, 2010). Despite the fact that several authors have proposed differing explanations to justify the sticky or sluggish nature of retail interest rates, no consensus has emerged on the issue even within the EMU countries operating a single monetary policy.

From the foregoing discussions, a few trends emerged which are worth mentioning. First, the factor that determines the magnitude and speed of the interest rate pass-through from policy rate to retail interest rates varies from country to country. Second, stickiness in retail interest rates within a country varies over time; as financial markets develop and become sophisticated, so the pass-through increases. Third, pass-through largely depends on the structure of the financial system. Finally, it was evident that as far as the current level of debate on factor limiting pass-through is concerned, there is no consensus in the literature. In what follows, the next sections review the empirical literature on interest rate pass-through.

[29] Mojon (2000) and Sander and Kleimeier (2004) showed that money market volatility is negatively correlated to PT.
[30] Monetary policies that enhance free market principles and competition in financial markets.

Discussion begins with studies on developed economies and then moves on to research done on emerging and developing economies.

2.4 EMPIRICAL REVIEW

2.4.1 Introduction

Early studies[31] on the subject of monetary policy transmission mechanism and its effectiveness focused on price rigidities and adjustments under a framework of oligopolistic competition. Given the significance of the pass-through process for the conduct of monetary policy, interest in the speed and magnitude of retail interest rates adjustments to changes in policy controlled rate have heightened in recent years, and this has led to several landmark researches. Studies on retail interest rate pass-through became popular after the successful implementation of the single currencies (Euro) in Europe. The associated asymmetries and the observed differences in financial structure and how they affect the pass-through process the Euro zone have attracted lots of attention in the literature (Wang and Lee, 2009: 1272). In this regard, Sander and Kleimeier (2002) comment that most research on interest rate rigidity focuses on the Economic and Monetary Union member countries. Some examples in the Euro area of such studies include Sander and Kleimeier (2000); Mojon (2000); Donnay and Degryse (2001); Toolsema *et al*. (2002); de Bondt (2002); Sorensen and Werner (2006); and Mirdala (2009).

Even though some authors have attempted to classify pass-through studies, it is important to note that there is no consensus on how these studies are classified. For instance, Sander and Kleimeier (2004) consider two approaches to IRPT studies, the "cost of funds approach"[32] and the "monetary policy approach"[33]. On the other hand, de Bondt (2002) considers a different approach and classifies the studies into: those that show that transmission of policy and/or money market rates to lending rates are incomplete in the short-run; those that examine the issue of asymmetry in interest rate pass-through process; and those that examine the pricing behaviour of banks by using bank level data. Consequent on the lack of consensus, the ensuing discussions are based on issues relevant to pass-through. In situations

[31] Studies such as Hannan and Berger (1991); Neumark and Sharpe (1992); Lowe and Rohling (1992); Scholnick (1996).

[32] Kwapil and Scharler (2010) argue that the cost of fund reflects the opportunity costs that arise for a bank that issue loans and the financing cost for a bank that takes in deposits.

[33]The focus of the monetary policy approach is on the effect of monetary policy on retail interest rates and considers no other explanatory variables (Samba and Yan, 2009: 32).

where applicable, the discussions are presented in chronological order. The first focus will be on early studies and then progress to the current state of the debate. Note that a comprehensive summary of the studies discussed is provided in Appendix A. The empirical review begins with studies done on developed economies and then moves on to discuss studies done on emerging and developing economies.

2.4.2 Developed Economies

Stiglitz and Weiss (1981) is one of the earlier works done on interest rate rigidity. Following Stiglitz and Weiss (1981), Hannan and Berger (1991), and Neumark and Sharpe (1992) formed the basis for the theoretical framework that influences the studies on interest rates rigidities. Focusing on the US deposit markets, Hannan and Berger (1991) found that price rigidity is significantly greater in markets characterized by higher levels of banking concentration and that deposit rates are significantly more rigid when the stimulus for a change is upward rather than downward. This reveals asymmetry in banks' reaction to monetary policy. Their results are consistent with those of Neumark and Sharpe (1992). Neumark and Sharpe (1992) also find upward rigidity in the deposit rates of two hundred and fifty-five (255) US banks. From these studies, they proposed the hypotheses of collusive behaviour of banks and customer reaction hypothesis[34]. These early studies mainly focused on asymmetry in financial markets since asymmetry of retail interest rates adjustment has been viewed as one of the obstacles to the effectiveness of monetary policy. For instance, Borio and Fritz (1995) found asymmetries in lending rates in twelve Organisation for Economic Co-operation and Development (OECD) countries using a Distributed Lag Analysis (DLA) in an Error Correction (EC) framework and found mixed evidence with regards to the degree of pass-through. In some countries, they found high degree of pass-through, while in others interest rate was sticky. They argue that the type of interest rates used could explain the differences across OECD countries. As it was evidently clear in their study, for policy rate to be fully reflected in retail interest rates it takes three to twenty four months. Also, Moazzami (1999) used an error correction model to investigate the adjustment lending rates to changes money market rate in Canada and the US and found that lending rates respond to changes in market rates with lags.

As noted previously, the early studies on interest rate rigidities were mainly focused on price adjustment under oligopolistic competition. The majority of these studies were able to

[34] For detailed explanation on collusive pricing behaviour and customer reaction hypothesis see Section 2.3.1.11

identify possible asymmetries in financial markets which engender the need for an in-depth analysis into the causes of interest rates stickiness in financial markets. Motivated by this, the first attempt to provide a comprehensive analysis on the dynamics of interest rate adjustment was made by the Bank for International Settlements (BIS) in 1994. The BIS (1994) report shows that there are significant differences in monetary transmission within the Euro area and that short-term bank lending rates to enterprises are sticky (BIS, 1994). These findings initiated the debate on the efficiency of the interest rate transmission mechanism as a tool of monetary policy. Subsequent to this, several researchers were keen to uncover the factors responsible for such stickiness in bank lending rates. Among these researchers, Cottarelli and Kourelis (1994) confirmed the BIS (1994) findings that short-term pass-through is sticky and the degree of short-term pass-through is mainly related to factors such as the stage of financial market development; the degree of financial market openness; the level of concentration in the banking system; inflation; volatility of money market rate and bank costs. Following Cottarelli and Kourelis (1994), Borio and Fritz (1995) building on the earlier studies by BIS (1994) by using an Autoregressive Distributional Lag (ADL) and Error Correction Model also find significant differences in the OECD countries. They argue that the differences across countries are as a result of the different types of lending rate used in each country. However, although these results confirm the previous findings of the BIS (1994) report, there has been no consensus on the factors explaining the cross country differences in interest rates transmission.

Studies[35] on interest rate rigidities prior to the BIS (1994) report and the study by Cottarelli and Kourelis (1994) were mainly focused on the US and other markets; however, the successful launch of the single currency in Europe saw a refocus on the interest rate stickiness literature, from interest rates rigidities under oligopolistic competition to measuring the speed of adjustment under economic and monetary groupings. It is worthy to note that a common phenomenon evident within the Euro area is the incomplete pass-through of short-term retail rates and major differences in interest rate transmission confirmed by the BIS (1994) report and other researchers. The incomplete nature of short-term interest rate pass-through has heightened the debate on the subject and poses a challenge for the conduct of the single monetary policy operated within the Euro area.

[35] Hannan and Berger (1991); and Neumark and Sharpe (1992);

In general, most of the early empirical studies[36] believe that the retail interest rate adjustment process is asymmetric. The rigidity in the pass-through is the reason for asymmetries in financial markets. Neumark and Sharpe (1992), following Hannan and Berger (1991), were the proponents of asymmetries in retail bank interest rates. From their studies, they were able to propose two competing hypothesis to explain asymmetry: collusive behaviour of banks and adverse customer reaction. They suggest that in highly concentrated markets, it is difficult for banks to alter their collusive price arrangements. For instance, increases in deposit rates imply an extra payment by the bank for deposits. This implies rigidity in increasing deposit rates. Alternatively, Scholnick (1996) extended the collusive price arrangement to lending. For instance, a decrease in lending rate will result in lower revenue to the bank because of the loss of interest income by the bank. This implies lending rate will be more rigid downward as banks perceive a loss of revenue. Collusive pricing arrangement implies rigidity in increasing the deposit rate and decreasing the lending rate (Wang and Lee 2009: 1271). The customer reaction, on the other hand, implies greater rigidity in a deposit rate decrease and increase in the lending rate. Following Hannan and Berger (1991) and Neumark and Sharpe (1992), Scholnick (1996) finds evidence of collusive pricing arrangement between Malaysia and Singapore. He shows that deposit rate in both countries are more rigid when below equilibrium than when above it and further states that banks in both countries tend to adjust their deposit rates downward more rapidly than upward. Lim (2001) using a multivariate asymmetric error-correction model also provides evidence of upward adjustment rigidity in deposit rate and downward rigidity in lending rate in Australia[37]. However, Marotta (2009) finds weak evidence of asymmetry in the EMU countries with the exception of France and the Netherlands where evidence of asymmetry was found.

It is worth mentioning that an objective analysis of pass-through literature without mentioning studies conducted in the Euro area would be biased in that studies on the Euro area have been the centrepiece of recent debate on pass-through. In this regard, attention is now turned to the Euro area. It has been well documented that interest rate pass-through process varies a lot in terms of the short-run and long-run pass-through in the Euro area. Studies conducted within the Euro area have shown significant difference in the pass-through

[36] Hannan and Berger (1991); Neumark and Sharpe (1992); Scholnick (1996); and Wang and Lee (2009).
[37] His results suggest that banks adjust their loan and deposit rates, in response to a change in the bank-bill rate, at a faster rate during periods of monetary easing (negative changes) than during periods of monetary tightening (positive changes).

process, and these differences are believed to be accounted for by country-specific structural differences.

A key issue that is notable as far as the pass-through process is concerned in the Euro area is the significant variation observed within the Euro area by most researchers. Most early studies[38] find that the pass-through from policy rate to retail interest rates varies widely within the Euro area. For instance, a recent study by Marotta (2009) confirms the findings of early studies. By using Engle–Granger cointegration (Engle and Granger, 1987), ADL model and Dynamic Ordinary Least Squares (OLS) with data from 1994 to 2003 for nine EMU countries, Marotta (2009) shows that pass-through is heterogeneous across the EMU countries and incomplete in most countries. Furthermore, Hulsewig *et al.* (2009) also find short-run pass-through in the Euro area to be 54% which indicates an incomplete short-run pass-through.

Besides the marked differences among the Euro area economies, empirically, several studies[39] have shown that retail interest rates in the Euro area respond less than one-to-one to changes in policy rate in the short-run and in some cases in the long-run. Recent studies have also confirmed this assertion. For instance, Marotta (2009) found that short-run pass-through ranged from 12% to 107% before the introduction of the euro and from 15% to 89% after the euro was introduced. On the other hand, the long-run pass-through ranges from 40% to136% to 20% to101% before and after the introduction of the Euro. De Bondt (2005), measuring the pass-through from overnight interest rate to deposit and loan rates in the Euro area in the period 1996 to 2001, observed that the short-run pass-through for both deposit and lending rates is incomplete, while in the long-run, the pass-through to lending rates is complete, but for deposit rates is incomplete. He, however, concluded that pass-through has been quicker since the introduction of the euro.

Empirical evidences[40] on IRPT from policy interest rates to retail interest rates have shown that retail interest rates respond to policy rate with lags in the Euro area. Sander and Kleimeier (2000) using cointegration analysis explore asymmetries in the transmission of policy rate innovations on bank lending rates to show that the speed of adjustment of lending rate to policy rate is sticky in the short-run and changes differ widely within the EMU. Their

[38] Mojon (2000), Sander and Kleimeier (2004); de Bondt (2000, 2005)
[39] Cottarelli and Kourelis, 1994; Borio and Fritz, 1995; Moazzami, 1999; Sander and Kleimeier, 2004; de Bondt, 2005)
[40] See the summary of empirical pass-through studies in Appendix A.

results have implications for the European Central Bank (ECB), which means that the ECB is still confronted with asymmetries that complicate the conduct of monetary policy. Donnay and Degryse (2001) explore the pass-through from money market rate to several bank lending rates and government bond rate using structural vector autoregressive model (SVAR) based on Cholesky decomposition and also find asymmetries in the price of credit both within and across countries in Europe. They confirmed that there is divergence in the lending rate pass-through which is consistent with the findings of Borio and Fritz (1995). On this same line of argument, Toolsema *et al*. (2002) find weak evidence for convergence of monetary policy transmission among the EMU countries. Alternatively, Baugnet *et al.* (2007) show that in Belgium, banks adjust their retail interest rates relatively rapidly to changes in market rates, even though there is significant heterogeneity across sectors, products and banks.

Recent studies[41] follow the same trend of argument that retail interest rates are rigid in the short-term and complete in the long-term. Several explanations can be used to justify the rigidity in the short-term deposit and lending rates across the EMU countries. One common explanation proposed by Toolsema *et al.* (2002: 6) is that the differences in regulatory framework may cause the retail banking market to remain segmented, and the adjustment of policy-controlled interest rate may remain country specific, while Wang and Lee (2009) argue that the economic policies and regulations account for cross country differences in retail interest rates. Moreover, Sander and Kleimeier (2000) argue that the completeness (i.e., the speed and the size) of the pass-through depends on the structure of the banking market and potential information asymmetries in the economy. Mirdala (2009) shows that the efficiency of interest rate channels in the EMU are complicated. Using a Structural Vector Autoregressive (SVAR) methodology on the variables[42] of four EMU countries (i.e., Czech Republic, Hungary, Poland and the Slovak Republic), his results show that all five variables are different across all the countries, and this complicates the efficiency of the interest rate transmission mechanism of the monetary policy pass-through in the selected countries.

Against this backdrop, some striking evidences emerged about the studies done on the Euro area economies. First, it was observed that there are major differences within the Euro area in terms of the speed and magnitude of the pass-through. Second, most studies show differing results for the immediate pass-through and long-term pass-through; while some studies show

[41] Sorensen & Werner (2006); Sander and Kleimeier (2006); Egert, Crespo-Cuaresma and Reininger (2006); Leuvensteijn, Sorensen, Bikker and van Rixtel (2008); and Mirdala (2009)

[42] Real Gross Domestic Product, annual core Inflation, M3, 3-months money market rates and Real Effective Exchange Rate.

that pass-through is incomplete in the short-run, others show that it is complete. Third, another issue that is prevalent in most studies is the adjustment asymmetries. Some studies found evidence of asymmetric adjustment while others do not. Finally, debates on the factors responsible for sticky and incomplete retail interest rates adjustments are still unclear. Consequent on the above, attention is now turned to studies between the Euro area and Central and Eastern European economies.

Another strand of studies tried to compare the magnitude and speed of pass-through between the Euro area and Central and Eastern European (CEE) countries[43]. In these studies it was evidently clear that on average the magnitude and speed of pass-through in the CEE economies is higher compared to the Euro area countries. For instance, Sander and Kleimeier (2006), by regressing a sundry of retail interest rates on 1-month money market rate using symmetric and asymmetric error correction models, show that pass-through in the CEE countries is complete and quicker than the Euro area. In confirmation to the findings of Sander and Kleimeier (2006), Egert *et al.* (2007) also find higher pass-through for five CEE countries and lower pass-through for three Euro area countries using dynamic OLS, ARDL and Engle–Granger cointegration and data from 1994 to 2005.

To gain further insight on the discussion, attention is now turned to comparative studies among developed economies as well as emerging economies. One recent study in this strand of literature is Kwapil and Scharler (2010). Analysing equilibrium determinacy in a sticky price model by comparing the interest rate pass-through process in the Euro area and US, they show that in the US pass-through for deposit rate is almost complete but is incomplete for lending rates. On the other hand, they show that pass-through in the Euro area is incomplete for both deposit and lending rates and the immediate pass-through is heterogeneous. Their results on average for short-run pass-through in US were 97% and 79% for deposit and lending rates respectively, while in the Euro area they were 16% and 34%, respectively. On the other hand, the long-run pass-through was 93% and 57% for US deposit and lending rates respectively, while for the Euro area they were 32% and 48%, respectively. In another recent study, Wang and Lee (2009) using asymmetric threshold cointegration and EC-EGARCH (1, 1)-M model focusing on the US and nine Asian countries show that there is complete pass-through for US deposit rates. While eight Asian economies exhibit asymmetric

[43] The CEE countries in general are Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Romania, Slovenia, Croatia, Bosnia-Herzegovina, Serbia, Kosovo, Albania, Montenegro, Macedonia and Bulgaria.

adjustment in the short run, five of them are found to have upward rigid adjustments in the deposit interest rate, and three downward rigid adjustments in the lending rates. All these studies propose different explanations for their findings; it should be noted, however, that factors such as the financial structure of the economy; regulation and legal structures; competition; asymmetry, stage of development of the financial markets; and economic policies account for most of the differences in the pass-through process.

Most early studies on retail interest rate stickiness or interest rate pass-through were mainly done in developed economies such as US and the Euro area. However, there has been an increasing interest in the issue in emerging and developing countries. The next section will provide a review of some of the available literatures on emerging and developing economies.

2.4.3 Emerging and Developing Economies

There has been extensive literature on interest rate rigidity in developed countries in the last two decades, with relatively few studies on emerging and developing countries. However, the movement from exchange rate targeting to inflation targeting regimes in the mid 2000s by most emerging market and developing economies towards a market-oriented monetary policy operating system has increased the role of interest rate in the economy (Mohanty and Turner, 2008: 2-5).

Interest on banks' interest rate stickiness has heightened in recent years in developing countries primarily on account of the rigidity in retail interest rates and higher margins despite financial reforms and liberalization (Acheampong, 2005: 4). Also, Scholnick (1996: 485) argues that understanding the rigidity of commercial banks' interest rates has important implications for programmes of financial liberalization in developing economies. The discussion starts with an overview of emerging market economies and later progresses to developing economies.

Mohanty and Turner (2008) exploring monetary transmission in emerging markets provide an insight on the importance of the pass-through process in emerging countries by affirming that, in the 1980s and 1990s, emerging markets experienced several impediments to the operation of the interest rate channel. For instance, factors such as lack of well developed money and bank markets, frequent shifts in risk premium, and binding interest rate controls combined with non-price mechanisms for allocating credit are responsible for such

impediments. These factors, they argued, reduced the pass-through and the macroeconomic effects of policy rate to other interest rates (Mohanty and Turner, 2008: 10).

Empirical evidences on interest rate pass-through in emerging market economies are unclear based on the fact that these economies are experiencing rapid changes in their financial systems. One early study on emerging market economies is Scholnick (1996) who finds evidence of asymmetries between Malaysia and Singapore. Using cointegration and error correction models, his results show that deposit rates in both countries are more rigid when below equilibrium than when above it; suggesting that banks in both countries tend to adjust their deposit rates downward more rapidly than upward.

Berstein and Fuentes (2003) explore the response of commercial banks lending rate to a money market interest rate movement in Chile using data on lending, deposit and interbank rates from 1996 to 2002 and find high flexibility in retail bank interest rates and sluggish adjustment of lending rates to changes in policy rate. They argue that the characteristics of banks affect the degree of stickiness in Chile. On the same trend, Tomasz (2003) also found evidence of sluggishness of retail interest rate pass-through in Poland. Contrary to Berstein and Fuentes (2003), Tomasz argues that the degree of stickiness in retail rates is determined by the level of profitability of banks; more profitable banks tend to adjust lending rates faster than the less profitable ones. Further, more profitable banks pass-through immediately a larger part of market interest rate changes and tend to return faster to equilibrium. On the other hand, Burgstaller (2005) using a Structural VAR model shows that long-run pass-through for most of the retail rates is found to be incomplete in Austria in the period 1995 to 2003.

Gonzalez and Salas-Fumas (2005) measure the magnitude and stability of the adjustment speed over time and its symmetry to an increase or decrease in the money market interest rates in Spain from 1988 to 2003 using Partial Adjustment Model (PAM). Their results show that the transmission parameter decreases with the size of banks, especially in loan products, and money market interest rate pass-through parameter is less than unity. Additionally, they find that pass-through parameter increases in loans during the period of nominal convergence but remains stable during the Euro years. On the other hand, Aydin (2007) finds evidence of higher pass-through for all types of loans in Turkey between 2001 and 2005. Alternatively, Ozdemir (2009) finds contradictory results for Turkey between 2001 and 2007. The latter finds greater rigidity in deposit and lending rate decreases than increases, and that retail

interest rates do not adjust asymmetrically to an increase or decrease in money market rate in Turkey. Ozdemir (2009) further confirms that pass-through from money market to deposit and lending rate in Turkey is complete in the long run.

Moreover, some studies have investigated pass-through of a change in policy rate to retail interest rates in the context of emerging and developing African economies. One early attempt in Africa was Jankee (2004) who examines the rigidity of commercial banks' interest rates within a nonlinear framework in Mauritius. Using Johansen cointegration, TAR and M-TAR models on data from 1988 to 2003, Jankee (2004) found asymmetry in lending rates adjustments. It was evident from his results that pass-through was incomplete in Mauritius witnessed by the observed values of 41% and 24% for deposit and lending rates respectively.

One recent study on interest rate pass-through in Africa is Samba and Yan (2010), who focus on the interest rate pass-through from the short-term interest rates towards the long-term rates by using monthly interest rate series for Central Africa Economic and Monetary Community (CAEMC) from 1990 to 2007 in an Autoregressive Distributed Lag (ADL) framework. Several findings emerge from this study. First, the short-term pass-through in lending rate is twice the deposit rates. Based on this result, they found that the long-term pass-through of lending rate was greater than deposit rates. Second, the results show that lending rate is characterized by an overshooting effect in response to changes in the policy rate while long-term pass-through for deposit rate is incomplete (less than unity). The authors attribute these findings to several imperfections in the financial systems within the CEAMC countries. For instance, absence of competition in the banking sector; excess liquidity in the banking system (explains the upward rigidity in deposit rates); and poor financial structures (i.e., stock markets). Moreover, when the time span is split into two interest rate cycles, they find evidence of asymmetry in the pass-through from policy rate to both lending and deposit rates.

With regards to Southern Africa, pass-through analyses have been widely applied in estimating retail interest rates adjustments (De Angelis *et al.,* 2005; Aziakpono, Wilson and Manuel, 2007; Aziakpono and Wilson, 2010), measuring banking market integration (Aziakpono, Kleimeier and Sander, 2007) and financial integration (Aziakpono, 2008). The three attempts in estimating retail interest rate adjustments that are worth mentioning are De Angelis *et al.* (2005), Aziakpono, Kleimeier and Sander (2007) and Aziakpono and Wilson (2010). Focusing on the period just after the Repo system was introduced and after it was adjusted, De Angelis *et al.* (2005) show that pass-through was higher in the first Repo system

than the second Repo system. Aziakpono, Wilson and Manuel. (2007) employed the asymmetric error correction model as in Scholnick (1996) and two wholesale bank interest rates (prime interbank lending rate and the negotiable certificate of deposit rate) to examine how market interest rates adjust to changes in the South African Reserve Bank (SARB) official rate under different monetary policy regimes in South Africa. Their results show that there were higher speeds of adjustment during policy regimes that are market-oriented than during less market-oriented eras. Thus their results suggest that a market-oriented policy would be more effective in transmitting the effect of the central bank's monetary policy stance to the rest of the economy. Aziakpono and Wilson (2010) measuring the speed of adjustment in different policy regimes in South Africa used four types of cointegration tests[44], symmetric and asymmetric error correction model and rolling window techniques on data from 1980 to 2007. Their results suggest that the speed of adjustment varies across retail interest rates, with lending rates having the highest and government bond yield having the lowest speeds of adjustment. Also they found asymmetry in retail interest rates adjustment and proposed that such asymmetries are a result of the negative customer reaction and collusive pricing behaviour of banks.

As far as the WAMZ economies are concerned, no studies have been done explicitly on this topic. However, a study worth mentioning is Acheampong (2005). Acheampong (2005) investigates the interest rate channel of monetary policy transmission by analysing both the impact and the long run adjustments of the lending rate to changes in the money market rates in Ghana. The study also uses both symmetric and asymmetric adjustment based on an error correction model. The author finds that interest rates in Ghana respond sluggishly to changes in the money market rates. The evidence does not support the hypothesis of asymmetric adjustment in bank interest rates to an increase or a decrease in money market rate. However, an analysis of the pass-through process among the WAMZ countries is therefore highly relevant at this time when the region is considering the launch of a single currency by 2015. There is a need for research to be done in this regard. This study aims to fill this gap by exploring the interest rate pass-through dynamics within the WAMZ countries.

[44] The cointegration tests are the Johansen Maximum Likelihood, Engle –Granger, Cointegrating Durbin Watson and ECM-Based tests.

2.5 SUMMARY AND CONCLUSION

This chapter reviewed the theoretical issues relating to monetary transmission mechanisms and retail interest rate stickiness. A brief description of the monetary policy transmission mechanism was provided. Interest rate pass-through and the interest rate channel were also discussed. The potential explanations suitable to justify interest rate stickiness or determinants of interest rate pass-through in financial markets proposed by Lowe and Rohling (1992), that is, adverse selection; switching costs; risk sharing; consumer irrationality; and menu costs, were discussed. Furthermore, other determinants of pass-through such as those related to the financial structure of the economy are considered. Based on the discussions, one can deduce that the stickiness of retail interest rates can be attributed to a host of factors which are also dependent on the economic policy and the regulatory environment. Understanding these factors would help monetary authorities implement policies that aim at influencing aggregate demand.

Careful surveys of interest rate pass-through studies reveal a number of interesting patterns in the empirical literatures[45]. First, interest rate pass-through estimates vary a lot from country to country. Second, in most countries interest rate pass-through is found to be less than one-to-one adjustment of retail interest rates to changes in monetary policy interest rate, that is, interest rate is sluggish and incomplete. Third, the interest rate pass-through lacks uniformity between lending rates and deposit rates. For instance, in some countries deposit rates are stickier than lending rates while in others lending rates are stickier than deposit rates. Fourth, there is large variability in interest rate pass-through, and variability depends on the type of interest rates used. Fifth, inconclusive evidence is found as to whether retail interest rate adjustments are asymmetric, although, in most countries the adjustment is found to be symmetric. Finally, the magnitude and speed of the interest rate pass-through are found to decline as the maturity of the bank instrument increases.

The striking evidences that emerge from the literature are that retail interest rates in developed, emerging and developing countries respond sluggishly to changes in official/policy rates. This complicates the conduct of monetary policy, even in the Euro area, which operates a single currency. The scant literature on developing countries especially in Africa creates a gap in the understanding of the dynamics of interest rate pass-through in Africa. Also, the conflicting and inconclusive empirical evidences on the dynamics of interest

[45] Note that these findings are reported in the summary of empirical pass-through studies in Appendix A.

rate pass-through in developed, emerging and developing economies compounded with the scant literature on developing West African countries raised empirical questions on the nature of interest rate pass-through.

Does monetary policy stance of central banks in the WANZ economies affect the real sector of the economy via the interest rate channel? If they do, how much of (magnitude) and how quickly (speed) are these changes in monetary policy stance transmitted to their ultimate targets? These questions can only be answered empirically, and the answer to these questions has been the crux of recent researches in the field of monetary economics. The first step in answering such empirical questions requires a comprehensive understanding of the structure of the financial systems and monetary policy framework of the countries under consideration. In what follows the next chapter provides an overview financial system and monetary policy of the countries investigated.

CHAPTER THREE:
OVERVIEW OF THE FINANCIAL SECTORS IN THE WAMZ

3.1 INTRODUCTION

The financial system, which consists of all financial intermediary and financial markets and their relations with respect to the flow of funds to and from lenders and borrowers[46] as well as the financial infrastructure, has been seen as a crucial prerequisite for the effective transmission of monetary policy in the economy (Haan *et al.*, 2009: 5). Economists[47] have long realized that the financial system of the economy plays a crucial role in determining the speed (i.e., fast or slow) and magnitude of transmission of the monetary policy decisions of the central bank to the rest the economy. The structure of a country's financial system has considerable effect on the central bank's monetary policies and may impact on its effectiveness. It is interesting to note that financial systems differ across countries and the WAMZ member states are no exceptions. Therefore, it is imperative that detailed description of the structure and composition of the financial system is given since it affects the degree of interest rate pass-through (Cottarelli *et. al.*, 1995: 679). Considering the fact that financial structures are crucial determinants of the speed of adjustment of commercial bank interest rates to changes in policy rate, this chapter reviews the financial system of each country.

The focus of this chapter is to provide information on the level of development, structure and performance of the financial sector. Also, the structural variables that are essential for the pass-through process, such as the size and composition of the financial system, degree of competition and bank concentration, ownership structure of the banking system, economic policy and regulation, and financial markets' openness and development across the WAMZ economies are investigated over time. Further, since the monetary frameworks (market-oriented or controlled) have been seen as a key determinant for the effective transmission of monetary policy impulses, information will be provided on the monetary policy framework of each country over time. The remainder of the chapter is organized as follows: Section 3.2 provides a brief overview of some historical evidences on the WAMZ financial systems; recent changes have taken place in the financial sectors of the WAMZ and these changes have implication for IRPT in each country, therefore, in Section 3.3, the financial structure of the WAMZ financial systems would be described and assessed. Several pass-through studies

[46] Lenders and Borrowers refer to households, governments, business firms, and foreigners.
[47] Cottarelli and Kourelis (1994), Cottarelli *et al.* (1995), Mojon (2000), Schwarzbauer(2007)

have shown that the monetary policy regime[48] operated in a country is crucial for interest rate pass-through, therefore, the focus of Section 3.4 is to provide an overview of the monetary policy regimes adopted by each country under investigation; and Section 3.5 concludes.

3.2 FINANCIAL SYSTEM IN THE WAMZ: SOME HISTORICAL EVIDENCE

West Africa has over three decades of history of economic integration. The formation of the Economic Community of West African States (ECOWAS), which includes fifteen countries (Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo), dates back to 1975 and provides the framework for economic integration in West Africa. The Francophone countries with the exception of Guinea formed the first monetary zone in West Africa in 1994 (Lue *et al*., 2002).

April 2000 marked a milestone in the history of the ECOWAS with the signing of a declaration for the creation of a second monetary zone. The heads of states and governments of Gambia, Ghana, Guinea, Nigeria and Sierra Leone, acting within the ECOWAS framework of regional integration, formed the second West African Monetary Zone (WAMZ) with the primary objective of establishing a common central bank that will issue and manage a common currency within a cooperative framework (WAMI, 2008). The successful implementation of the single currency unit (CFA) by the Francophone West African countries prompted the other countries outside the CFA zone to form the second West African Monetary Zone and a common Central Bank. This drive warranted the formation of the West African Monetary Institute (WAMI) with an objective of forming a monetary union and launching a single currency (ECO) in the second West African Monetary Zone. The launch initially was planned for December 2009, but was later postponed to January 2015. This move is therefore expected to facilitate intra-regional trade and payment transactions, reduce foreign exchange speculation, and reduce foreign exchange transaction costs for its members.

The past 25 years have seen revolutionary changes in the structure of the WAMZ financial system. Several financial institutions have emerged and a factor that has accounted for the observed growth in the WAMZ financial systems is financial liberalization. In the era prior to the 1990s and the implementation of the World Bank supported Structural Adjustment

[48] Studies such as (Gidlow, 1998; Aziakpono and Wilson, 2010) have argued that the monetary policy regime (whether market-oriented or controlled) operated by a country determines the speed and magnitude of the PT.

Programmes (SAP), the WAMZ financial sectors were characterized by state-owned financial institutions, which dominated the banking industry. Inefficiency and the lack of competition resulted in the poor performance of the financial institutions, and these institutions became distressed (Lue *et al*., 2002: 7). In most countries interest rates were administratively managed which had adverse implications for the speed of interest rate pass-through. This led to the collapse of local currencies and external debt repayment problems for most countries. Scholnick (1996: 485) noted that administered interest rates (both lending and deposit) distort investment decisions and result in the misallocation of funds.

Most troubled countries in West Africa sought help from the World Bank, which requires economic reforms as a precondition for assistance. These reforms require regulatory authorities to reduce direct control of the economy (Lue *et. al.*, 2002: 8). As noted by Ayadi *et al.* (2006: 318), the adoption of liberalization programmes in the 1980s by most developing countries was characterized by more attention being given to market forces in allocating credit through freely determined interest rates. Among other things, financial reforms in West Africa, like most Sub-Saharan African (SSA) countries, were classified into three categories such as improvement of the financial sector, improvement of monetary management and strengthening of capital movement and the foreign exchange market.

The financial system of the WAMZ has undergone tremendous changes in the last two decades. Given the fact that the objectives of monetary policy cannot be achieved in isolation from the financial system, it is clear that some the changes in the financial system have implications for the way monetary policy changes are transmitted through the financial system. These changes could have implications for effectiveness of monetary policy. However, it is important to understand the composition and structure of the financial sectors of the countries that make up the WAMZ to uncover the monetary policy transmission process (i.e., speed and magnitude) in these economies. A comprehensive understanding of the composition and structure of the financial system will help pinpoint the factors that are crucial for the effectiveness of monetary policy in each economy.

3.3 STRUCTURE OF THE WAMZ FINANCIAL SYSTEM

The financial structure of every country plays a pivotal role in the transmission of monetary policy through the interest rate channel, that is, the transmission of policy interest rate to retail interest rates (lending and deposit rates). For instance, Agenor and Montiel (2008: 177)

noted that stickiness in retail interest rates in any given economy depends chiefly on the country's financial structure, and a country's financial structure in turn depends on other factors such as "the degree of development of financial markets, the degree of competition within the banking system, and ownership structure of financial intermediaries". Among others, Cottarelli and Kourelis (1994: 590–592) followed similar arguments for the relevance of the financial structure in transmitting monetary policy impulses. They argued that features such as "the degree of development of money and financial markets; the degree of competition within the banking system, and between banks and other intermediaries; the existence of constraints on capital movements; and the ownership structure of the financial intermediaries are responsible for stickiness in bank lending rates.

It is worth mentioning that the measures considered in this section are suggested by Beck *et al.* (1999; 2009) and World Bank/International Monetary Fund[49] for analysis of the structure of the financial system, assessment of financial development and determining the relative importance of its different components. The measures considered are: ratio of liquid liability to GDP; deposit money bank assets to GDP; bank deposit to bank credit; interest rate spread; level of bank concentration ratio; and stock market capitalization to GDP. Note that these measures are discussed under their appropriate sections. The next sections explore the various financial structures of the countries under investigation and their implications for interest rate pass-through.

3.3.1 Size, Depth and Composition of the WAMZ Financial System

The WAMZ countries' financial sectors have been fast expanding in the past decade, with large pan-African financial institutions increasing their presence in the whole of Africa, taking advantage in the region's increasingly open financial markets. The Nigerian banks are becoming a major player in the region. For instance, as of December 2008, there are six in Ghana, seven in Gambia, and seven in Sierra Leone (Table 3.1), while the other WAMZ member countries limit their branch networks within national borders (WAMI, 2008: 26).

In the WAMZ, the banking industry has been the dominant sector of the financial system, although the non-bank financial markets are becoming prevalent. For instance, Sierra Leone with assistance from the Commonwealth Secretariat, has recently established a stock exchange, while Ghana and Nigeria had earlier established stock exchanges. Recently,

[49] See Financial Sector Assessment – A Handbook © 2005 The International Bank for Reconstruction and Development/The World bank/The International Monetary Fund.

several financial institutions have emerged which foster and enhance financial intermediation, while other industries such as the stock markets and insurance business are burgeoning as alternative investment outlets (WAMI, 2008: 25).

Table 3.1: Banks with Cross-Border Subsidiaries in WAMZ countries

		Countries			
Bank	**Home Country**	**Gambia**	**Ghana**	**Nigeria**	**Sierra Leone**
Access Bank	Nigeria	√	√	√	√
First International Bank	Gambia	√			√
Guaranty Trust Bank	Nigeria	√	√	√	√
Intercontinental Bank	Nigeria		√	√	
Oceanic Bank	Nigeria	√	√	√	
PHB	Nigeria	√		√	√
Skye Bank	Nigeria	√		√	√
UBA	Nigeria		√	√	√
Zenith Bank	Nigeria	√	√	√	√

Source: Compiled by author from WAMI Annual Report (2008) and various Countries' Central Banks.

To measure the size of the financial system Beck *et al.* (1999) suggested the ratio of the liquid liabilities to Gross Domestic Product in the economy. Beck *et al.* (1999) noted that the ratio is a better measure of the size of the financial system since it includes all banks, bank-like and non-bank financial institutions. It has been widely used in researches as an indicator of financial depth. For instance, King and Levine (1993) used liquid liabilities to Gross Domestic Product in their finance and growth paper as a measure of financial depth. There are cross-country similarities and variations between Gambia, Ghana, Nigeria and Sierra Leone in liquid liabilities to GDP, as shown in Figure 3.1, ranging from 79% in Gambia to 9% in Sierra Leone. A notable variation that is evident from Figure 3.1 is the ratio for Gambia with relative higher values amongst the four countries over time. A sharp increase set in after 1999 that continued till 2005 and dropped to a value of 48% in 2006, while Ghana and Nigeria were relatively flat ranging from 13% to 29% and 12% to 26% respectively. Sierra Leone, on the other hand, ranked lowest amongst the countries with relatively low values over time, ranging between 9% and 20%.

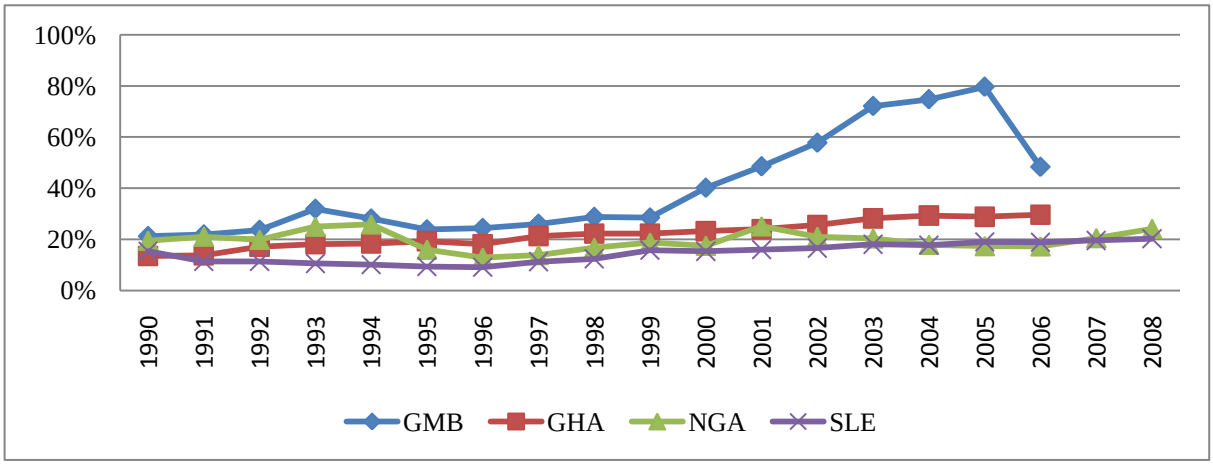


Figure 3.1: Ratio of Liquid Liabilities to Gross Domestic Products

Source: Compiled by author based on data from Financial Structure Dataset, Beck and Al-Hussainy (2010).

Figure 3.1 revealed some similarities in the measures used. From both plots it is obvious that the ratios for Gambia are the highest followed by Ghana, Nigeria and Sierra Leone, the lowest. Therefore, one can argue that the level of financial depth and financial intermediation is very low in the WAMZ economies as a whole, although Gambia is comparatively higher than Ghana, Nigeria and Sierra Leone for the period under review.

3.3.1.1 The Size of the Bank and Non-Bank Financial Sector in the WAMZ

Reforms in the late 1980s and early 1990s resulted in a shift of the financial sectors away from shallow and distressed financial systems among most African countries to more market-oriented financial systems and the WAMZ member countries were no exception. Prior to the 1990s, the financial systems of the WAMZ member states were dominated by banks, mainly foreign banks owned by colonial masters and few state-owned banks (Lue *et al.*, 2002: 25). The implementation of the World Bank supported Structural Adjustment Programmes (SAP) (between 1988 and 1998) has helped restructures the financial systems. According to Lue *et al. (*2002: 28) the "reform programmes were mainly focused on improving the banking legislation and supervision, deregulation of administered interest rate structure and credit allocation, removal of subsidized lending rates on credit to priority sectors, deregulation of foreign exchange markets, establishment of a non-performing assets recovery trust, and privatization of state-owned banks".

The Central Bank of Ghana (BOG) Report (2008) shows that in Ghana, as at the end of 2008, there were 24 commercial banks compared to 17 deposit money banks in 2001; 126 Rural and Community Banks; and 35 insurance companies. Non-bank financial institutions in

operation stood at 41, comprising 21 finance companies; 14 savings and loans companies; four leasing companies; one mortgage finance company; and one discount house (WAMI, 2008: 25; Bank of Ghana, 2008).

In Nigeria, the banking sector in the 1990s was characterized by a rapid increase in the number of banks. As at the end of 1997, there were 115 banks comprising 64 commercial banks and 51 merchant banks, compared to 10 commercial banks in 1980 and 41 merchant banks in 1985 (Lue *et al.* 2002: 35). As a result of the several reforms and restructuring in the financial sector, the Nigerian financial system as of 2008 comprised 24 deposit money taking banks, five discount houses, 709 microfinance institutions, 112 finance companies, 93 primary mortgage institutions, five development finance institutions and 77 insurance companies (CBN, 2008; WAMI, 2008: 26).

The banking and financial landscape in Sierra Leone has expanded in recent years. Evidenced by the expansion of the banking sector, the financial sector continues to deepen. Prior to the rebel incursion in Sierra Leone in early 1990s, there were four commercial banks. As at end of 2009, the financial system of the country comprised 14 commercial banks compared to four commercial banks in 2000. From 57 in 2008, the number of branches of commercial banks increased to 73 in 2009. Also, as at the end of 2009, the financial system comprised two discount houses, six community banks, 10 insurance companies, eight microfinance institutions and one mortgage finance institution (Bank of Sierra Leone, 2009: 5 and 39).

Gambia, similar to Sierra Leone, also has a thin[50] financial sector with 11 commercial banks including an Islamic Development Bank and a total of 44 branches as at the end of 2008 compared to 4 banks in 2000. At the end of 2008, there were nine insurance companies, 62 microfinance institutions and five finance companies in operation (WAMI, 2008: 25). Like other West African countries, Gambia's financial system is dominated by commercial banks which account for 97 percent of total sector assets. Although all the commercial banks are now privately owned, the banking industry is concentrated with the two largest banks (i.e., Standard Chartered Bank and Trust Bank Limited) accounting for 66 percent of the total banking sector assets, extending 58 percent of loans and collecting 71 percent of deposits (Sriram, 2009: 7).

[50] A thin financial system refers to one where the markets are characterized by low liquidity, high spreads, and high volatility (WAMI, 2008).

Table 3.2: Number Financial Institutions in the WAMZ

Country	Commercial Banks		Non-Bank Financial Institution	
	2000	2008	2000	2008
Gambia	4	11	18	133
Ghana	18	24	139	243
Nigeria	89	24	749	1025
Sierra Leone	4	13	43	103
Total	115	72	1249	1429

Source: Compiled by author from World Bank (2007) Making Finance Work in Africa and WAMI Annual Report (2008).

In what follows, it is evident that the bank and non-bank financial institutions have grown in numbers in the last decade as shown in Table 3.2. A notable exception is the reduction in the number of commercial banks in Nigeria, from 89 in 2000 to 24 in 2008. This drastic cut in the number of banks is as a result of several restructuring and reforms adopted to maintain banking sector soundness, stability and enhance supervision within the Nigerian banking system.

A common feature of the financial systems in most emerging and developing countries is that their financial systems are dominated by the banking sector. To show the importance of the financial services performed by commercial banks relative to the size of the economy, the study considers the ratio of deposit money bank assets to GDP as shown in Figure 3.2.

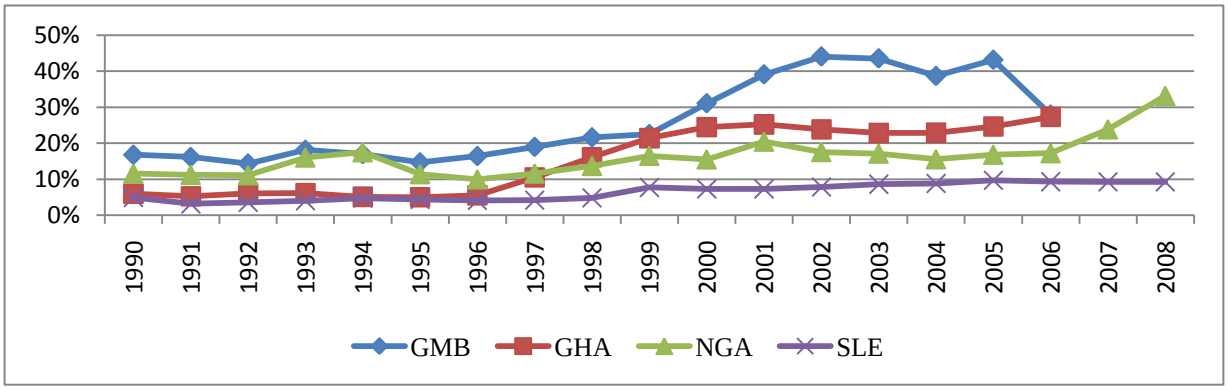


Figure 3.2: Deposit Money Banks Assets to GDP

Source: Compiled by author based on data from Financial Structure Dataset, Beck and Al-Hussainy (2010).

This measure according to Beck and Demirguc-Kunt (2009: 8) provides evidence of the importance of the financial services performed by commercial banks (Deposit money banks assets to GDP) relative to the size of the economy. In Figure 3.2, it is clear that the sizes of

commercial banks relative to the size of the economies in Gambia, Ghana and Nigeria are larger compared to Sierra Leone.

3.3.1.2 Competition, Concentration and Efficiency of the WAMZ Banking Sector

Monetary policy impulses are rapidly transmitted in open financial systems where there are several banking institutions and market conditions are competitive. Thus, a key determinant of interest rate pass-through is the degree of competition within the banking sector. Alternatively, in highly concentrated banking sectors, the responsiveness of retail interest rates to changes in policy rate becomes sluggish and asymmetric[51] (Kamin *et al*., 1998: 24–25). Competition within the banking system of any country is crucial for interest rate pass-through. For instance, an economy with limited alternative sources of finance and lower degree of competition in the credit and deposit markets will have lower elasticity of demand for loans and ultimately limited response of retail interest rates to changes in policy rate (Agenor and Montiel, 2008: 177). Empirical evidence has shown that the levels of competition and concentration of the financial system are crucial for the determination of the speed of adjustment or the rate at which commercial banks interest rates respond to changes (increase or decrease) in official interest rates. For instance, studies[52] have shown that in highly concentrated markets, retail interest rates adjust asymmetrically to changes in official interest rates. It is noteworthy that in financial systems where the banking sector is dominated by state-owned or state-subsidized banks the responsiveness of retail interest rates to policy rates could be sluggish because these banks are not under pressure to maximize profit and in some instances may want to protect the political interest of the government by keeping interest rates stable even when there is stimulus for banks to increase or decrease interest rates.

The last three decades saw a number of major changes in the financial landscape of the WAMZ. Against such background of far-reaching structural changes, this section poses the question: How have deregulations in the WAMZ financial systems changed competition and concentration conditions? To answer this question, the degree of competition and concentration are examined by using the economic indicators of competition and concentration. The three variables that are used as indicators of intermediation efficiency,

[51] Note that this is not always the case. Authors such as Cottarelli and Kourelis (1994) have argued that banks can still be competitive in concentrated markets if they are subject to threat of new entry.
[52] Hannan and Berger, 1991; Neumark and Sharpe, 1992; Scholnick, 1996; and de Bondt, 2005.

competition and concentration in the WAMZ economies: bank credit to bank deposit, interest rate spread/margin and bank concentration ratio, will be discussed sequentially.

To assess the degree of competition in the banking sector of the WAMZ, the study uses Bank Credit to Bank Deposits ratio which, according to Beck and Demirguc-Kunt (2009: 9), is the ratio of claims on the private sector to deposit in commercial banks. They commented that the bank credit to bank deposit ratio measures the extent to which commercial banks intermediate the economy's savings into private sector credits. They further noted that an increase in the bank credit to bank deposit ratio is an indication of an increase in not only the level of economic development but the level of financial development. Figure 3.9 depicts plots of the bank credit to bank deposit ratios.

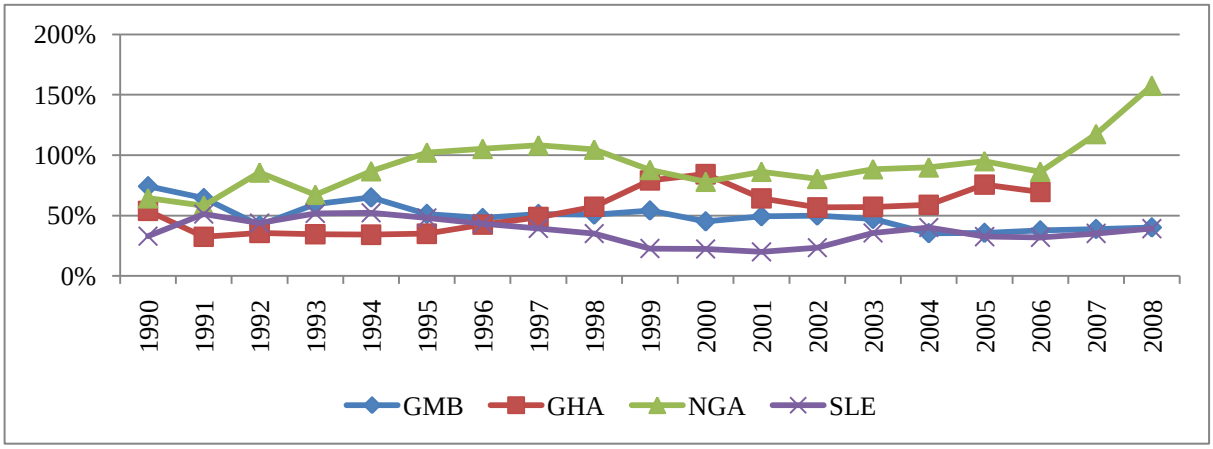


Figure 3.3: Bank Deposit to Bank Credit

Source: Compiled by author from Financial Structure Dataset by Beck and Al-Hussainy (2010).

Figure 3.3 shows that there are variations amongst the countries, ranging from 19.9% in 2001 in Sierra Leone up to 157.3% in 2008 in Nigeria. It shows that Nigeria has high intermediation efficiency compared to the other economies, whereas in Gambia and Sierra Leone there has not been a clear trend over time. In Ghana since 1995, the ratio shows a consistent increase until 2000, begins to drop for three years and starts rising again in 2004. Note that low ratios indicate financially underdeveloped economies in which banks lack the ability to attract deposits and channel these deposits into private sector credits (Beck and Demirguc-Kunt (2009: 9). The reverse is true.

Attention is now turned to interest rates spread (interest rates margin) which is the difference between lending and deposit rates. It could also be referred to as the difference between

earnings generated from a bank's assets and payments made on its liabilities. High spread between lending and deposit rates is an indication of concentration in the banking market. Thus, as noted by Hannan and Liang (1993), concentration in the banking market may lead to higher spread between deposit and lending rates. Figure 3.4 shows plots of interest rate spread for the economies under review from 1990 to 2009.

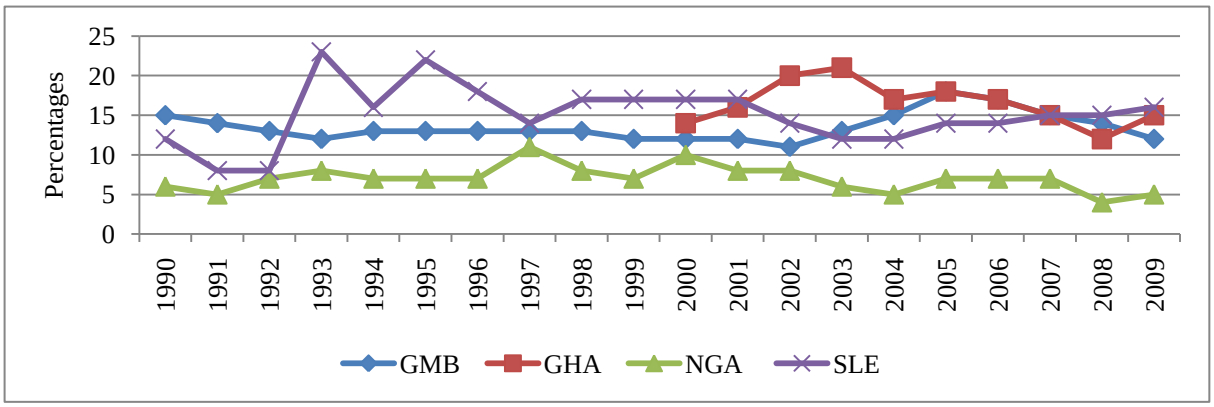


Figure 3.4: Interest Rate Spread in the WAMZ: 1990-2009

Source: Compiled by author from World Development Indicators (WDI) and Global Development Finance (GDF), World DataBank (World Bank, 2010).

In Gambia and Sierra Leone the loan market is much smaller and concentrated as the few banks operate in the form of conglomerates. The few large banks adjust interest rates to preferred customers sluggishly to market conditions. For instance, in Gambia, real lending rates and interest spreads at commercial banks have been high. This is due to factors such as high lending rates, weak legal environment and attractive high yields on government securities (Sriram, 2009: 8). Despite the rapid growth in the banking sector (from four banks in 2000 to fourteen in 2009) and the influx of foreign banks, Sierra Leone recorded the highest average spread and lending rates for the period under review as shown in Figure 3.4. This is an indication that banks dominate the financial system and that the non-bank financial markets, which are expected to compete with banks and serve as alternative sources of funding for firms and household in the economy, are still underdeveloped. Nigeria has the lowest interest spread and has been trending downwards over time. The low average interest rate spread in Nigeria reflects the high degree of competition in the banking markets and the active non-bank financial markets. Thus, it is expected that interest rate pass-through would be high in Nigeria compared to the other countries.

To gauge the level of competition in the WAMZ banking sectors, the Bank Concentration ratio, which is calculated as the ratio of the three largest banks assets to total banking sector

assets, was used. The plots in Figure 3.6 indicate that there has been no clear trend between Gambia, Ghana and Sierra Leone, but a slight decrease in Ghana's concentration ratios between 2005 and 2008. In Nigeria the concentration is very low compared to the other countries over time. It has been argued that low degree of bank concentration could mean high degree of competition in the banking market. The existence of active capital markets in Ghana and Nigeria provides households and firms with access to alternative sources of funding, such as securities markets, and this in turn is expected to increase the speed at which retail rates respond to changes in deposit rates.

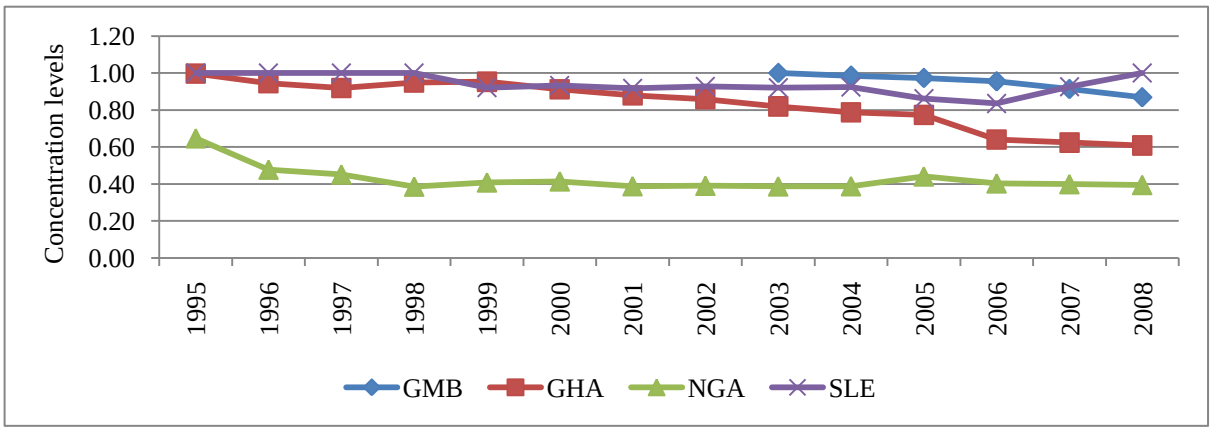


Figure 3.5: The Degree of Bank Concentration in the WAMZ Countries.
Source: Compiled by author from Financial Structure Dataset by Beck and Al-Hussainy (2010).

Economic theory suggests that the presence of active domestic securities markets should accelerate the speed of adjustment of retail interest rates to policy rates. For instance, Kamin *et al.* (1998: 28) suggest that in a well-developed and competitive capital markets, retail interest rates often respond to policy rates flexibly. This is expected to be the case for Ghana and Nigeria which have active securities markets. In Nigeria, the consolidations of the banking industry and the several reforms have intensified competition in the banking industry. The increase of the minimum capital requirement of approximately USD200 million has engendered banks to seek additional markets (WAMI, 2008: 26). In Ghana, the competitive environment between the banking sector and the non-bank formal and informal markets ensures provision of alternative sources of funding for business.

In an economy with developed non-bank financial markets, banks compete with other financial institutions as both borrowers and lenders, and this helps to stabilize and increase competition in the financial system. Increased competition will ultimately increase the speed

of adjustment of retail interest rates to official rates. As mentioned earlier, some of the WAMZ member countries such Nigeria and Ghana have made significant progress in establishing most of these institutions while in Gambia and Sierra Leone these institutions are burgeoning. For instance, prior to the civil war in Sierra Leone, the banking sector was highly concentrated: Barclays and Standard Chartered Bank together accounted for over 80 percent of the domestic market (Lue *et al.* 2002: 36).

As pointed out in the Section 2.3 of chapter two, the levels of financial development in the economies have implications for monetary policy transmission process. Economic theory predicts that an increase in the number of financial institutions and the emergence of non-bank financial institutions will be followed by innovations, increased level of intermediation, introduction of new products and these developments will provide alternative sources of funding for firms. Such improvements in the financial system will encourage competition not only within the banking market but also between the banks and non-bank financial markets. When such competitive environment is created economic theory suggests that the interest rate pass-through from policy interest rates to commercial banks interest rates will be quicker. The next section explores the Non-Bank financial Markets in the WAMZ.

3.3.1.3 The Size of the Non-Bank Financial Markets[53] *in the WAMZ*

A developed financial system will include a variety of non-bank financial institutions besides banking institutions. It has also been argued that non-bank financial markets such as the capital markets and interbank markets play pivotal roles in the transmission of monetary impulses in the economy. The non-bank financial markets provide alternative sources of funding for firms and households and in some cases performed the traditional role of commercial banks. Therefore, they are seen as an alternative to banks and compete with banks in both deposit and lending markets. The active presence of non-bank financial institutions in the economy is highly relevant for enhancing competition, market discipline and development of the financial system. Lue *et al.* (2002: 2) noted that banks promote market discipline, including their private clients by conducting credit risk analyses. Likewise, other institutions and markets also exercise discipline over banks, and this in turn strengthens the financial system. In this section, an overview of the capital, interbank and insurance

[53] Non-bank financial markets include stock markets, bond markets, government securities markets, secondary markets for mortgages and insurance, spot and forward foreign exchange markets, and forward markets for equities and bonds.

markets of the WAMZ will be presented and, thereafter, their implication for interest rate pass-through.

3.3.1.3.1 The Capital Markets

Stock exchanges, though confined within the national boundaries of the WAMZ member countries, have been in operation in Nigeria and Ghana since 1960 and 1989 respectively. Quite recently, Sierra Leone with assistance from Common Wealth Secretariat has also established a stock exchange, in June 2009.

The Ghana Stock Exchange (GSE) was formed in 1989 and started trading with 11 companies listed in 1990. Ghana's stock market capitalization expressed as a percentage of GDP stood at 18% at the end of December 2008. This figure is very low compared to other stock exchanges in Africa, for instance the Johannesburg Stock Exchange at the end of 2008 closed with 308%. The low stock market capitalization as a percentage to GDP is evidence that the exchange is dominated by debt offerings, and government bonds account for a significant proportion (BOG, 2008). Over the years, the GSE has witnessed a level of growth: from a total of 11 listed companies in 1990, there were 36 quoted firms by December 2008 (WAMI, 2008: 27). The performance of the GSE in 2008 improved during the recent financial crises. The annual report shows that the all-share index recorded over 50 percent appreciation. According to WAMI (2008: 27), GSE market capitalization stood at GHc. 17.89 billion (USD 15 billion) at the end of 2008.

Established in 1960, the Nigerian Stock Exchange (NSE) commenced operation in 1961 with 19 companies listed, and by the end of 2006 there were 228 listings; currently the NSE consists of six branches. The 2007/2008 financial turbulence reduced the number of equity and debt listings to 213 by the end of the first quarter of 2009. The NSE like its GSE counterpart also has government bonds dominating the debt offerings with low stock market capitalization as a percentage to GDP of 17% in 2006. The banking sector is the dominant sector of the exchange and accounts for over 60 percent of the top 20 companies' market capitalization (CBN, 2009).

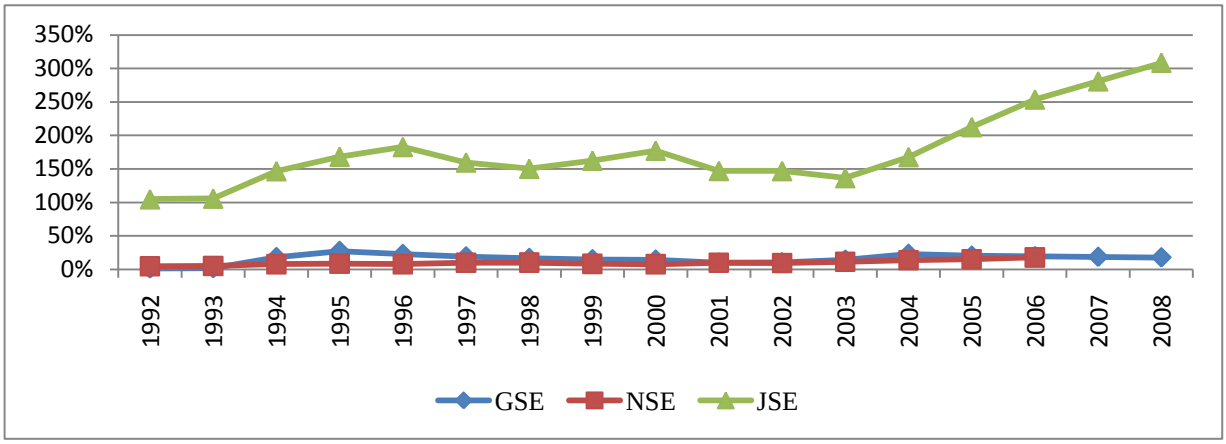


Figure 3.6: Ratio of Stock Market Capitalization to GDP in Ghana, Nigeria and South Africa

Source: Compiled by author from Financial Structure Dataset by Beck and Al-Hussainy (2010).

Figure 3.6 illustrates an equity market indicator that is used in empirical studies to indicate the size of the stock market relative to the size of the economy (Beck and Demirguc-Kunt, 2009: 13). It is clear from Figure 3.6 that in terms of stock market capitalization relative to the size of the economy, GSE is larger than the NSE. The market capitalizations of the GSE and NSE are very low compared to the JSE (i.e., Johannesburg Stock Exchange in South Africa) and those of advanced countries (Figure 3.6).

The size and the liquidity level of the stock market have implications for the transmission of monetary policy stance of the central bank. Economic theory predicts that economies with large and liquid stock markets will have high speed of pass-through since stock markets serve as an alternative source of funding for firms and household. Other measures, such as stock market total value traded to GDP, stock market turnover ratio and listed firms to population, used as indicators of capital market development are reported in Appendix B. Sierra Leone assisted by the Common Wealth Secretariat has established a stock exchange in 2009. The Sierra Leone Stock Exchange (SLSE) is still at its formation stage and as at the end of 2009 trading activities have still not commenced.

However, due to the low market capitalization and slow growth in this sector, a technical committee comprising experts from the stock exchanges and WAMI staff, has been set up for the harmonization of activities of the exchanges. This move is aimed at boosting growth of the capital markets, integration of the exchanges and promotion of cross-listing of stocks in a unified regional market (WAMI, 2008: 27). The unification and integration of the stock

exchanges in the WAMZ would have implications for the capital markets of the member states and the management of monetary policy in the region. It is expected that a growth in the capital markets of the region will be crucial for the effectiveness of monetary policy and enhance the speed with which retail interest rates respond to policy rates.

3.3.1.3.2 The Inter-Bank and Money Markets

The money market, which is described as a market for short-term funds usually with maturity not exceeding one year, is a key vehicle for the transmission of monetary policy impulses. The nature of instruments used in this market can be both short and long term and they can be used for either monetary policy or to procure government debt (Haan *et al.,* 2009: 71). The WAMZ member countries' money markets, like other money markets, are dominated by commercial banks. These banks, according to Haan *et al.* (2009: 71–72), depend on the money market for the management of their short-term liquidity positions and for the fulfilment of their minimum reserve requirements. Other participants in the WAMZ money market include money market funds, insurance companies and pension funds, while participation of discount houses is limited.

Money market in Gambia is an evolving market, evident by the increase in the volume of transactions from D575.00 million (USD 22 million) in 2007 to D1,075.50 million (USD 41 million) in 2008, reflecting an 87.04 percent growth (WAMI, 2008). Intensified activities are also witnessed in the inter-bank market as almost all the banks in the country actively participate in this market. On the other hand, the inter-bank and money market in Sierra Leone though active is characterized by few instruments such as 91-day, 182-day, 364-day treasury bills and one year treasury bond. The commercial banks, National Social Security and Insurance Trust (NASSIT), discount houses, other financial institutions, and individuals are the investors in this market. However, the Bank of Sierra Leone (BSL) recently replaced the rediscount window with a repo and reverse repo mechanism. This action is expected to stimulate activities in the inter-bank market and better manage the overall liquidity in the banking system (BSL, 2009: 27). Conversely, Nigeria's money and inter-bank market is more robust with a wide range of instruments compared to those of Gambia and Sierra Leone (WAMI, 2008). By implication, interest rate pass-through is expected to be higher in Nigeria than the other countries.

An active and intensified inter-bank market is crucial for monetary policy transmission since banks depend on this market for their short-term liquidity position. However, it is noteworthy

that the importance of the inter-bank market depends largely on whether the financial system is open or closed. In an opened financial system banks can easily access external sources of funding. In such an open financial system, commercial banks may be slow to react to changes in policy rate; thus the transmission of monetary pulses becomes rigid. While in a closed financial system, there are limited sources of finance available to commercial banks, which hence rely heavily on short-term accommodation from the central bank. The interest rate pass-through is expected to be higher in a closed financial system than an open financial system.

3.3.1.3.3 Insurance Markets

The insurance sector in the WAMZ is very small compared to that in developed countries, and it is characterized by licensed life and non-life insurance companies (including licensed insurance brokers and loss adjusters). The insurance market consists of about 150 licensed life and non-life companies. Nigeria accounts for the largest market share in the industry with over 100 licensed insurance companies contributing a gross annual industry premium of USD 673 million and market share of the top ten companies of 58 percent as of 2008. Ghana accounts for around 35 licensed life and non-life insurance companies accompanied by a total gross annual premium of USD 168 million. The top ten insurance companies in Ghana account for 75 percent of the total market share as of 2008 (WAMI, 2008: 28).

Despite the low capital requirements for insurance companies in Gambia and Sierra Leone, the insurance markets are very thin in these countries compared those in Nigeria and Ghana. In Sierra Leone the insurance market comprises ten (10) registered companies, while Gambia has nine (9) registered companies. The capital requirement for insurance companies in Gambia is USD 0.68 million, and in Sierra Leone, USD 0.08 million. These figures contrast with those of Nigeria which has capital requirements of $17.0 million, $25.0 million and $83 million respectively for life, non-life and re-insurance. In Ghana, the capital requirement is $1.0 million, and $2.5 million for direct insurance and re-insurance respectively. In the next section the degree of competition and concentration in the WAMZ banking sector are discussed.

3.4 MONETARY POLICY FRAMEWORK IN THE WAMZ

The monetary policy regime in an economy is crucial for the speed of adjustment of retail interest rates to changes in monetary policy rates. It has been argued that economies that

adopt monetary policies that promote free market principles and competition in the financial system and more transparent monetary policy tend more to a high speed of adjustment than those with restrictive policies (Aziakpono and Wilson, 2010: 29–30). Central banking in the WAMZ has witnessed continuous changes, and these changes are in line with international trends in central banking. For instance, Ghana adopted formal Inflation Targeting in 2007, while Gambia and Sierra Leone have restructured their respective central banks and now have active interbank markets and have introduced the Repo rate. In this regard, the Repo rate[54] and the Reverse rate[55] have become the main instruments for conducting monetary policy (WAMI, 2008: 29). This is an indication that the central banks are now shifting from non market-oriented policy instruments to more market oriented ones.

Consequent to the rapid growth in the banking industry within the WAMZ region, monetary policy management is gradually moving from direct controls, such as interest rate controls and credit ceiling and cash reserve requirements, to be more market-oriented (WAMI, 2008: 25–27). With market-oriented regimes, it is expected that retail interest rates will respond to official rates within short lags.

3.4.1 Monetary policy framework in Gambia

The Central bank of Gambia (CBG) was established in 1971. The primary objective among others of monetary policy in Gambia is price stability. Other objectives include achieving and maintaining exchange rate stability, and having a sound and vibrant financial system to encourage and promote sustainable economic development. In the late 1990s, interest rates in Gambia were very high due to the tight monetary policy strategy of the CBG to contain inflation to levels below 6% in the economy (Lue *et al*., 2002: 26, WAMI, 2008: 35).

The current operating framework of monetary policy in Gambia is monetary targeting. The bank adopts broad money (M2) as its intermediate target and reserve money as operating target. Continuous monitoring of the net domestic assets and net foreign assets of the CBG on a weekly basis is the crux of its implementation. To signal the policy stance, the authorities announce the rediscount rate during the MPC bimonthly meetings. Gambia uses treasury bills as the main policy instrument through open market operations. Instruments such as

[54] The Repo rate refers to the rate at which banks invests their excess funds in Government securities or central bank securities.
[55] The Reverse repo rate refers to the rate at which banks obtain funds from the central bank pledging Government securities held to the central bank.

rediscount window, reserve requirement and purchase/sales of foreign exchange are also used to influence liquidity conditions in the market (Sriram, 2009: 9–10).

3.4.2 Monetary policy framework in Ghana

The objective of monetary policy in Ghana since the establishment of the Central Bank of Ghana (BOG) in 1957 is maintaining price stability and this has remained unchanged. Monetary policy implementation in Ghana has undergone several changes through phases. Prior to the 1980s, the BOG used a controlled regime with direct instruments, but after the successful launch of the Economic Recovery Program (ERP) in early 1983, the use of an indirect instrument under the monetary framework was adopted. This framework was in effect until the adoption of the current regime of inflation targeting (Amoah and Mumuni, 2008: 13).

In the late 1990s and early 2000s, the BOG was faced with turbulent monetary policy management as a third of the total money supply was held in private hands outside the financial system. This raised concern for the central bank, which stimulated commercial banks to intensify their campaigns for the mobilization of deposit to the banking system and to mop up the excess liquidity (Lue *et al*., 2002: 27). The aim of monetary policy in Ghana as at 2008 was to reduce end-period inflation to the range of 6 to 8 percent using inflation targeting framework. Further to successful implementation of the inflation targeting regime, anecdotal evidence shows that market interest rates were responsive to movements in the monetary policy rates (WAMI, 2008: 40).

The BOG, in May 2007, announced the adoption of inflation targeting as its monetary policy framework with a medium term target of 5% CPI inflation. Ghana is the second Sub-Saharan African country to adopt inflation targeting framework following South Africa. Further to this development, the financial system is expected to be more market-oriented. Also, it is expected that an inflation targeting regime will enhance accountability and transparency of monetary policy and therefore high or complete IRPT from policy rate to retail interest rates (Liu *et al.*, 2008: 506).

3.4.3 Monetary Policy Framework in Nigeria

The Central Bank of Nigeria (CBN) like other central banks has the responsibility of overall control and administration of monetary and financial sector policies of the Federal

Government. Consequently, CBN is responsible for administration of banks and other financial institutions. Further to the amendment of the bank's mandate, the 1991 Act required that the sole aim of the CBN is ensuring high standards of banking practice and financial stability through its surveillance activities, as well as the promotion of an efficient payment system (CBN, 2008).

Since inception in 1959, the CBN has adopted several monetary policy regimes. Exchange rate targeting regime was adapted from 1959 to 1973, and monetary targeting regime from 1974 to date. Under these regimes, direct and indirect monetary controls were implemented from 1974 to 1992 and 1993 to date respectively. These policy regimes were operated on a short-term basis (i.e., annually) from 1959 to 2002. However, the CBN introduced a medium term monetary policy framework in 2002 to address the long standing lag with which monetary policy actions affect its ultimate objective in the short-term (CBN, 2008).

As of 2008, monetary policy was focused on maintaining a disinflationary path with the sole aim of achieving single-digit headline inflation. The CBN adopted a tight monetary policy stance to sustain monetary and price stability. Subsequent to this the CBN maintained a Monetary Policy Rate (MPR) at 9.5% and continued to use Open Market Operation (OMO) for liquidity management (WAMI, 2008: 50).

3.4.4 Monetary Policy Framework in Sierra Leone

In Sierra Leone the monetary policy objective is to achieve and maintain price stability. The operating target for achieving this goal is reserve money. The main monetary tool of Bank of Sierra Leone (BSL) is the weekly primary auction of treasury bills. BSL relies on indirect instruments of monetary policy such as Open Market Operation (OMO), Reserve Requirements and Repo/Reverse repo transactions (BSL, 2009: 5).

As of 2008, the aim of monetary policy in Sierra Leone was to contain inflationary pressure; ensuring high and sustainable growth and financial stability. Achieving these goals requires a tightening monetary policy to limit the effect of external shocks. At the end of 2008, the BSL introduced the 182 day and 364 day Treasury Bills to enhance monetary policy management (WAMI, 2008: 56).

Like other African countries, Sierra Leone adopted the World Bank sponsored adjustment programs in the late 1980s and early 1990s. The series of coups d'état in 1992 and 1997, and the anarchic situation in the country led to a collapse in the formal financial system in May

1997. However, the financial system was revamped in 1999 when economic and financial stability was restored by the Nigerian led ECOWAS/United Nations forces (Lue *et al.,* 2002: 36).

3.5 SUMMARY AND CONCLUSION

The preceding sections presented an overview of the financial systems and monetary policy framework in the WAMZ economies. One thing that became increasingly clear in the overview is that, in all four countries, both monetary policy framework and banking industries have changed as a result of the liberalization efforts embraced by the countries in the 1980s and 1990s. It is important to note that the forward looking monetary policy strategies adopted by the various monetary authorities, adoption of inflation targeting regime in Ghana, opening of a stock exchange in Sierra Leone, an increasing number of banks and the increased competition in the banking industry, have laid the ground for more efficient and effective financial markets in the region.

The insight obtained from the preceding overview reveals that the interest rate channels of monetary transmission could play a role in transmitting monetary impulses in the various economies and consequently their interest rate pass-through. However, a thorough analysis is required before any conclusion can be drawn as to whether the interest rate channel is important for the effectiveness of monetary policy and, consequently, at what magnitude and speed the monetary policy stance is transmitted. The next chapter presents the methodology for the assessment of the speed and magnitude of the pass-through.

CHAPTER FOUR:
METHODOLOGY AND EMPIRICAL FRAMEWORK

4.1 INTRODUCTION

Studies on monetary policy transmission and interest rate pass-through have widely used several variants of time series techniques to investigate the relationship between two or more variables. One common technique in the literature is the use of cointegration and error correction techniques to search for long-run equilibrium relationships among variables. Since the seminal work of Engle and Granger (1987), several variants of cointegration technique have been developed and adapted in empirical studies to find long-run relationships between two or more variables in a system.

The main focus of this chapter is to provide the general framework for the empirical analysis. In pursuing the objectives stated in chapter one of the study, this chapter presents both empirical and analytical methodology for the study. The focus of this study is to examine the magnitude, speed and the possibility of asymmetry in the pass-through of official rates to retail rates in four of the five countries that make up the WAMZ. To do this, the study examines the relationship between official interest rate and retail interest rates (i.e., lending and deposit rates) using a rolling regression analysis in an error correction model (ECM) framework. The rest of the chapter is organized as follows: Section 4.2 defines the data and the sources from which they are obtained; Section 4.3 discusses the estimation techniques. The analysis starts with the unit root tests followed by the tests for cointegration and ends with the empirical pass-through analysis, and Section 4.4 concludes the chapter.

4.2 DATA AND METHODOLOGY

4.2.1 Data Definitions, Selection and Sources

The study investigates the interest rate pass-through of changes in the official interest rate to retail interest rates in four Anglophone West African countries. To this end, the study uses monthly data on Central Bank's policy/official rates and retail interest rates from 1989 to 2009 for all the interest rate series for Gambia, Nigeria and Sierra Leone. The interest rate series for Ghana starts from 2000 and ends in 2009. This is due to several constraints; lack of data on the retail lending rate series for Ghana and limited availability of data on average

lending rate to manufacturing. Following Acheampong (2005), average lending rate to manufacturing was used as a proxy for lending rates which is evidence of the fact that the Ghanaian loan market is dominated by the manufacturing sector. Discount rate to commercial banks for Gambia and Nigeria are used as variables representing the central bank official interest rates, while the 91-day treasury-bill rates are used as official interest rate for Ghana and Sierra Leone. Except for Ghana, for which average lending rate to manufacturing is used as proxy for lending rate, all lending and deposit rates for the countries under investigation represent commercial banks' retail rates. All the interest rates series are sourced from the International Monetary Fund's (IMF) International Financial Statistics (IFS) database via Thomson DataStream with the exception of Ghana's lending rate, which was obtained from the download facility of the Central Bank of Ghana. Table 4.1 provides further information on all the interest rate series for the countries under investigation.

Table 4.1: Summary of data used for estimation (policy and retail interest rates)

	Type	**Acronym**	**Source**	**Start date**	**End date**
Gambia					
Discount Rate	Official rate	DISR	IMF/IFS	1989M01	2009M12
Lending Rate	Retail rate	LR	IMF/IFS	1989M01	2009M12
Deposit Rate	Retail rate	DR	IMF/IFS	1989M01	2009M12
Ghana					
Treasury Bill Rate	Official rate	TBR	IMF/IFS	2000M01	2009M12
Lending Rate	Retail rate	LR	BOG	2000M01	2009M12
Deposit Rate	Retail rate	DR	IMF/IFS	2000M01	2009M12
Nigeria					
Discount Rate	Official rate	DISR	IMF/IFS	1989M01	2009M12
Lending Rate	Retail rate	LR	IMF/IFS	1989M01	2009M12
Deposit Rate	Retail rate	DR	IMF/IFS	1989M01	2009M12
Sierra Leone					
Treasury Bill Rate	Official rate	TBR	IMF/IFS	1989M01	2009M12
Lending Rate	Retail rate	LR	IMF/IFS	1989M01	2009M12
Deposit Rate	Retail rate	DR	IMF/IFS	1989M01	2009M12

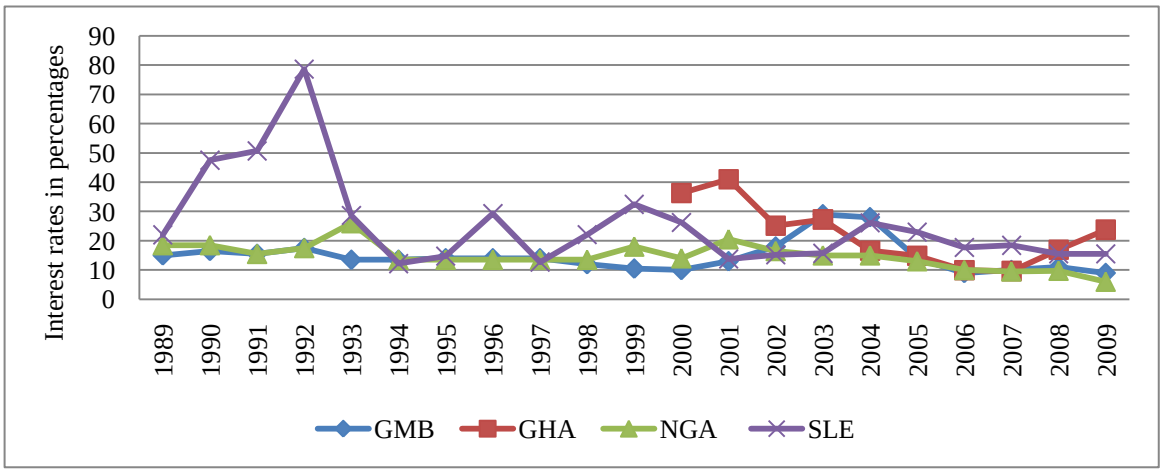
Notes: DISR-Discount Rate, DR-Deposit Rate, LR-Lending Rate, TBR-Treasury Bill Rate, BOG - Central Bank of Ghana, IMF/IFS - International Monetary Fund/International Financial Statistics.

To conduct a detailed analysis of interest rate dynamics in the countries under investigation, two sets of analyses will be done. First, analysis for the entire sample period will be conducted. Second, the rolling regression technique[56] will be applied with a sample period of six years (i.e., 72 observations). A total of sixteen (16) samples will be analysed starting with January 1989 to December 1994, January 1990 to December 1995, January 1991 to December 1996 and so on until January 2004 to December 2009. For Ghana, five (5) samples will be analysed starting from January 2000 to December 2005, January 2001 to December 2006 and so on until January 2004 to December 2009. The idea behind the rolling window is that it reveals the dynamic development of the pass-through over time (Aziakpono and Wilson, 2010: 17). The rolling regression technique is very important evidence of the fact that financial systems of the countries under investigation have witnessed significant changes and these changes have implications for monetary policy and the level of interest rate pass-through.

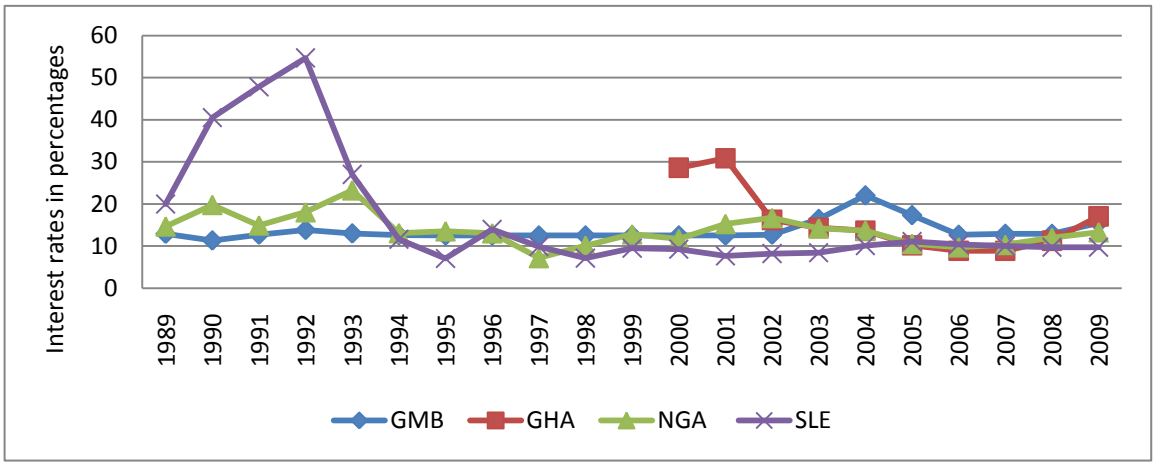
Figure 4.1 shows a plot of the interest rate series (i.e., policy, lending and deposit rates) for the countries under investigation. It is evident from the plot that lending rates on average are very high in Ghana with an average of 32 percent followed by Sierra Leone which averaged 31 percent. Gambia also has an average lending rate of 27 percent and Nigeria recorded the least with an average of 20 percent for the period under review. One reason for the low lending rate in Nigeria is the result of the several financial reforms which have enhanced competition among banks and the non-bank financial sectors. One notable exception is the interest rates for Sierra Leone. Between the periods 1990 to 1996, lending and deposit rates were very high with a maximum of 73 percent for lending rates and 70 percent for deposit rates. The reason for this was the civil war, which officially started in Sierra Leone in 1991 and caused instability in the financial system of the country.

[56]Rolling regression is a technique with fixed number of observations and the start date and the end date successively increase by one observation. See Brooks (2008: 246) for detailed explanation.

A: Policy rates – 1989 to 2009



B: Deposit rates – 1989 to 2009



C: Lending rate – 1989 to 2009

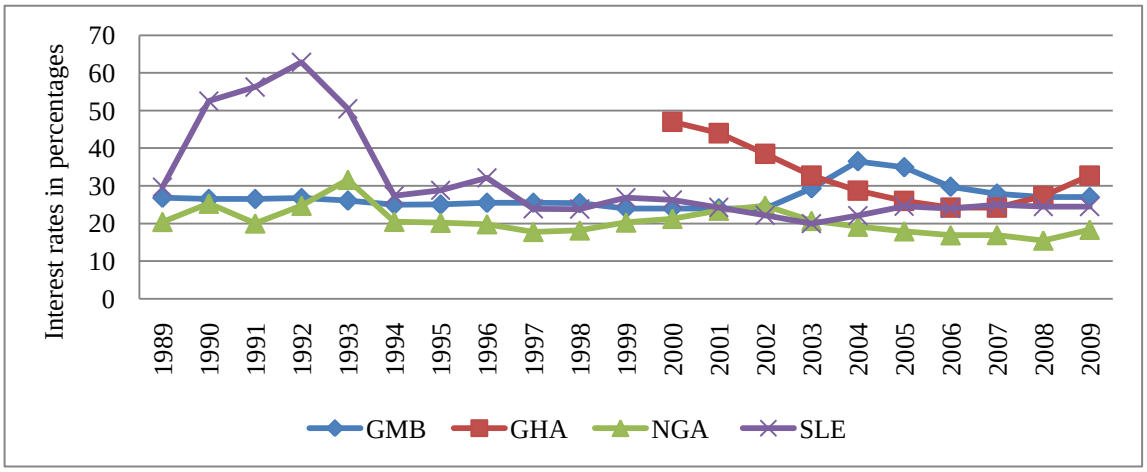


Figure 4.1: Interest Rate Behaviour: 1989–2009

4.3 ESTIMATION TECHNIQUES

4.3.1 Tests for Cointegration

It is a common phenomenon that time series data are non-stationary but move together over time, that is, there exist some influences on the series which implies that the series are bound by a long-run equilibrium relationship. Non-stationary variables are said to be cointegrated if a linear combination of them is stationary (Brooks, 2008: 336). Also, if the interest series are cointegrated, it means they have a long-term, or equilibrium, relationship between them. (Gujarati and Porter, 2009: 764). The essence of cointegration analysis is to determine whether such a long-run relationship exists, and if so, the number of cointegrating vectors. The primary model that shows the linear relationship between the interest rate series is commonly specified as:

$$y_t = \beta_0 + \beta_1 x_t + u_t \qquad (4.1)$$

where y_t represents the endogenously determined commercial banks retail interest rates (i.e., Lending and Deposit rates); x_t denotes the exogenously determined central bank policy/official rates (here discount rates or treasury bills rates); β_0 denotes the intercept coefficient; β_1 is the slope coefficient/long-run parameter and u_t is the stochastic error term. Equation (4.1) can be used for the bi-variate cointegration analysis to examine the dynamics of interest rates (retail and policy) amongst the countries under investigation.

The natural starting point for a study of this nature is to specify a model such as Equation (4.1) which can be used for estimating the short-run error correction and the long-run cointegrating vectors. It should be noted that variables used to estimate such models have time series properties, and it is therefore imperative that the interest rate series are tested for unit root. Testing time series data for unit root is necessary to avoid spurious[57] or nonsense regression. Therefore, to avoid spurious regression, the analysis starts by conducting unit root tests. The aim of the unit root test is to determine the order of integration among the interest rate series. That is, whether the series are integrated of order zero I(0), order one I(1) or higher orders. Note that if the interest rate series are integrated of order I(1), econometric theory suggests that the linear combination of them will produce a residual that is integrated of order I(0) implying that the series have a long-run equilibrium relationship; hence they are

[57] According to Brooks (2008: 19) a spurious regression is one with significant coefficient estimates and high R^2 but makes no economic sense.

cointegrated. However, cointegration can still be present when I(0), I(1) and I(2) variables are combined (Harris, 1995: 80).

Statistical techniques such as graphical analysis; autocorrelation function (ACF); Correlogram; Unit Root tests (e.g., Dickey–Fuller test; Augmented Dicky–Fuller (ADF) test; Philips–Perron; Ng–Perron); and those that directly test for stationarity[58], have been developed to investigate unit roots/stationarity. In this study, the ADF test (tests the null hypothesis that the series have a unit root against the alternative of stationarity) and the Kwiatkowski, Philips, Schmidt and Shin (KPSS, 1992) test (tests the null hypothesis of stationarity against the alternative of non-stationarity) are used to examine the stationarity properties of the series[59]. The ADF test has been widely used in empirical studies but has been criticized for its poor size and power properties (Brooks, 2008: 330–340). Consequent to these criticisms, the KPSS test will be used to complement the ADF test. Unlike the ADF test, the KPSS test does not suffer from small sample problems (Burger, 2008: 11). After establishing the order of integration of the interest rate series, the next step is to test for cointegration.

Several techniques[60] for testing for cointegration between series of non-stationary data have been employed in empirical studies of this nature. For the purpose of this study, four approaches will be used to test for cointegration among the interest rate series. These include: the Johansen Maximum Likelihood approach (Johansen, 1988), the Engle–Granger approach, the Cointegrating Regression Durbin–Watson (CRDW) approach and the Error Correction based approach[61]. The next section discusses the econometric procedures for the empirical pass-through analysis.

4.3.2 Empirical Pass-Through Analysis

Pass-through analysis of interest rates is attributed to the pioneering work of Cottarelli and Kourelis (1994). After this study, pass-through analysis has been extensively employed in empirical studies in diverse ways. For instance, it can be used to estimate the speed of adjustment of retail interest rates to changes in policy rates, the level of competition in banking markets, and asymmetries across countries using a single monetary policy. An

[58] See Gujarati and Porter (2009:748–759) for full discussion on these tests.
[59] For detailed discussion of the ADF and KPSS test, see Brooks (2008: 327–331)
[60] Johansen and Juselius, Engle–Granger, Cointegration Regression Durbin-Watson, Autoregressive Distributed Lag and Error Correction Model Based techniques.
[61] The cointegration tests are not discussed here since they have been widely applied in empirical studies. However, chapter seven of Brooks (2008) and Kremers *et al*. (1992) provided detail analysis of the tests.

important application of the pass-through analysis is to investigate the monetary policy transmission process as it can be used to unveil how fast and how complete changes in monetary policy rates are transmitted onto retail interest rates (Sander and Kleimeier, 2006: 216).

Variants of the pass-through methodology have been widely applied in the euro zone and other regional economic groupings; for instance, Samba and Yan (2010) - CAEMC; Hulsewig *et al.* (2009) - Euro area; Aziakpono, Kleimeier and Sander (2007) - SADC; Sander and Kleimeier (2006) - CMA; and de Bondt (2005) - Euro area. The study focuses on the four Anglophone West African countries which are members of the WAMZ. Following the influential work of Cottareli and Kourelis (1994) which has been followed by de Bondt *et al.* (2002); Toolsema *et al.* (2002); Sander and Kleimeier (2004; 2006); Aziakpono and Wilson (2010), the empirical model showing the relationship between the interest rates is specified as:

$$RR_t = \alpha_0 + \sum_{i=1}^{m^*} \beta_{RR,i} RR_{t-i} + \alpha_1 PR_t + \sum_{j=1}^{n^*} \beta_{PR,j} PR_{t-j} + \varepsilon_t \qquad (4.2)$$

where RR_t represents the endogenously determined commercial banks retail interest rates (i.e., Lending and Deposit rates); PR_t denotes the exogenously determined central bank policy/official rates (here discount rates and treasury bills rates); m^* and n^* indicate the optimal lag lengths; α_0 denotes the intercept or the credit risk premium (Marotta, 2009: 192) and based on the cost of funds approach, α_0 represents a constant markup or markdown on the retail interest rates (de Bondt, 2002: 8; Aziakpono and Wilson, 2010: 19). The parameter α_1 is the slope/long-run parameter and ε_t is the stochastic error term. The slope/long-run parameter (α_1) shows the percentage change in policy rate that is reflected in changes in retail interest rates in the long-run; it shows by how much retail interest rates change in response to a change in policy interest rates (Samba and Yan, 2010: 36). Building from the cost of funds approach proposed by de Bondt (2005: 45) and followed by Aziakpono and Wilson (2010: 19), it is expected that $0 \leq \alpha_1 \leq 1$. A value close to zero for α_1 implies that the degree of long-run pass-through is incomplete or slow. On the other hand, if α_1 is equal to one the long-run pass-through is said to be complete. In certain instances, it is also possible for α_1 to have a value greater than one; in such a case there is an over pass-through[62]. Most empirical studies have shown that even though the long-run PT exhibits some degree of variability from one

[62] See de Bondt (2005: 45) and Aziakpono and Wilson (2010: 19) for further explanation.

country to another, it is in most cases close to one (i.e., complete). This phenomenon is common in most advanced and emerging economies.

The presence of cointegration reveals that there is a stable long-run relationship between the interest rate series. Therefore the empirical long-run pass-through can be estimated as:

$$RR_t = \theta_0 + \theta_1 PR_t + \varepsilon_t \quad (4.3)$$

The above equation is the parameterized form of Equation (4.1) and shows the long-run relationship between retail interest rates and policy rates. The parameters θ_0 and θ_1 denote the long-run intercept and slope coefficients respectively. Note that if the interest rates series are cointegrated, the long-run pass-through, otherwise known as long-term multiplier θ_1 can be estimated from Equation (4.3). A value of one (1) indicates that long-run PT is complete, while a value less than one (1) indicates incomplete pass-through. As mentioned earlier, determining whether the long-run and short-run PTs are complete or incomplete is very important for a study of this nature since a complete PT is an indication of an effective interest rate channel. Theory suggests that when two or more series are cointegrated there is a long-run or equilibrium relationship between them, although in the short-run there may be disequilibrium.

However, monetary authorities are more concerned about the immediate or short-term impact than long-term impact of monetary policy on their target variables. Hence, analyses of the short-run response of the interest rate series to a change in policy rate are crucial for a study of this nature. Note that the times series for interest rates exhibit an I(1) property (Sander and Kleimeier (2004: 464). Building from the model in Equation (4.2), the empirical short-run pass-through model will be estimated using first differences to avoid the problem of spurious regression as shown below:

$$\Delta RR_t = \beta_0 + \sum_{i=1}^{m^*} \beta_{RR,i} \Delta RR_{t-i} + \beta_1 \Delta PR_t + \sum_{j=1}^{n^*} \beta_{PR,j} \Delta PR_{t-j} + \varepsilon_t \quad (4.4)$$

where Δ denotes the first differenced operator of the parameters, m^* and n^* represent the number of lags chosen while the β_0 and β_1 parameters are the short-term intercept and slope coefficients respectively. The slope coefficient (β_1) is interpreted as the short-run or immediate pass-through. It is very important in pass-through analysis as it shows the immediate effect of changes in policy rates on retail interest rates (Aydin, 2007: 15). Also, in Sander and Kleimeier (2004: 465) terminology, it could be referred to as the impact

multiplier. Thus, if β_1 is equal to one (β_1=1) it indicates that the short-run PT is complete. Alternatively, if β_1 assumes a value less than one (β_1<1) it indicates an incomplete short-run PT of changes in official rates to retail interest rates (Sander and Kleimeier, 2004: 465). Several factors can account for the incomplete PT of changes in official rates to retail interest rates; fortunately, these factors have already been discussed in Section 2.3.1. It is worth mentioning that estimating Equation (4.4) at first difference will lead to a loss of information about long-run relationships but Sander and Kleimeier (2004: 464) noted that such information could be recovered if retail interest rates (RR) and policy rates (PR) are cointegrated.

The long-run pass-through can also be computed from equation (4.4) as an alternative to equation (4.3). This alternative procedure for computing the long-run PT was proposed by Kwapil and Scharler (2010: 243) as follows:

$$\theta_1 = \left(\sum_{i=0}^{m} \beta_1\right) / \left(1 - \sum_{j=1}^{n} \beta_{RR,_i}\right) \qquad (4.5)$$

where β_{RR} is the coefficient of retail interest rates and β_1 denotes the coefficient of policy interest rate. As highlighted earlier, if θ_1=1 pass-through is complete and a value less than one (θ_1<1) indicates stickiness in lending and deposit rates. It is worth noting that there are instances in which the long-run pass-through would be greater than one (θ_1>1). Such a situation is described as overshooting or overpass-through. According to Sander and Kleimeier (2004: 465) overshooting may not necessarily imply banks are rationing credit but being compensated for higher risk.

4.3.3 Equilibrium Correction or Error Correction Model (ECM)

The Granger Representation Theorem suggests that if two variables, for instance policy rate and retail interest rates, are cointegrated, the relationship between them can be expressed as an error correction model (Gujarati and Porter, 2009: 764). Leuvensteijn *et al.* (2008: 15) noted that an error correction model unravels the long-run co-movement of variables from the short-run adjustment towards the equilibrium; therefore the relationship between non-stationary but cointegrated variables should be based on an error correction model. Note that if the error correction coefficient is statistically significant, one can deduce that market forces are in operation to restore long-run equilibrium (Aziakpono, Wilson and Manuel, 2007: 9). Therefore, if policy rate and retail interest rates are cointegrated, it shows that they have a stable long-run equilibrium relationship, while a short-run disturbance between policy rate

and retail interest rates is corrected or adjusted back towards equilibrium by the error correction mechanism (Aziakpono, Wilson and Manuel, 2007: 9).

Applying the error correction framework to the relationship between policy rates and retail interest rates using monthly data, one can deduce that the error correction framework therefore represents, within a month, how much retail interest rates (i.e., lending and deposit) adjust to return to their long-run equilibrium after a shock or change in the policy rate. The model specified in Equation (4.4) accounts for the short-run dynamics of the pass-through and leads to the loss of information about long-run relationships even though it avoids the problem of spurious regression. According Sander and Kleimeier (2004: 464), if retail interest rates and policy rate are cointegrated, information about long-run relationships can be recovered by augmenting Equation (4.4) with a lagged error correction term (ECT) as shown below:

$$\Delta RR_t = \beta_0 + \sum_{i=1}^{m^*} \beta_{RR,i}\, \Delta RR_{t-i} + \beta_1 \Delta PR_t + \sum_{j=1}^{n^*} \beta_{PR,j} \Delta PR_{t-j} + \beta_{ECT} ECT_{t-1} + \varepsilon_t \qquad (4.6)$$

where Δ indicates first difference, β_{ECT} is the coefficient of the error correction term and it measures the speed of adjustment to equilibrium. The coefficient of β_{ECT} is expected to be negative to restore equilibrium and its size determines the speed of adjustment to long-run equilibrium. ε_t is the white noise error term. ECT_{t-1} is the error correction term representing a series of the residuals obtained from the cointegrating Equation (4.2) and if it is statistically significant, it could mean that market forces are in operation to restore long run equilibrium after any short run disturbance (Aziakpono, Wilsin and Manuel, 2007: 9).

The error correction model in Equation (4.6) indicates that a change in retail interest rates depends on a change in policy interest rates and also on the equilibrium error term (Gujarati and Porter, 2009: 764). The expected sign of β_{ECT} should be negative and thus implies that the change retail interest rates should be negative to restore equilibrium.

Once the short-run dynamics between policy and retail interest rates have been estimated from an error correction model, the usual procedure is to determine the time taken for the retail interest rates to return to attain the long-run adjustment. The procedure used to determine this is called the Mean Adjustment Lag (ML) attributed to Doornik and Hendry (1994). The next section discusses the concept of ML, symmetric and asymmetric adjustments in an error correction framework.

4.3.4 Mean Adjustment Lag: Symmetric and Asymmetric Error Correction Framework

It is important to note that while error correction showed the adjustment of retails interest rates towards equilibrium, the ML shows the time taken for these rates to achieve the long-run PT. The symmetric mean adjustments lag of a complete pass-through can be calculated from Equation (4.6) above. The mean lag which shows the speed of adjustment of retail interest rates back to equilibrium after a change in monetary policy was proposed by Doornik and Hendry (1994) and has been followed by Scholnick (1996); Sander and Kleimeier (2004); Chong *et al.* (2006); Egert *et al.* (2007); Aziakpono, Wilson and Manuel (2007); Kwapil and Scharler (2010); and Aziakpono and Wilson (2010). It is calculated as follows:

$$ML = (1 - \beta_1)/\beta_{ECT} \qquad (4.7)$$

The above Equation (4.7) could also be referred to as the degree of rigidity for the symmetric error correction model. With reference to this study, Equation (4.7) assumes that the adjustments are symmetric when the retail interest rates are above or below their equilibrium level (Scholnick, 1996: 489). Therefore, high mean lag implies high rigidity (i.e., slow adjustment) of retail interest rates to changes in the policy rates. Conversely, a low mean lag shows low rigidity (fast adjustment) of the retail interest rates to changes in policy rate (Aziakpono, Wilson and Manuel, 2007: 9).

To detect potential asymmetry in the adjustment of retail interest rates to changes in policy rate, the study follows the technique proposed by Scholnick (1996) to examine the asymmetric adjustment of retail interest rates when above or below their equilibrium level. When a residual is above its mean, it can be interpreted as the retail interest rate being above its equilibrium level with respect to policy interest rate. The technique required that each residual (labelled here as *EC*) obtained from the cointegrating regressions be divided into two distinct set of series, EC^+ and EC^-, where EC^+ represents the error correction term when residuals are above their equilibrium levels, and EC^- represents the error correction term when residuals are below their equilibrium levels; these are estimated as follows:

$$EC^+ = EC, \quad \text{if} \quad EC > \mu$$

$$EC^+ = 0, \quad \text{if} \quad EC < \mu, \qquad (4.8)$$

and

$$EC^- = EC, \quad \text{if} \quad EC < \mu$$

$$EC^{-} = 0, \qquad \text{if} \qquad EC > \mu \tag{4.9}$$

where μ is the mean of residual (*EC*). Splitting the residuals has implication for the speed of adjustment of retail interest rates after a change in the policy rates. Recall that the cointegrating residuals are *I*(0), which literally implies that the series are mean reverting. Therefore, applying this to the study, if the residual is above its mean, it can be translated as retail interest rates (lending or deposit rate) are also above their equilibrium levels with policy rate. When such disequilibrium situations exist, it is desirable for these rates to trend downwards to equilibrium. On the other hand, when the residual is below its mean, retail interest rates are below their equilibrium levels with policy rate. Hence, it is expected to move back upward to equilibrium.

The asymmetric short-run dynamic equation can be obtained from Equation (4.6) as follows:

$$\Delta RR_t = \beta_0 + \beta_1 \Delta PR_t + \delta_i \sum_{i=1}^{m^*} \Delta PR_{t-i} + \gamma_j \sum_{j=1}^{n^*} \Delta RR_{\,t-j} + \theta_1 EC_{t-1}^{+} + \theta_2 EC_{t-1}^{-} + \varepsilon_t \tag{4.10}$$

where θ_1 and θ_2 are the coefficients of the error correction terms when the retail interests are above and below equilibrium respectively. Therefore, the derived asymmetric mean adjustment lags are:

$$ML^{+} = (1 - \beta_1)/\theta_1 \tag{4.11}$$

and

$$ML^{-} = (1 - \beta_1)/\theta_2 \tag{4.12}$$

Equations (4.11) and (4.12) are the asymmetric adjustment lags in retail interest rates when they are either above (4.11) or below (4.12) their equilibrium means. To test whether asymmetry exists, Scholnick (1996: 490) suggests using the Wald Test with a $\chi^2(1)$ distribution on the restriction that $\theta_1 = \theta_2$ in Equation (4.10) (i.e., Equations 4.11 and 4.12 are equal). Therefore, equality implies symmetry (or no asymmetry), otherwise, asymmetry exists (Aziakpono and Wilson, 2010: 21). The importance of asymmetric mean adjustment is that it reveals whether the speed of adjustment is faster upwards or downwards. This further provides an indication of the direction of the rigidities in the interest rates being analysed.

In particular, the Wald test has implications for this study as it reveals the asymmetric responses to shocks or innovations in monetary policy. For instance, retail interest rates react

differently to expansionary and contractionary monetary policies. Therefore, when residuals are above equilibrium levels, retail interest rates move down, and when residuals are below their equilibrium levels, retail interest rates move up.

4.4 SUMMARY AND CONCLUSION

This chapter set out an analytical framework in which the methodological issues relating to the measurement of interest rate pass-through are analysed. The chapter starts with the definition, sources and scope of the data used for the empirical investigation. It progressed by discussing the empirical model and techniques employed to estimate such models. It started with the first step in which a test for stationarity or unit root on the series is carried out. The two commonly used techniques in the literature for testing for stationarity (i.e., ADF and KPSS) are proposed. Once the stationarity and correct order of integration of the series have been inferred, the usual procedure is to estimate the long-run relationship, otherwise known as cointegrating relationship. To obtain robust cointegrating relationship, four approaches for testing for cointegration are proposed.

Once the null hypothesis of non cointegration has been rejected and cointegration between the series has been ascertained, a thorough pass-through analysis is conducted to unveil the short-run and long-run pass-through dynamics of interest rates for both the entire estimation period and rolling windows. The rolling window technique is used to identify whether pass-through of monetary policy impulses has become similar over time. The error correction model which measures the degree of adjustment to equilibrium will be estimated. From the error correction framework, and following Scholnick (1996), the symmetric and asymmetric adjustments will be estimated using the mean adjustment lag proposed by Doornik and Hendry (1994). The mean adjustment lag shows the degree of rigidity for the symmetric error correction model when retail interest rates are either below or above their equilibrium level. The Wald test will be used to confirm the presence of asymmetry.

However, to achieve the objectives set out in chapter one, the above analytical framework will be applied to the four Anglophone West African countries. The next chapter presents and discusses the results from the empirical estimation.

CHAPTER FIVE:
EMPIRICAL RESULTS

5.1 INTRODUCTION

In this chapter the results of the interest rate pass-through analysis are presented and discussed as described in chapter four. Several findings emerged from the empirical pass-through analysis and these are presented at two levels: the first set of results will include the estimates for the entire sample period and the second set of results will include the estimates of the rolling windows for each country. The results are presented in sections as follows: Section 5.2 presents the results of the unit root tests while Section 5.3 presents the findings from the cointegration analyses. In Section 5.4, the pass-through analyses for the WAMZ economies are presented and discussed. This includes graphical analysis of the findings while Section 5.5 presents the results from the symmetric and asymmetric adjustments models. Section 5.6 concludes the chapter. The analyses start with the descriptive statistics of the interest rate series. To observe the nature of the interest rate series, the descriptive statistics, which include mean, median, standard deviation, minimum and maximum, were obtained and reported in Table 5.1 below:

Table 5.1: Descriptive Statistics of the Interest Rates Series

Country	Series	Period	Obs.	Mean	Median	Std. Dev.	Min.	Max.
	DISR	1989:01-2009:12	252	14.78	14.00	5.03	9.00	29.00
Gambia	**LR**	1989:01-2009:12	252	27.02	26.50	3.50	24.00	36.50
	DR	1989:01-2009:12	252	13.63	12.50	2.54	10.00	22.00
	TBR	2000:01-2009:12	120	22.13	23.20	10.57	9.38	46.75
Ghana	**LR**	2000:01-2009:12	120	32.39	31.75	7.97	9.80	47.75
	DR	2000:01-2009:12	120	15.99	14.00	7.79	7.25	33.50
	DISR	1989:01-2009:12	252	15.00	14.00	3.93	6.00	26.00
Nigeria	**LR**	1989:01-2009:12	252	20.67	20.07	3.85	10.04	37.80
	DR	1989:01-2009:12	252	13.70	13.13	3.82	5.08	27.00
	TBR	1989:01-2009:12	252	25.37	19.93	17.13	3.80	95.20
Sierra	**LR**	1989:01-2009:12	252	30.93	25.00	12.82	20.00	73.50
Leone	**DR**	1989:01-2009:12	252	16.21	10.00	14.16	5.13	70.60

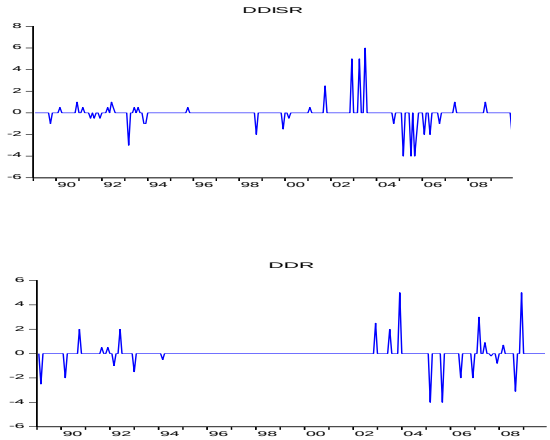
Notes: DISR-Discount rate; LR-Lending rate; DR-Deposit rate; and TBR-Treasury bill rate

Source: Author's estimates.

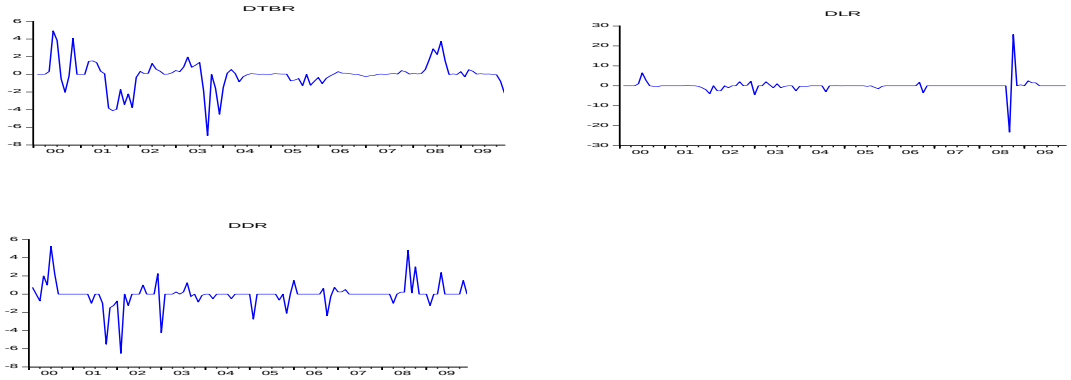
Descriptive statistics of the series indicate that interest rates are significantly different among the WAMZ countries for the period under review. Sierra Leone recorded the highest interest rates[63] with 95.20, 73.50 and 70.60 percent for policy, lending and deposit rates respectively, followed by Ghana with 46.75, 47.75 and 33.50 for policy, lending and deposit rates respectively. Gambia and Nigeria recorded similar averages with a notable exception of the minimum lending rate, which is 24.00 and 10.04 for Gambia and Nigeria respectively.

Before proceeding to discuss the results of the unit root tests, graphical plots of the changes in each country's interest rates over time are presented in Figure 5.1.

A: Gambia - 1989 to 2009

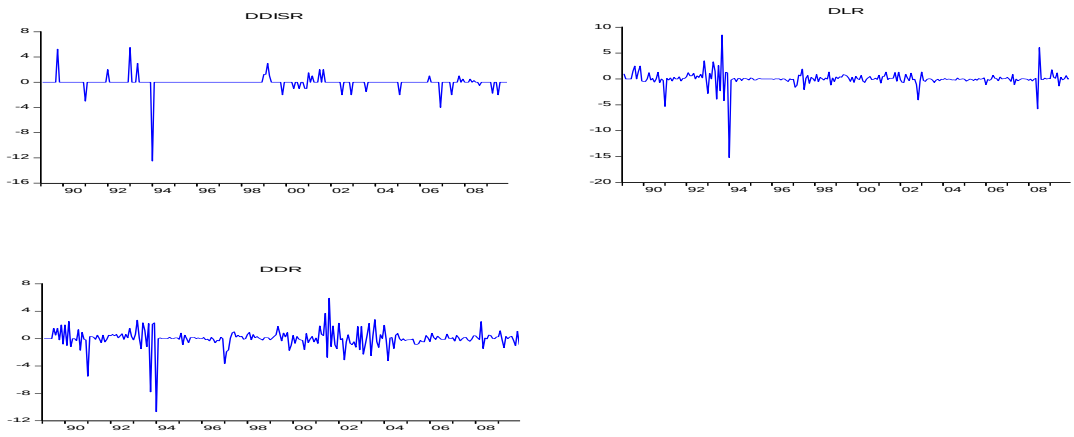


B: Ghana - 2000 to 2009



[63] Highest mean, median, standard deviation and interest rates.

C: Nigeria - 1989 to 2009



D: Sierra Leone - 1989 to 2009

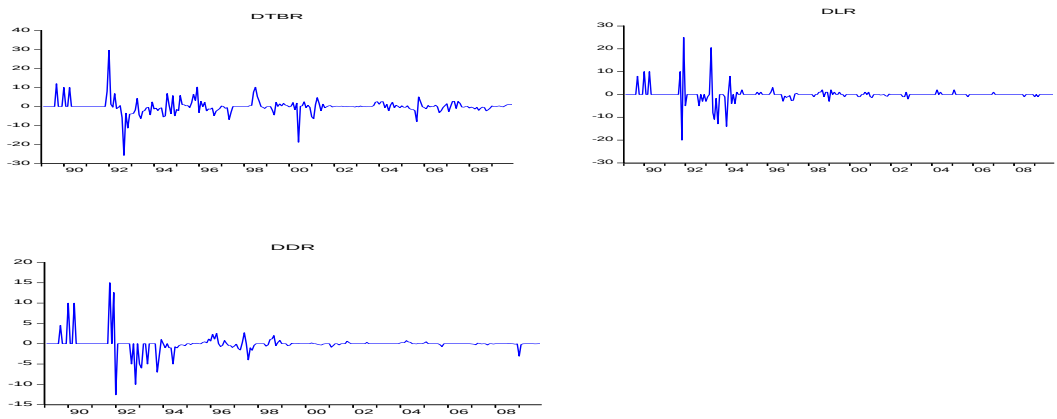


Figure 5.1: Changes in Interest Rates over time

Note: D represents changes in the relevant interest rate.

It is evident from Figure 5.1 that several upward and downward changes in the policy rates have been made during the period under review. The plots in Figure 5.1 above clearly show that both lending and deposit rates, though with lags, respond to changes in the central bank's policy rates in all four countries. Close examination of the plots revealed that, with the exception of Nigeria, lending rates are sticky when policy rates adjust downward, and deposit rates are also sticky when policy rates adjust upward. Even though there are some indications in the four countries that retail rates adjust to policy rates, which indicate that there are transmission mechanism of monetary policy in the WAMZ, the crucial issues in the monetary policy transmission process that are of relevance to the monetary authorities centre not only on whether changes in policies are transmitted but how fast (speed) and how much (magnitude) of the change in policy controlled rate is transmitted to the ultimate targets. The

plots above can only give a superficial insight on the speed and magnitude of these adjustments. The results of the empirical analyses on the speed and magnitude of these adjustments are reported in Section 5.4.

To provide some insights on the relationship of the variables, simple correlation matrices were computed. The reason for this is to provide an indication of the presence or absence of pass-through. The results of the simple correlation matrices for the level and first difference series are presented in Table 5.2.

Table 5.2: Correlation Analysis between Policy and Retail Interest Rates.

Level Series				**First Difference Series**			
Gambia							
	DISR	**DR**	**LR**		**DDISR**	**DDR**	**DLR**
DISR	1.00			**DDISR**	1.00		
DR	0.78	1.00		**DDR**	0.36	1.00	
LR	0.72	0.81	1.00	**DLR**	0.40	0.33	1.00
Ghana							
	TBR	**DR**	**LR**		**DTBR**	**DDR**	**DLR**
TBR	1.00			**DTBR**	1.00		
DR	0.93	1.00		**DDR**	0.43	1.00	
LR	0.87	0.88	1.00	**DLR**	0.05	0.30	1.00
Nigeria							
	DISR	**DR**	**LR**		**DDISR**	**DDR**	**DLR**
DISR	1.00			**DDISR**	1.00		
DR	0.69	1.00		**DDR**	0.38	1.00	
LR	0.83	0.85	1.00	**DLR**	0.49	0.51	1.00
Sierra Leone							
	TBR	**DR**	**LR**		**DTBR**	**DDR**	**DLR**
TBR	1.00			**DTBR**	1.00		
DR	0.87	1.00		**DDR**	0.18	1.00	
LR	0.83	0.94	1.00	**DLR**	0.26	0.54	1.00

Notes: DISR-Discount rate; LR-Lending rate; DR-Deposit rate; TBR-Treasury bill rate and D before each abbreviation mean Difference.

For the first difference series, the table shows that Gambia's LR has the highest correlation with DISR, with a correlation of 40%, followed by DR with a correlation of 36%. For Ghana the opposite is the case, DR has the highest correlation with TBR of 43% while LR has a very low correlation of 5%. The low level of correlation of LR to TBR can also been seen from the plots of DLR in Figure 5B above. Although the changes in TBR were frequent, LR graph remained relatively flat throughout the period. In level terms, the correlation coefficients vary between 0.72 and 0.94 implying policy and retail interest rates move together. Of all the countries Nigeria's LR records the highest correlation to DISR of 49% while DR is correlated with DISR by 38%. Sierra Leone recorded the lowest level of correlation of DR and TBR of 18% and a correlation of 26% between LR and TBR. Before proceeding to analyses of the results in relation to the objectives set in chapter one, attention is first given to the unit root tests performed on each series. These unit root tests were performed to determine if the series are all I(1) (i.e., integrated of order one). The next section discusses the results of the unit root tests.

5.2 UNIT ROOT TESTS

As mentioned earlier in chapter four, the empirical analysis starts by determining the order of integration and testing for unit root on the interest rate series using the ADF and KPSS tests. To ensure robustness of the results, the tests were conducted at levels and first difference under the various assumptions (see Appendix C).

5.2.1 Unit root analyses for the entire sample

Table C-1.0 in Appendix C shows the unit root tests results for policy rates (DISR or TBR), lending rates and deposit rates for Gambia, Ghana, Nigeria and Sierra Leone for the entire sample period. The tests were conducted with level and first difference series with the deterministic assumptions of 'intercept' and 'intercept and trend'. From Table C-1.0 it is evident that both the ADF and KPSS tests indicate that the interest rate series in all countries appear to be non-stationary at levels, but stationary when differenced once (i.e., I(1)). Further to this, cointegration tests were carried out for the entire sample period and the results for the cointegration tests are reported in Section 5.3. The next section discusses the unit root results for the rolling windows.

5.2.2 Unit root analyses for the rolling windows

The results of the ADF and the KPSS tests for the rolling windows are reported in Table C-1.1, Table C-1.2, Table C-1.3 and Table C-1.4 for Ghana, Gambia, Nigeria and Sierra Leone respectively. Even though in some cases examined some series are I(0), the tests show that most of the interest rate series are stationary at first differences. There are cases where unit root could not be tested for Gambia. For instance, five out of sixteen rolling windows for the ADF test and two out of sixteen rolling windows for the KPSS test for deposit could be tested for unit root. This is due to deposit rates during these periods remaining constant. Nigeria also witnessed similar situation with discount rates fixed for the 1994–1999 rolling window. As stated earlier in the chapter and having shown that most of the interest rate series are I(1), the next step is to test the interest rate series cointegrating relationship. The results for the cointegration tests are presented and discussed in the next section.

5.3 COINTEGRATION ANALYSES

As pointed out in chapter four (methodology), four techniques were used in testing for the existence of stable long-run relationship among interest rates series. The tests used were the Johansen maximum likelihood estimator (JJ), the Engle and Granger approach (EG), the Cointegrating Regression Durbin–Watson (CRDW), and the Error Correction Model based approach (ECM). Note that in cases where the various approaches are in disagreement as to whether to reject or accept the null hypothesis of no cointegration, the error correction-based test was used to confirm the presence of cointegration. This decision rule was based on the proposition made by Artis and Zhang (1998: 121) that the ECM statistic for testing for cointegration can generate more powerful tests than the Engle–Granger based tests and CRDW. In cases where the error correction-based method is not applicable, cointegration is confirmed if cointegration is found from any two approaches. The results for the Johansen (JJ) test, Engle-Granger (EG), Cointegrating Regression Durbin–Watson (CRDW) test and Error Correction Model (ECM) based tests are reported in Appendix D. Based on the bivariate estimations[64] of the interest rates series several findings emerged and the discussions of these findings are the focus of the ensuing sections.

[64] The cointegration tests are between lending rates and policy rates, and deposit rates and policy rates.

5.3.1 Cointegration analyses for the entire sample

Consequent upon the unit root test results, the tests for cointegration among the series was conducted for the entire sample period for all the countries; Table 5.3 presents a summary of the cointegration tests. It is clear from Table 5.3 that for the entire sample period the null of no cointegration could be rejected for both lending and deposit rates and across all the countries based on the estimates of the ECM statistics, which suggest that there is a stable long-run relationship between policy rates and retail interest rates. There are also similarities in the results reported in Table 5.3. It appears that for Gambia, Ghana and Nigeria, the null of no cointegration in the deposit could not be rejected for the Johansen and CRDW in all three countries, but could be rejected for the Engle-Granger and ECM statistics tests.

Table 5.3: Summary of interest rate pass-through analysis for the entire sample period

	Sample		**Cointegration Tests**				
Interest Rates	**From**	**To**	**JJ**	**EG**	**CRDW**	**ECM-Based**	**Concl.**
Gambia							
Lending Rate	1989	2009	yes	yes	no	yes	yes
Deposit Rate	1989	2009	no	yes	no	yes	yes
Ghana							
Lending Rate	2000	2009	yes	yes	yes	yes	yes
Deposit Rate	2000	2009	no	yes	no	yes	yes
Nigeria							
Lending Rate	1989	2009	no	yes	yes	yes	yes
Deposit Rate	1989	2009	no	yes	no	yes	yes
Sierra Leone							
Lending Rate	1989	2009	yes	yes	no	yes	yes
Deposit Rate	1989	2009	yes	yes	no	yes	yes

Note: JJ- is the Johansen method, EG- Engle-Granger method, CRDW- Cointegration Regression Durbin–Watson test, ECM-Based - Error Correction Based test.

It is worth noting that a cointegrating relationship was found in all the interest rate series rates and across all countries from the Engle–Granger and ECM based tests for the full sample period. However, the presence of stable long-run cointegration relationships suggests that interest rate pass-through analysis can be done to unveil both the short-run and long-run

dynamics of the interest rate series. The next section presents and discusses the results for the rolling window analysis.

5.3.2 Cointegration analyses for the rolling windows

As noted earlier the rolling windows estimation was used to examine whether cointegration relationships exist between the interest rate series and how they may have changed over time; these results are presented in Appendix D, tables D-1.1 to D-1.4. Overall, the results suggest that there were some degrees of disparity among the various methodologies as to whether to accept or reject the null hypothesis of no cointegration. As noted earlier, if the presence of cointegration is found by any two methods the null of no cointegration would be rejected.

The results suggest that the strongest evidence of cointegration in all countries is between lending and policy rates. Cointegration was strongest between lending and policy rates in Gambia and Nigeria where the null of no cointegration was rejected in fifteen out of the sixteen rolling windows, similarly in Ghana where five out five rolling windows are cointegrated. As far as Sierra Leone is concerned, the null of no cointegration was rejected in twelve out of sixteen rolling windows for lending rates. Lending rates are not cointegrated with policy rates in 1997–2002 and 1996–2001 rolling windows in Gambia and Nigeria respectively. In Sierra Leone, lending rates are not cointegrated with policy rate in 1995–2000, 1998–2003, 1999–2004 and 2002–2007 rolling windows.

Turning to the analyses for deposit rates, with the exception of Ghana where five out of the five rolling windows show evidence of cointegration, the strongest evidence of cointegration in deposit and lending rates was found in Nigeria. The weakest evidence of cointegration came from Gambia where the null hypothesis of no cointegration could not be rejected in five out of sixteen rolling windows. In Sierra Leone, the null of no cointegration was rejected in twelve out of sixteen rolling windows. In Gambia deposit rates are not cointegrated with policy rate in 1990–2005, 1995–2000, 1996–2001, 1997–2002 and 2000–2005 rolling windows, while in Nigeria deposit rates are not cointegrated with policy rate in 1994–1999, 1995–2000 and 2003–2008 rolling windows. In Sierra Leone, deposit rates are not cointegrated with policy rates in 1999–2004, 2002–2007, 2003–2008 and 2004–2009 rolling windows.

Overall, the Johansen Maximum Likelihood and the CRDW accepted the highest null of no cointegration in both lending and deposit rates for the rolling windows. It is clear from the

results in Appendix D that the null of no cointegration in most cases could be rejected in both the full sample and rolling windows for lending rates and deposit rates. Once the presence of cointegration and a stable long-run relationship between policy rate and retail interest rates has been ascertained, the next step, as stated in chapter four, is to unveil the short-run and long-run interest rate pass-through dynamics.

It is worth noting that the presence of cointegration only tells us that there is a stable long-run relationship between policy rate and retail interest rates. The cointegration results cannot tell us how fast and how much of the changes in official rates are transmitted to lending and deposit rates. To achieve this, an error correction model for the two types of interest rates in the economies analysed is used to unveil the dynamics of the short-run and long-run interest rate pass-through. The next section discusses the results of the short and long-run pass-through.

5.4 RESULTS FROM INTEREST RATE PASS-THROUGH ANALYSES

5.4.1 Short-Run Pass-Through Analyses

One of the objectives set out in chapter one was to examine the short-run and long-run dynamic adjustment of lending and deposit rates to changes in policy controlled interest rate. To achieve this objective, focus is first turned to the short-run pass-through. The short-run pass-through or the impact multiplier, which measures the immediate adjustment of retail interest rates to changes in policy-controlled interest rate, is crucial in determining the effectiveness of monetary policy in an economy.

As pointed out, the tests have shown that the interest rate series are cointegrated, and consequent upon these results, the ECM model was estimated and the results reported in Appendix D. The analyses continued with the examination of the degree of pass-through completeness between the types of interest rate series in all countries. Overall, the results for both the short-run and long-run pass-through show high levels of disparities in the entire sample and the rolling window analyses. Note that the analyses covered a period of twenty-one (21) years from January 1989 to December 2009 for Gambia, Nigeria and Sierra Leone. Based on the unavailability of data for Ghana, the sample period of ten (10) years was estimated. The analysis was done at two levels. First, the entire sample period was estimated for all economies analysed. Second, to capture the dynamics of interest rate pass-through over time, rolling samples of six years (72 observations) were estimated. The graphical plots

of the pass-through results are presented in the next section while the summary of the results is reported in tables D-1.0 to D-1.4 in Appendix D.

5.4.1.1 Short-Run Pass-Through analysis of the entire sample period

It is clear from Figure 5.2 that the short-run pass-through or impact multipliers in all the countries are very low and statistically different from one for both lending and deposit rates. An important finding for a study of this nature is the difference between the short-run pass-through of lending and deposit rates. The results show discrepancies across countries and between deposit and lending rates. The size of the short-run pass-through for deposit rates ranges from 13% to 47%, indicating that when policy rates change less than half of the changes are passed through to deposit rates. On the other hand, when policy rate changes, a minimum of -6% and a maximum of 66% is passed through to lending rates in the WAMZ economies. Note that in Nigeria and Sierra Leone, short-run PT was higher in lending rates than deposit rates, whereas short-run pass-through in deposit rates was greater than lending rates in Gambia and Ghana.

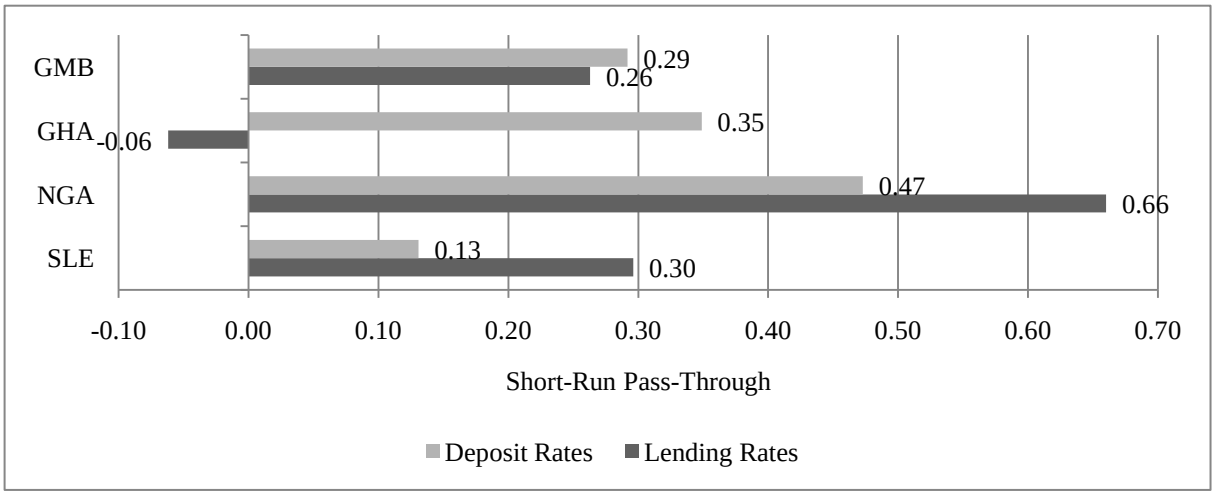


Figure 5.2: Estimated Short-Run Pass-Through

Source: Author's estimates.

Figure 5.2 shows that, in the short-term, both lending and deposit interest rates are sticky. For instance, when policy rate changes only 26%, 66% and 30% of the change can be passed through to lending rates in Gambia, Nigeria and Sierra Leone respectively. The short-run pass-through for Ghana is alarmingly low with -6%. One possible explanation for this could

be the type of lending rate used[65]. As argued by Achaempong (2005), the manufacturing sector is the dominant sector in the loan market in Ghana and thus, it is possible that the manufacturing corporations would have close ties with the banks that may have occurred as a consequence of long-term relationships. In such situations, the banks and their customers (manufacturing corporations, which are less risky) may have entered into implicit contracts in which the banks offered stable interest rates in order to protect customers from volatile interest rates (Allen and Gale, 2004). Deposit rates also showed a weak and incomplete short-run pass-through of 29%, 35%, 47% and 13% for Gambia, Ghana, Nigeria and Sierra Leone respectively. Thus, one can argue that the short-run pass-throughs of both lending and deposit interest rates are weak and incomplete in the WAMZ economies.

5.4.1.2 Short-Run Pass-Through Analysis for the Rolling Windows

The rolling windows have been done with 72 observations (i.e., 6 years), the results of which are reported in tables D-1.1 to D-1.0 of Appendix D. The results for the rolling windows show some disparities between lending and deposit rates over time. Figure 5.3 presents graphical plots of the impact multipliers of lending rates, and Figure 5.4 presents the impact multipliers for deposit rates.

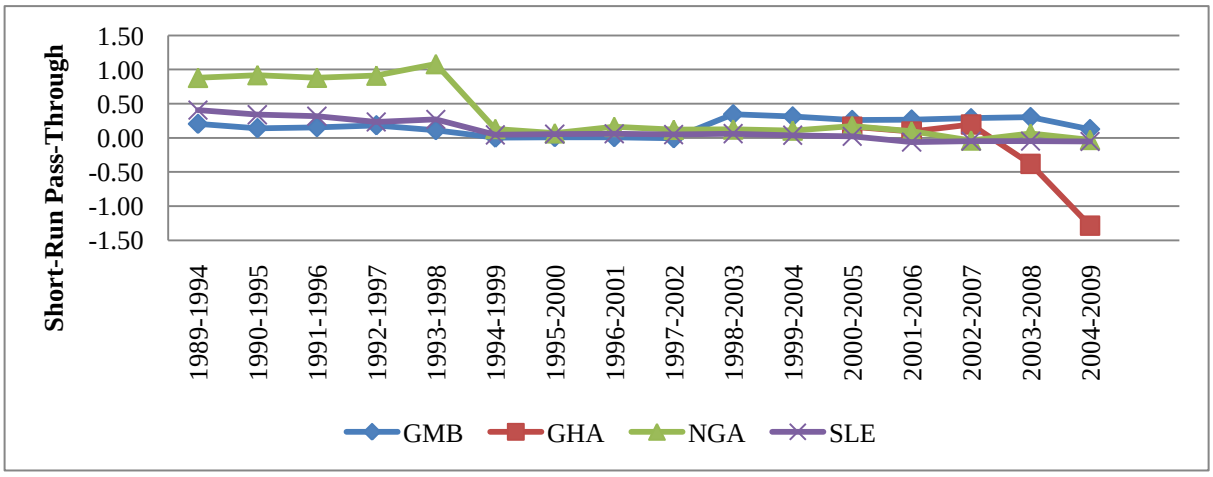


Figure 5.3: Short-Run Pass-Through – Lending Rates.
Source: Author's estimates.

Figure 5.3 shows that the lending rates short-run pass-through for Nigeria was exceptionally high from the 1989–1994 up to 1993–1998 rolling windows compared to the other countries analysed and even exhibit over shooting effect in the 1993–1998 rolling window. Also, it is

[65] As noted in chapter four, lending rate to manufacturing was used as a proxy for commercial banks lending based on the unavailability of lending rates series.

clear from Figure 5.3 that the lending rate short-run pass-through was stable for most of the period. The short-run pass-through in Nigeria decreases from the all time high short-run coefficient of 1.08 and moves towards the level of the short-run pass-through in Gambia and Sierra Leone.

In what follows, it also appears that since the 1994–1999 rolling window, Gambia, Nigeria and Sierra Leone moved towards similar levels. In other words, it is evident that there is convergence of the short-run pass-through. The short-run pass-through in Ghana also showed some level of convergence from 2000–2005 to 2002–2007 rolling windows and later diverges with a decreasing pass-through. A more salient point to note about the level of convergence in the WANZ economies is that the period of convergence coincided with the signing of a declaration for the creation of a second West African Monetary Zone in April 2000 by the heads of states of Gambia, Ghana, Guinea, Nigeria and Sierra Leone.

Despite the convergence in the short-run lending rates pass-through, the results in Table D-1.1 to Table D-1.4 show that the short-run lending rates pass-through in Gambia, Ghana and Sierra Leone are similar and very low ranging from -1.29 to 0.41. With regards to Nigeria, the results show that short-run lending rates pass-through range from -0.04 to 1.08. Thus, there is sufficient evidence to argue that there are discrepancies in the short-run lending rate pass-through across countries and incompleteness over time.

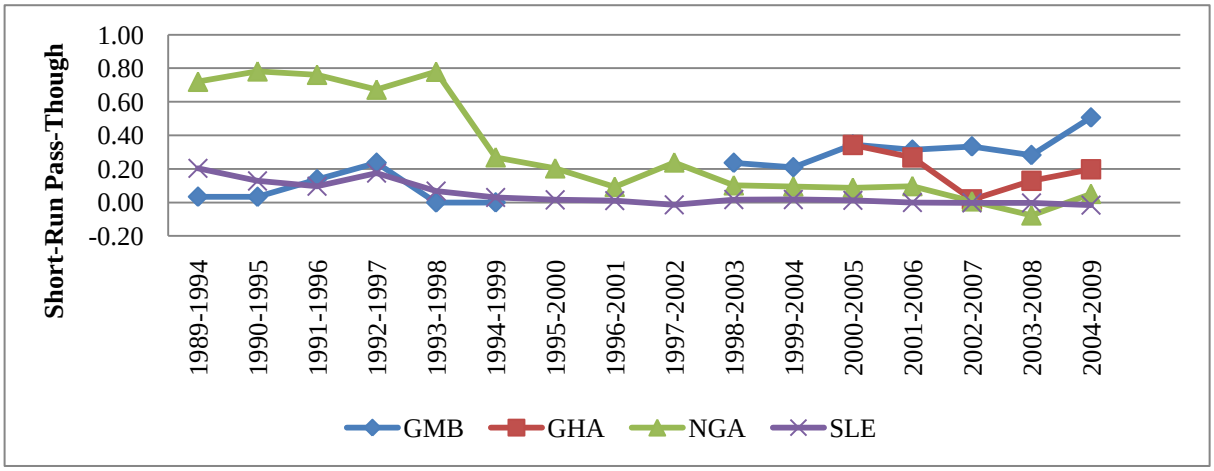


Figure 5.4: Short-Run Pass-Through – Deposit Rates

Source: Author's estimates.

As far as short-run pass-through for deposit rates are concerned, there are also some discrepancies among the economies analysed. With the exception of 1989–1994 up to 1993–

1998 rolling windows for Nigeria, the plots in Figure 5.4 show that short-run pass-through of deposit rates remained low, hovering between 51% and -8% from the 1993–1996 to 2004–2009 rolling windows. This implied that there are high levels of short-run rigidities in deposit rates in the WAMZ. Notably, in Nigeria the short-run pass-through was hovering around 67% and 78% from 1989–1994 to 1993–1998 rolling windows. From 1993–1998 rolling window, similar patterns occurred in Nigeria and Sierra Leone short-run pass-through with Nigeria beginning to drop from 1993–1998 until the 1996–2001 rolling windows to become similar to Sierra Leone over time. Though in Gambia and Ghana there were gaps in the plots; their short-run pass-throughs are not significantly different from the other countries from 1998–2003 to 2004–2009 rolling windows. Note that in the 2002–2007 rolling window Ghana, Nigeria and Sierra Leone converge to the same level of short-run pass-through. Also, with exception of Sierra Leone, Gambia, Ghana and Nigeria begin to converge towards higher pass-through in the 2003–2008 rolling window.

It was noted in chapter four that coefficients less than one for short-run pass-through indicate a sluggish adjustment of deposit and lending rates to changes in policy rate in the short-run, thus retail interest rates are sticky. It is worth mentioning that the incomplete short-run pass-throughs found for both lending and deposit rates are not unique to the WAMZ economies. Empirical evidences have shown that short-run pass-through in most cases is incomplete, not only in developing economies but also in emerging and developed economies. For instance, Hulsewig *et al.* (2009) reported an immediate PT of 54% for the Euro area. Also, Kwapil and Scharler (2010) found weak and incomplete short-run pass-through of 16% and 34% for deposit and lending rates respectively in the Euro area. Corresponding to these findings in the Euro area, Wang and Lee (2009) found that short-run pass-through in nine Asian countries range from 0.0003 to 0.47 for deposit rates and -0.004 to 0.179 for lending rates[66]. Attention is now turned to the long-run pass-through for deposit and lending rates in each country over time.

5.4.2 Long-Run Pass-Through Analyses

The detailed results of the long-run pass-through are reported in Appendix D, tables D-1.0 to D-1.4. Though the estimates for the long-run PT are higher than those of the short-run pass-through, it is clearly evident that the pass-throughs are weak and incomplete for the WAMZ economies. Figures 5.5, 5.6 and 5.7 show plots of the results for lending and deposit rates for

[66] See Appendix A for a summary of these studies.

the entire sample period, and lending rates and deposit rates for the rolling windows over time, respectively.

5.4.2.1 Long-Run Pass-through analyses for the entire sample period

Notably, long-run pass-through from policy rate to lending and deposit rates is less than one (1) in all four economies analysed, implying that interest rate pass-through is incomplete in the long-run. The meaning of this is that a one percent change (increase/decrease) in policy rates would not be accompanied by an equivalent change in retail interest rates in the WAMZ economies. Figure 5.5 shows the plots of the long-run pass-through for the entire sample period.

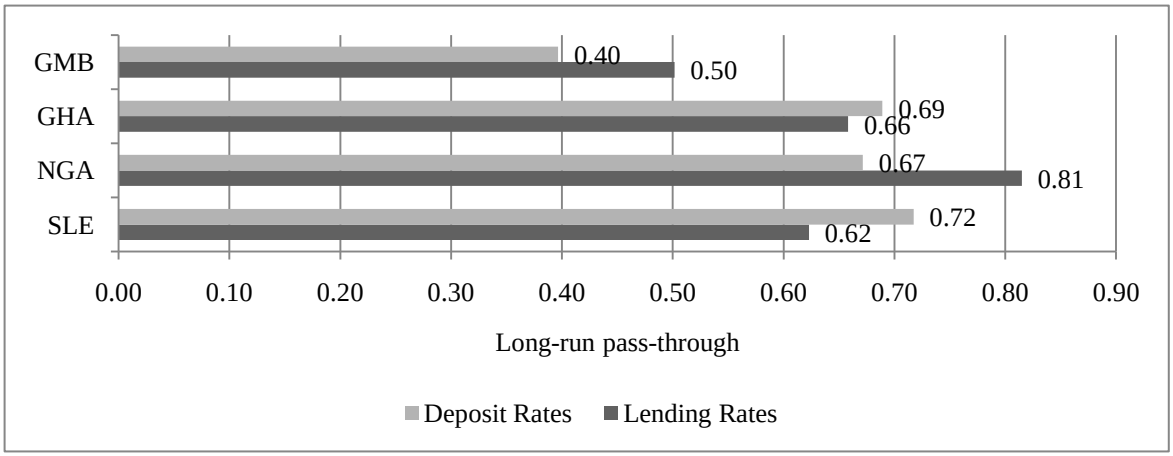


Figure 5.5: Estimated Long-Run Pass-Through

Source: Author's estimates.

Starting with the Gambian economy, the long-run pass-through coefficients of deposit and lending rates are statistically significant although are quite low. It is clear from Figure 5.5 that only 40% and 50% are passed through in the long-run to deposit and lending rates respectively when policy rates change. This implies that not all of the change is transmitted to both deposit and lending rates when policy rates change. Thus the long-run pass-throughs of deposit and lending rates are incomplete in Gambia. Sundry factors could be responsible for this, but one argument forwarded by Sriram (2009) is that in Gambia the banking sector, which is the dominant sector in the financial system, is highly concentrated with low degree of competition among banks. Other factors could be the underdeveloped state of the financial structures and non-availability of active non-bank financial intermediaries.

As far as Ghana is concerned, Figure 5.5 shows that 69% and 66% of the changes in policy-controlled rates are transmitted to deposit and lending rates respectively in the long-run. The

long-run pass-through coefficients are statistically significant but low, indicating an incomplete pass-through from policy rate to both deposit and lending rates. Pass-through in Ghana could not be complete because of the interest rate used. Ghana's pass-through coefficients are a bit high compared to those of Gambia. As noted in chapter three, one reason for this could be as a result of the availability of non-bank financial institutions such as securities markets, and the recent adoption of the inflation targeting framework in Ghana in 2007 is expected to stimulate pass-through. In an inflation targeting regime, interest rates become the most closely watch variable by the monetary authorities. Thus changes in policy interest rates are expected to be fully passed to retail interest rates in the short-run and long-run.

The analyses of the WAMZ economies continue with Nigeria. It is clear from Figure 5.5 that Nigeria records the highest coefficient of long-run pass-through among the economies analysed, with statistically significant coefficients of 81% for lending rates. This implies that when there is a change in official rate, 81% is transmitted to lending and deposit rates in the long-run. Likewise, 67% is passed through to deposit rates in the long-run. The long-run pass-through , though not complete in Nigeria, is relatively close to one for lending rates. The high long-run pass-through could be attributed to factors such competition in the banking sector, financial reforms, relatively active capital market and an active non-bank financial market with a wide range of products compared to the other WAMZ economies.

With regards to Sierra Leone, Figure 5.5 shows that the long-run pass-through coefficients are 72% and 62% for deposit and lending rates respectively. This implies that 72% and 67% is passed through to deposit and lending rates respectively when official rates change. Sierra Leone though has the highest long-run pass-through for deposit rate; the coefficients for retail interest rates are statistically different from one. Thus, it is evident that long-run PT is incomplete. Sierra Leone like Gambia also has a highly concentrated banking sector with low degree of competition.

5.4.2.2 Long-Run Pass-Through analyses of the rolling windows

It is evidently clear from Figure 5.6 that there are huge discrepancies in the long-run pass-through across countries over time. With the exception of Nigeria, Figure 5.6 shows that there is no evidence of complete pass-through in the other countries over time. The lending rates long-run pass-through in Gambia, Ghana and Sierra Leone fall within the range of 2% and 65% throughout the estimated period indicating that there is no evidence of complete

lending rates pass-through over time. In Nigeria, lending rate long-run pass-through ranges from 13% to 108% indicating that there are instances in which long-run pass-through were complete. It is however worth mentioning that in six out of sixteen rolling windows the pass-through is greater than one[67] and in one rolling window it equals one in Nigeria. Note that these periods coincided with the implementation of the World Bank sponsored financial reforms. This result is not surprising; as indicated in chapter three, the Nigerian banking sector is competitive, less concentrated and developed compared to the other three economies analysed.

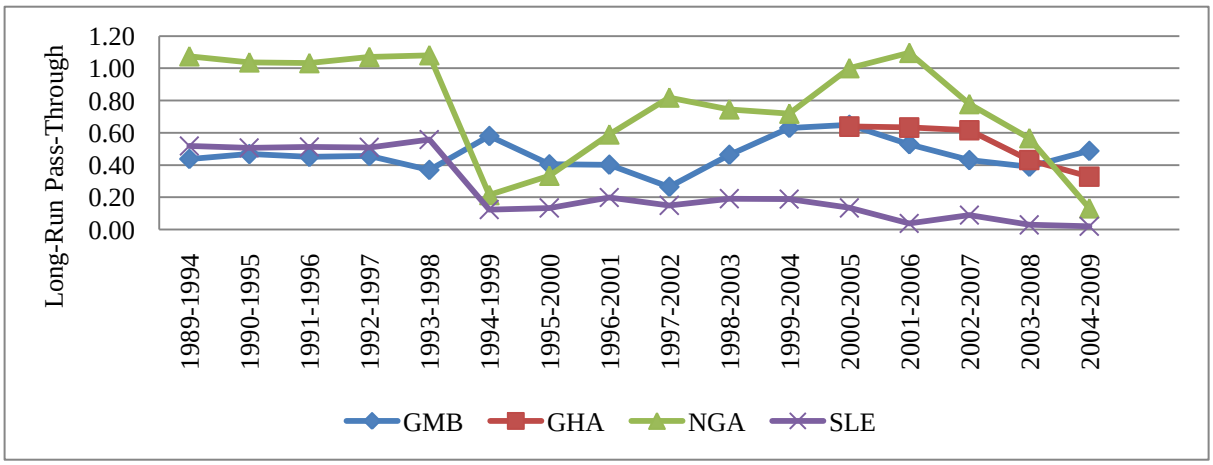


Figure 5.6: Long-Run Pass-Through – Lending Rates

Source: Author's estimates.

Figure 5.6 shows substantial variation in the lending rate long-run pass-through of Nigeria and Gambia starting from 1993–1998 to 2004–2009 rolling windows, whereas in Ghana and Sierra Leone lending rates long-run pass-through were relatively stable. Note that from the 1993–1998 rolling window onwards, Sierra Leone continuously has the lowest long-run pass-through among these economies. In Gambia, Nigeria and Sierra Leone, although each at different levels, pass-throughs were relatively stable from 1989–1994 to 1993–1998 rolling windows. Between the 1993–1998 and 1994–1999 rolling windows, pass-through in Nigeria and Sierra Leone dropped to become similar. Some indications of convergence start in the 2001–2006 and continue to 2004–2009 rolling window except for 2004–2009, where Ghana diverges. Despite the disparities in the long-run pass-through across the countries, there is evidence that these countries are trending towards similar levels since 2001–2006 rolling window as shown in Figure 5.6.

[67] When the value of pass-through is greater than one it indicates over pass-through or overshooting effects.

Turning to deposit rates, Figure 5.7 shows plots of the long-run pass-through for deposit rates. Like lending rates, deposit rates also show discrepancies across countries over time. In Gambia, Ghana and Nigeria there were considerable variations in the long-run pass-through of deposit rates ranging from -0.03(-3%) to 1.18(118%) over the estimated period. While in Sierra Leone it was relatively stable since 1994–1999 onwards.

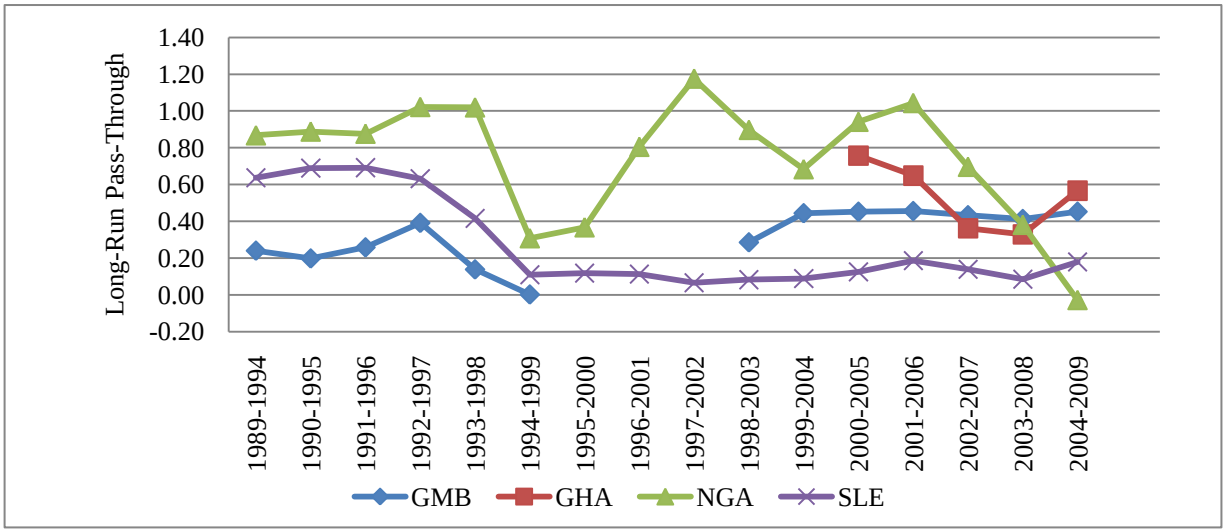


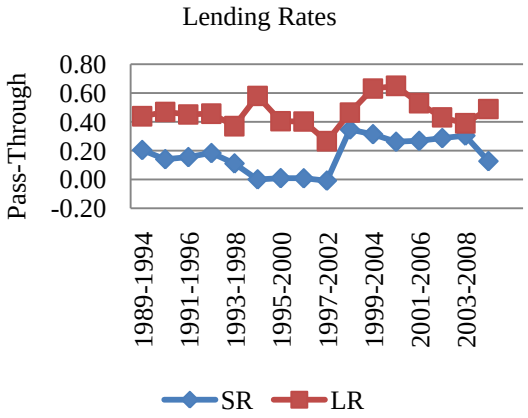
Figure 5.7: Long-Run Pass-Through – Deposit Rates

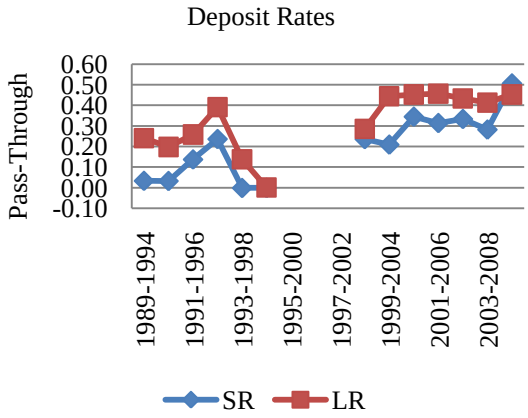
Source: Author's estimates.

Figure 5.7 suggests that the first visibility of convergence occurred in 1992–1997 to 1994–1999 windows where Gambia and Sierra Leone were converging to a lower pass-through later joined by Nigeria in the 1993–1998 windows. Evidence of convergence is also visible in the 2001–2006 windows when all the countries follow a decreasing trend in lower pass-through, but in the 2003–2008 windows all countries began to increase with the exception of Nigeria. The long-run pass-through of Nigeria witnessed a constant increase from 1989–1994 to 1993–1998 windows and a fall to 0.31(31%) in 1994–1999. From there it climaxed to the all time high of 1.18(118%) in the1997–2002 window. A key observation in the patterns for both lending and deposit rates pass-through is that there were high pass-throughs in the first five rolling windows, a period that coincided with the implementation of the World Bank sponsored Structural Adjustment Programmes in all the economies analysed.

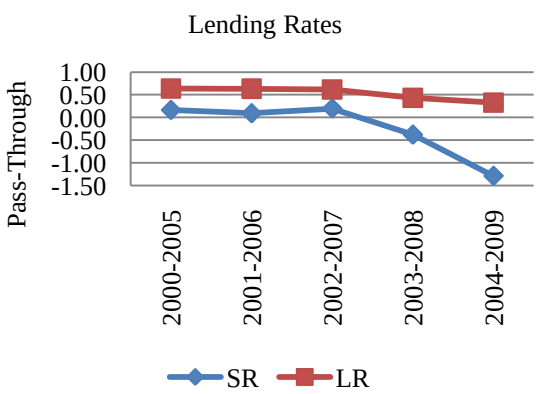
With regards to the differences between the short-run and long-run pass-throughs of lending and deposit rates, Figure 5.8 revealed that for most of the estimated periods the long-run pass-through is larger than the short-run pass-through.

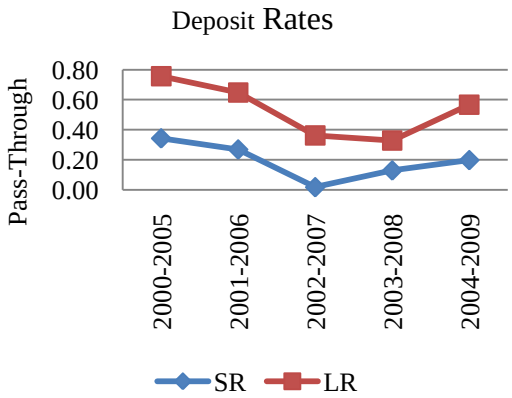
A: Gambia



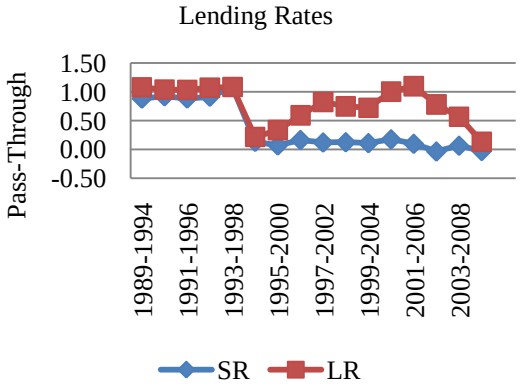


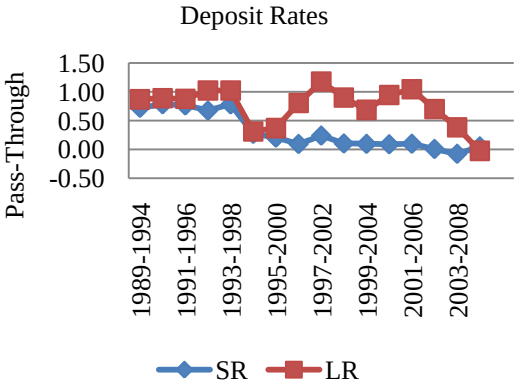
B: Ghana





C: Nigeria





D: Sierra Leone

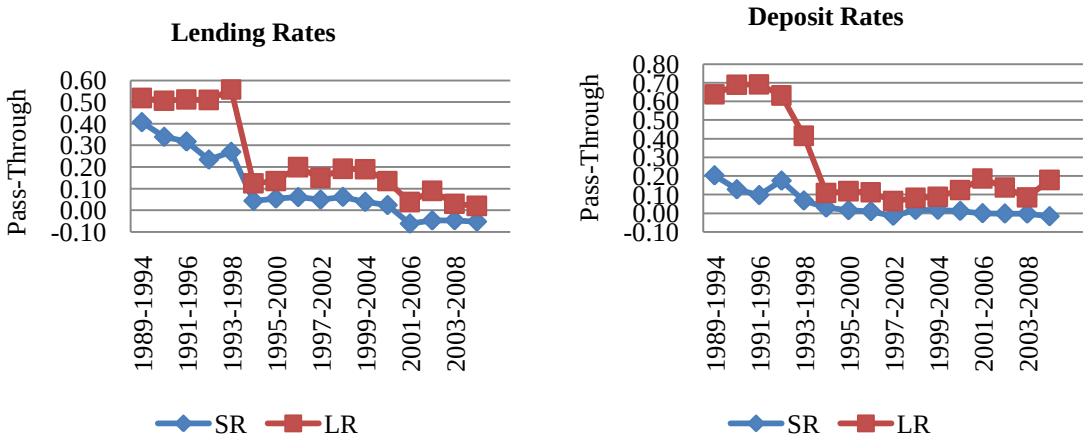


Figure 5.8: Short-Run and Long-Run Pass-Through for rolling windows

Source: Author's estimates

Only in Gambia and Nigeria in the 2004–2009 window is the short-run greater than the long-run pass-through. The disparity between the short-run and long-run pass-through is not only unique to the WAMZ economies. Empirical evidences[68] from advanced and emerging economies have shown incomplete pass-through across retail interest rates in both the short-run and the long-run.

Notably, both the short-run and long-run pass-throughs for the entire sample period are less than one among all four WAMZ economies, implying that pass-through is incomplete. There are considerable discrepancies in the empirical findings for the pass-through between lending and deposit rates. However, these results are not unique to this study, as empirical evidences have shown that pass-through is also complete in most advanced, emerging and developing economies[69]. On a whole the results report in Appendix D suggest the following: first, both long-run and short-run pass-through are incomplete. Second, the gap between short-run and long-run pass-through is wide in all countries. Third, among the economies analysed, Nigeria has the highest pass-through while Sierra Leone has the lowest. Fourth, in Nigeria pass-through is complete in some rolling windows in the long-run and the short-run for lending and deposit rates. Finally, among the retail interest rates, on average the pass-through is

[68] Mojon (2000); de Bondt (2005); De Graeve *et al.* (2007); Wang and Lee (2009); Kwapil and Scharler (2010); and Marotta (2009).
[69] See Appendix A for summary of these studies.

largest for lending rates in all countries. There are possible reasons why this might be the case.

First, the incomplete pass-through could be as result of the underdeveloped financial systems in the WAMZ. As noted in chapter three, the financials systems of the WAMZ are underdeveloped with a limited range of financial products and limited alternative sources of funding. The unavailability of alternative sources of funding might force bank customers to accept whatever interest rates they face and make retail interest rates less sensitive to change in policy rates. Second, incomplete pass-through could be as a result of a high degree concentration in the banking sectors. When the banking sectors are highly concentrated, retail interest rates often do not respond to changes in policy rates. Third, the low degree of competition within the banking sector, and between banks and non-bank financial institutions, might have contributed to the incomplete pass-through. The degree of competition in the financial system has important implications for interest rate pass-through. It should be noted however that the reason for incomplete pass-through might be country-specific in some cases.

It is worth noting that the short-run and long-run pass-through analyses do not tell the complete story of interest rates adjustment dynamics. They only tell how much (magnitude) of the policy-controlled rate is transmitted to deposit and lending rates and thereby confirm whether the PT is complete or incomplete. A crucial aspect of the analysis that cannot be explained by short-run and long-run pass-through coefficients is whether the adjustment in lending and deposit rates to changes in policy-controlled rate is fast (speed) or how sticky is the adjustment upwards or downwards. The ensuing sections provide detailed analysis of the adjustments in an error correction framework.

5.5 SYMMETRIC MEAN AND ASYMMETRIC ADJUSTMENT IN THE ECM

5.5.1 Mean Adjustment Lags

The mean adjustment lag (ML) measures the time taken for a change in the policy rate to be fully passed through to both lending and deposit rates. A high mean adjustment lag value indicates high rigidity or slower adjustment and a low value implies high speed of adjustment of retail interest rates in response to changes in policy rates. Note that policymakers are not just interested in the magnitude of adjustments reflected on the ultimate target of monetary policy but also the speed of transmission at which these changes are conveyed to the ultimate

targets. Therefore, determining whether retail interest rates quickly reflect changes in policy rate or whether such changes are rigid is of utmost importance. Also note that in rolling windows where cointegration was not found, it is impossible to calculate an error correction model, and thus mean adjustment lags cannot be calculated. The next section discusses the mean lag adjustments and the results are reported in Appendix D, tables D-1.0 to D-1.4.

5.5.1.1 Mean Adjustment Lags for the entire sample period

Figure 5.9 shows plots of the ML for lending and deposit rates for the entire sample period. It is clear from Figure 5.9 that Nigeria has the lowest ML in lending rates indicating that the speed of adjustment is highest in Nigeria in comparison to the other economies analysed. Ghana comes second, Sierra Leone third and Gambia exhibits the least speed of adjustment. On the other hand, the ML for deposit rates is lowest in Ghana, closely followed by Nigeria and Gambia, with Sierra Leone having the highest, suggesting that Sierra Leone has the lowest speed of adjustment in deposit rates to changes in policy rate.

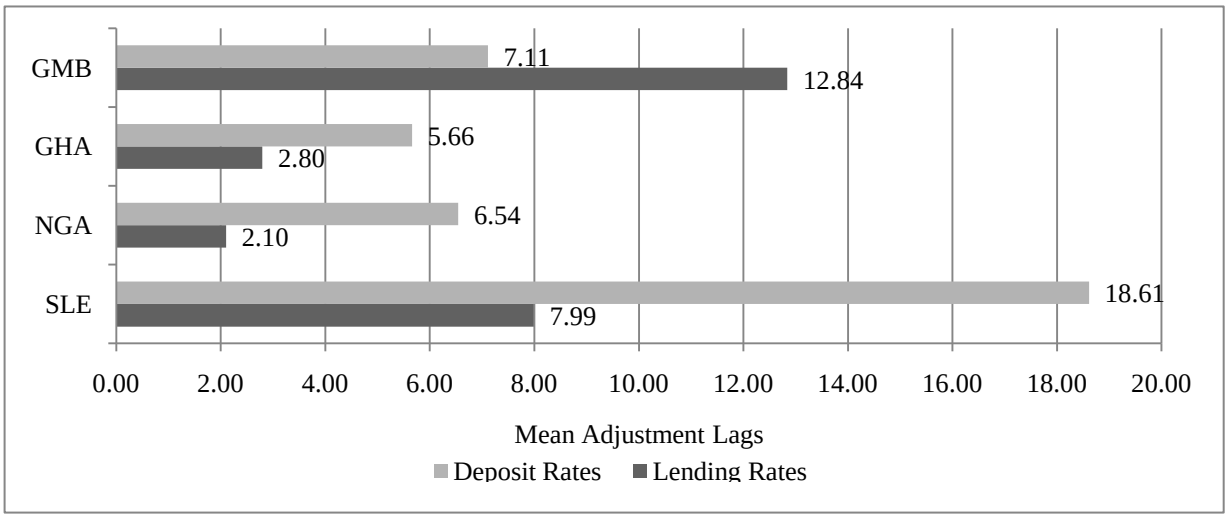


Figure 5.9: Mean Adjustment Lag of the entire sample period – Lending and Deposit Rates

Source: Author's estimates.

It is evident from Figure 5.9 above that there is some degree of rigidity in adjustment in the lending and deposit rates of the WAMZ economies. The results are not surprising as they reflect the earlier findings of incomplete short-run and long-run pass-through. Of the two retail rates used, ML for lending rates are lower in Ghana, Nigeria and Sierra Leone than deposit rates suggesting that lending rates adjust more quickly to changes in policy rates than deposit rates in these economies. Only in Gambia where deposit rates adjust faster than

lending rates. The results reported in Appendix D suggest that when the central bank changes policy rate, it takes approximately, thirteen, three, two and eight months for such changes to be fully reflected in lending rates in Gambia, Ghana, Nigeria and Sierra Leone respectively. Also, deposit rates adjust in seven, six, seven and nineteen months to changes in policy rates. What is apparent about the ML in all four economies analysed is that the speed of adjustment is very high for both lending and deposit rates implying that the transmission of monetary policy action to its ultimate target is slow and could take considerable length of time in Gambia and Sierra Leone. The next section discusses the findings for the rolling windows.

5.5.1.2 Mean Adjustment Lags for the rolling windows

For the periods in which cointegration was found in the rolling window analysis, on average it takes lending rates to fully adjust to changes in policy rates four, three, four and eight months in Gambia, Ghana, Nigeria and Sierra Leone respectively. Note that MLs were only calculated for rolling windows where long-run equilibrium relationships are found. This explains the breaks in the ML and ML plots in Figures 5.10 and 5.11.

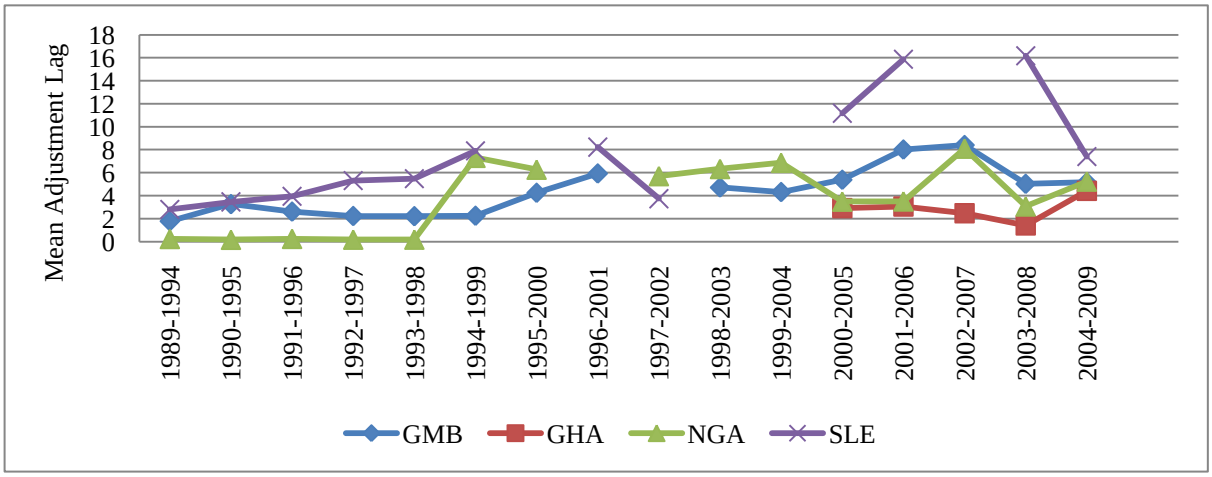


Figure 5.10: Mean Adjustment Lag of the rolling windows – Lending Rates
Source: Author's estimates.

Overall, it was manifested in the short-run and long-run pass-through that the mean lags for lending rates were very low in Nigeria for the first five rolling windows (1989–1994 to 1993–1998), indicating a high speed of adjustment. For example, during the rolling windows (1989–1994 to 1993–1998) lending rates fully adjust to policy rates less than a month in Nigeria. These indicate a high speed adjustment in early 1990s followed by a slower speed of adjustment of seven months in the 1994–1999 rolling window. These periods of higher speed of adjustment coincided with the post liberalization period when the banking sector became

more competitive. After the 1994–1999 rolling window, the ML for Nigeria averaged between three and eight months for the rest of the estimated period. The highest in ML occurred in the 2002–2007 rolling window in Nigeria. In Ghana ML for lending rates is relatively stable throughout the estimated period, ranging from one to four months. The highest speed of adjustment of 1.41 months is observed in the 2003–2008 rolling window while the lowest speed of adjustment of 4.42 months is observed in the 2004–2009 rolling window. In Gambia the speed of adjustment in lending rates was stable in the first six rolling windows, with an average speed of 2.39 months, and started slowing down to 8.41 months in the 2002–2007 rolling windows. The speed of adjustment started increasing in the 2003–2008 to 2004–2009. Sierra Leone recorded the lowest speed of adjustment in lending rates for the rolling windows analyses. For instance, the speed of adjustments range from 2.81 to 16.18 months; these indicate high rigidity in the transmission of monetary policy in Sierra Leone. In Sierra Leone the speed of adjustment witnessed a stable decrease from a speed of 2.81 to 8.22 months for the first eight rolling windows and increased to 3.74 months in the 1997–2002 rolling windows. After the 1997–2002 rolling window the speed of adjustment started decreasing to reach the all-time low of 16.18 months in the 2003–2008, therefore, indicating a very high rigidity in lending rate adjustments.

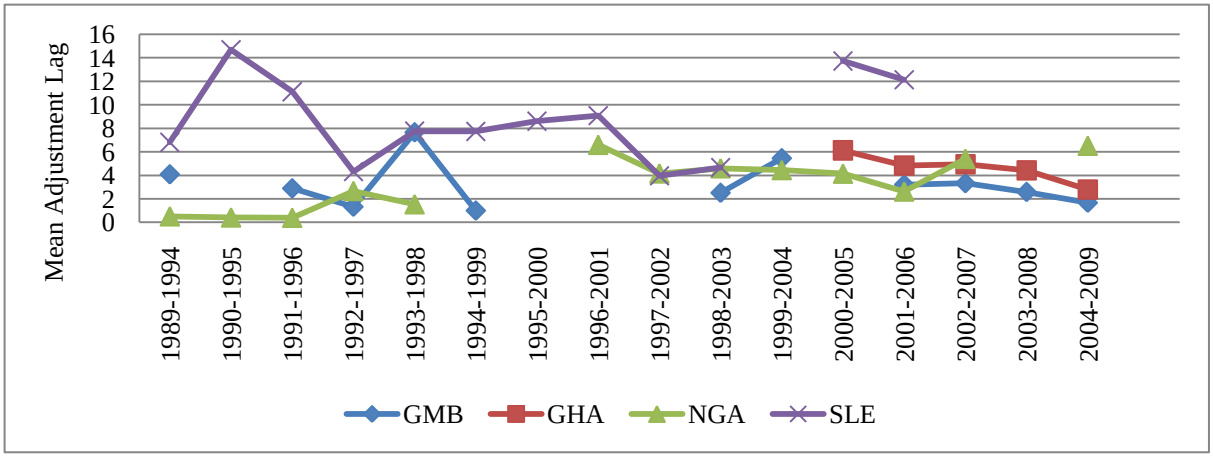


Figure 5.11: Mean Adjustment Lag of the rolling windows – Deposit Rates

Source: Author's estimates

Attention is now turned to deposit rates. Figure 5.11 shows plots of the ML for deposit rates of the economies analysed. Note that for the periods in which cointegration was found, on average, it takes deposit rates to fully adjust to changes in policy rates three, five, three and nine months in Gambia, Ghana, Nigeria and Sierra Leone respectively. It is apparent from the results in Appendix D that lending rates adjust faster than deposit rates in most cases. In

Ghana, speed of adjustment was stable and increasing over the period, ranging from a maximum of 6.12 months in 2000–2005 rolling window to 2.79 months in 2004–2009 rolling windows. In the first three rolling windows, deposit rate adjusted to changes in policy rate in less than a month in Nigeria. It slowed down to 2.66 months in the 1992–1997 rolling windows. After the 1993–1998 rolling window, the speed of adjustment was fairly stable in Nigeria with an average speed of adjustment of 4.81 months for deposit rate to fully adjust to changes in policy rate. The highest speed of adjustment in deposit rate in Sierra Leone occurred in the 1997–2002 rolling window of 3.96 months and the lowest, of 14.68 months, in the 1990–1995 rolling window. The speed of adjustment in Sierra Leone was unstable throughout the estimated period ranging from 3.96 to 14.68 months; this indicates a very high rigidity in the transmission of monetary policy in Sierra Leone. In Gambia proper inference cannot be made on the speed of adjustment of deposit rate to changes in policy rate since in most of the windows a stable relationship between deposit rate and discount rates (policy rates) was not found. However, in the rolling windows where cointegration was found, the speed of adjustment ranged from 1.00 to 7.65 months, and after the 1999–2004 rolling window the speed of adjustment continued to increase until 2004–2009, indicating that the transmission policy is becoming faster in Gambia.

From the above analyses, some striking evidence emerged. One could expect that the speed of adjustment should be slow in the developing WAMZ economies but this is clearly not the case. The ability of monetary authorities to influence economic activities via changes in policy rates in the WAMZ was surprisingly high, especially in Ghana and Nigeria, compared to the findings in some emerging and advanced economies. For instance, in the Euro area, de Bondt (2005) found that speed of adjustment ranged between 2.8 to 10.2 months for lending rates and 3 to 23.8 months for deposit rates. Also, Chong *et al.* (2006) found a high speed of adjustment in Singapore, ranging from 6.0 to 13.2 months for deposit rates and 8.3 months for lending rates. Charoenseang and Manakit (2007) also found speed of adjustment to be between 0.25 and 15.57 for lending rates, and 7.09 and 12.52 months for deposit rates in Thailand. Scholnick (1996) found the speed of adjustment in lending rates to be 11.4 and 8.3 months in Malaysia and Singapore respectively. These findings show that the speed of adjustment in the WAMZ economies is comparatively high and in line with some emerging economies in Asia and advanced economies in the Euro area. The next section discusses the asymmetric mean adjustment lags.

5.5.2 Asymmetric Mean Adjustment Lags in the ECM

While the mean adjustment lag shows how long it takes lending and deposit rates to fully reflect changes in policy rate in the long-run, the asymmetric mean adjustment lag determines the speed of adjustment in lending and deposit rates back to equilibrium when they are either above or below their equilibrium levels. Recall that the Wald Test with a $\chi^2(1)$ distribution was used to test whether the coefficients of the positive and negative residuals are equal in Equation 4.10 in chapter four (i.e., $\theta_1 = \theta_2$), if the coefficients of the Wald Test are significant it implies there is asymmetric adjustment and if insignificant the adjustment is symmetric. The asymmetric mean adjustment lags which described the behaviour of commercial banks in adjusting retail interest rates in response to changes in policy interest rates were estimated as described in chapter four and the results are reported in Appendix E, tables E-1.0 to E-1.4.

5.5.2.1 Asymmetric Mean Adjustment Lag for the entire sample period

Figure 5.12 shows the plots of the estimated asymmetric mean adjustment lag of lending rates for the entire sample period for the economies analysed. It is apparent from Figure 5.12 that there are disparities across countries when lending rates are either above or below their equilibrium levels. For example, lending rates are rigid downward in Nigeria and Sierra Leone while rigid upwards in Gambia and Ghana.

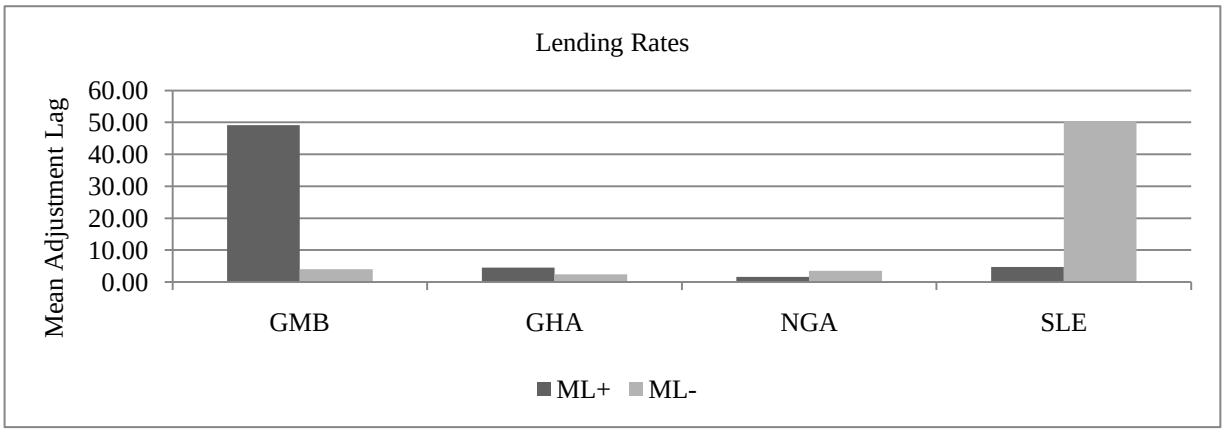


Figure 5.12: Asymmetric Adjustment: Entire sample period for Lending Rates
Source: Author's estimates.

The results regarding asymmetry in Gambia show that there is significantly upward asymmetric adjustment in lending rate to changes in policy rate. This is evident from the plot in Figure 5.12 with higher upward rigidity of 49.10 months, indicating that commercial banks

in the Gambia adjust lending rates upward rigidly. Such behaviour is consistent with the customer reaction hypothesis. On the other hand, significant downward asymmetric adjustment in lending rates was found in Sierra Leone suggesting that commercial banks in Sierra Leone rigidly adjust lending rates downwards. This behaviour by commercial banks in Sierra Leone is consistent with the collusive pricing arrangement among commercial banks in the loan market. It appears that commercial banks in Sierra Leone operate in unison in fixing prices. Breaking this pricing arrangement would mean loss of revenue if there was a decrease in lending rates, thus causing high rigidities in lending rate decreases rather than in lending rate increases. There is no evidence of asymmetry in lending rates in Ghana and Nigeria.

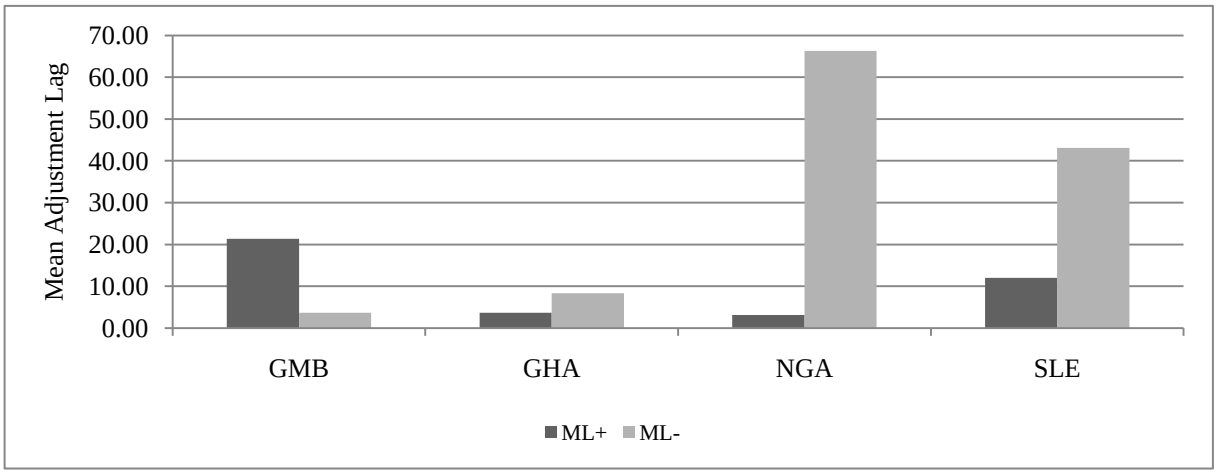


Figure 5.13: Asymmetric Adjustment: Entire sample period for Deposit Rates
Source: Author's estimates.

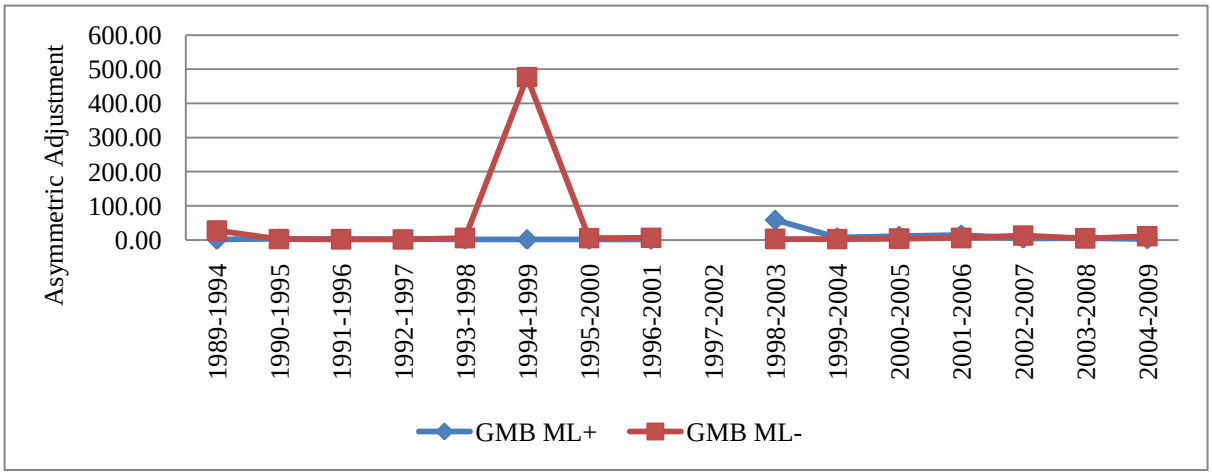
With regards to deposit rates, the empirical tests suggest that there is upward asymmetric adjustment in deposit rates in Gambia. Deposit rate is rigid when below equilibrium levels implying that deposit rate is more rigid when increasing compared to when the rates are decreasing, supporting the collusive pricing arrangement among commercial banks in Gambia. Also, downward asymmetric adjustment in deposit rates is found in Nigeria. This means that deposit rates are less rigid when increasing compared to when they are decreasing implying that commercial banks Nigeria tend to adjust their deposit rates upward faster than adjusting them downward. This behaviour of commercial banks is consistent with the customer reaction hypothesis among banks in the deposit market. These results are consistent with previous empirical findings. For instance, Hannan and Berger (1991); Neumark and Sharpe (1992) and Scholnick (1996) found that deposit rates are less rigid when they are above their equilibrium levels than when below equilibrium levels. That is less rigid when they are decreasing compared to when they are increasing. There are no evidences of

asymmetric adjustment in deposit rates in Ghana and Sierra Leone. The next section discusses the results of the asymmetric mean adjustment lag for the rolling windows analyses.

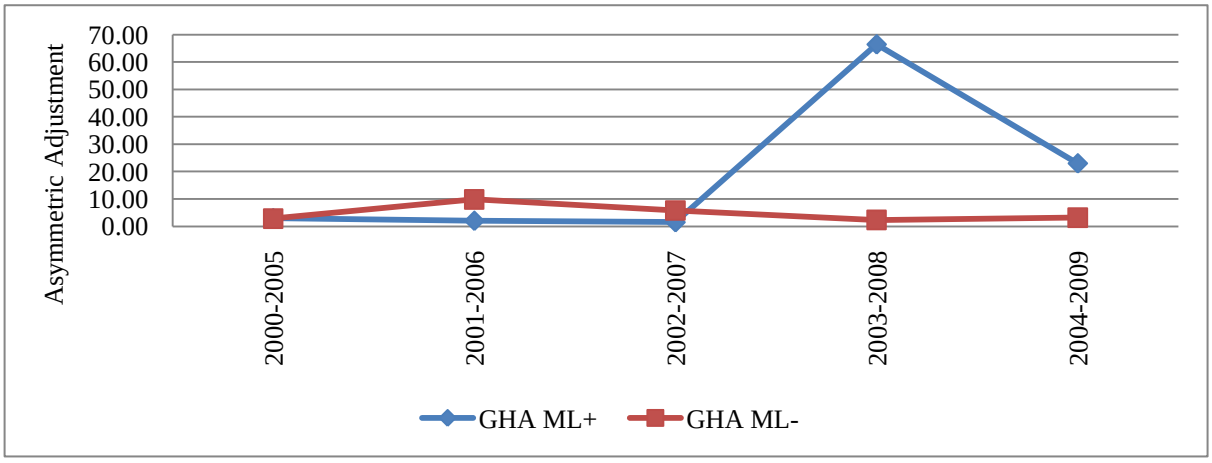
5.5.2.2 Asymmetric Mean Adjustment Lag for the rolling windows

The empirical tests show that there are huge discrepancies in lending and deposit rates among the economies analysed as shown in figures 5.14 and 5.15 below.

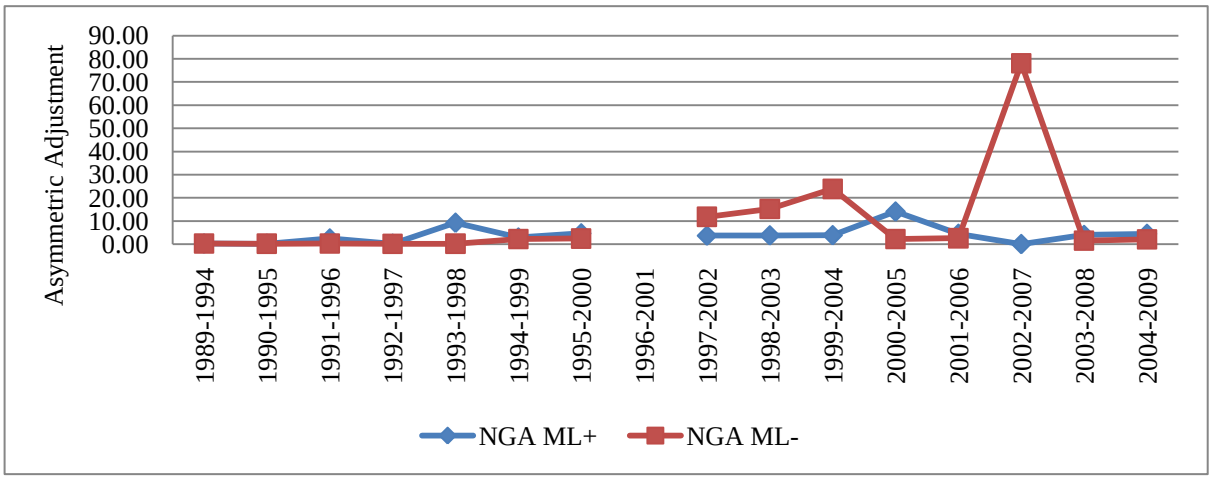
A: Gambia



B: Ghana



C: Nigeria



D: Sierra Leone

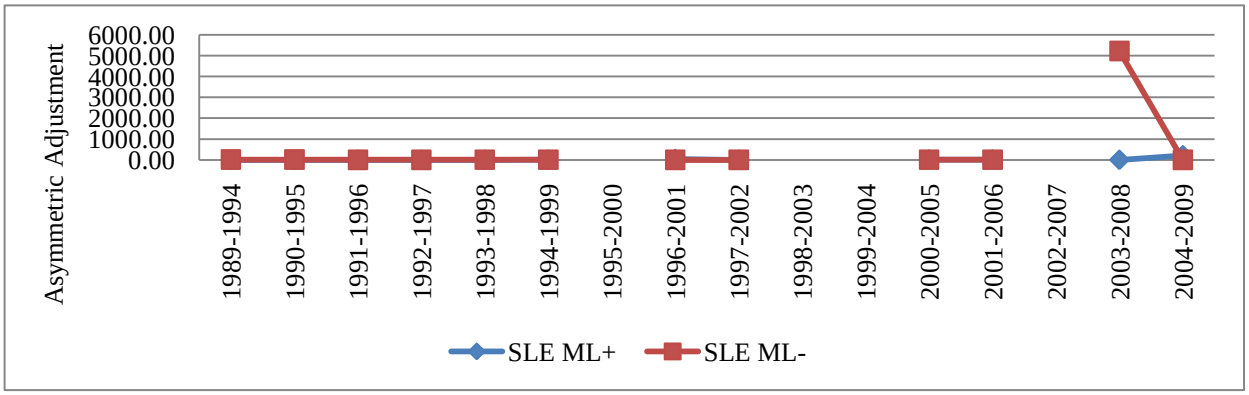


Figure 5.14: Asymmetric Adjustment: Rolling windows – Lending Rates

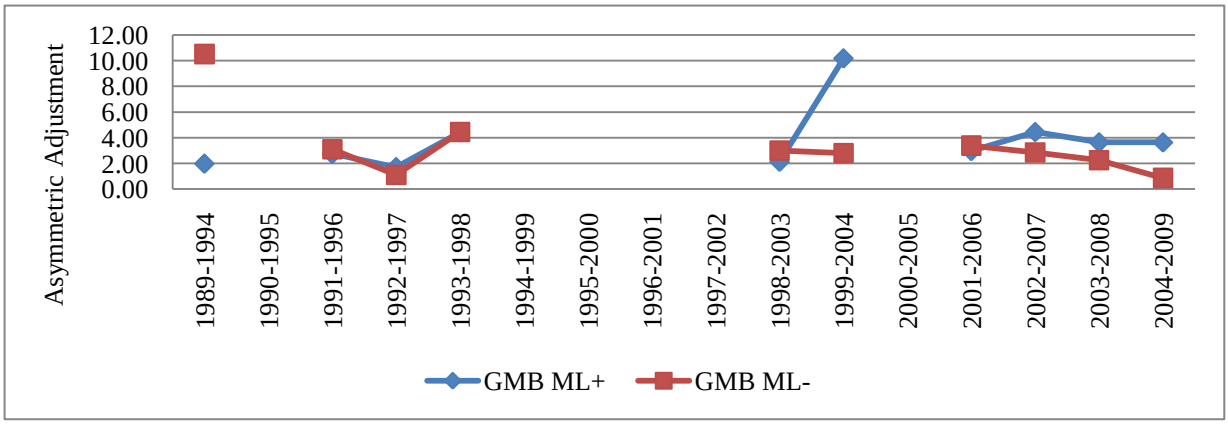
Source: Author's estimates.

The rolling window results of the asymmetric mean adjustment provided insufficient evidence of asymmetry in lending rates in Gambia. For instance, nine out of fifteen rolling windows where cointegration was found accepted the null hypothesis of no asymmetry while six rolling windows rejected the null hypothesis. The direction of asymmetry was found to be constant over time in the six cases where asymmetry was confirmed with lending rates significantly rigid downward supporting the collusive pricing arrangement among commercial banks. The all time high downward rigidity in lending was shown in the 1994–1999 rolling window 1994–1999 of 476.71 months implying that lending rate was highly rigid downward during this period in Gambia as shown in Figure 5.14. Also, in Ghana three out the five rolling windows rejected the null of no asymmetry while the other two accepted it, but the direction of asymmetry seem to be mixed. In the rolling windows 2001–2006 and 2002–2007, lending rate was significantly more rigid in downward adjustment than upward

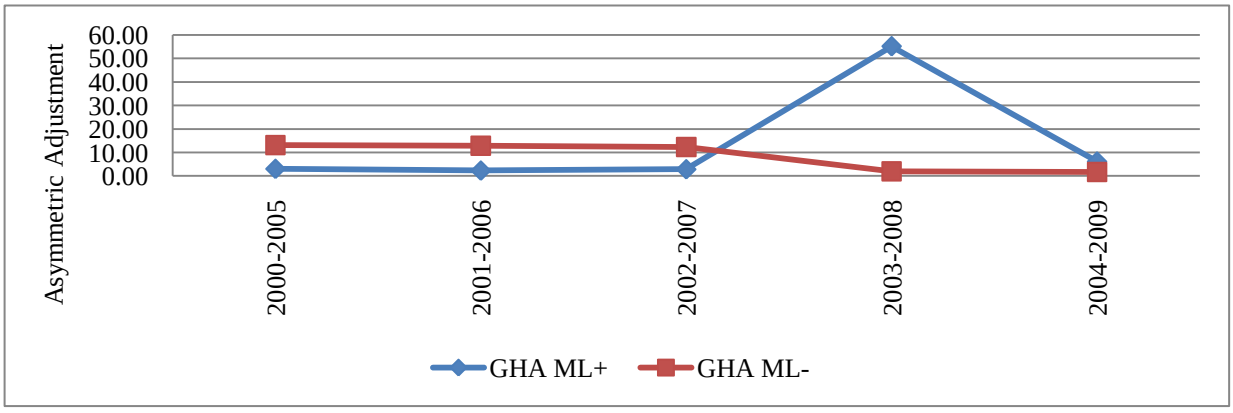
adjustment, supporting collusive pricing arrangement among banks. Conversely, in the 2004–2009 rolling window lending rate was more rigid upward than downward, supporting the customer reaction hypothesis.

In Nigeria, cointegration was found in fifteen rolling windows and out of these the null hypothesis of no asymmetry could not be rejected in nine and was rejected in six rolling windows, indicating some evidence of asymmetry in lending rates. The results show that the direction of asymmetry was constant upward over time, thus supporting the hypothesis of negative customer reaction. The negative customer reaction found in Nigeria was as a result of the increased level of competition among commercial banks. As far as Sierra Leone is concerned, the empirical evidences suggest that there are no evidences of significant asymmetric adjustment in lending rates, with the null hypothesis of no asymmetry being accepted in eleven out of the twelve rolling windows where cointegration was found. Upward asymmetric adjustment in lending rates was only found in the 1996–2001 rolling window which supports the theory of negative customer reaction.

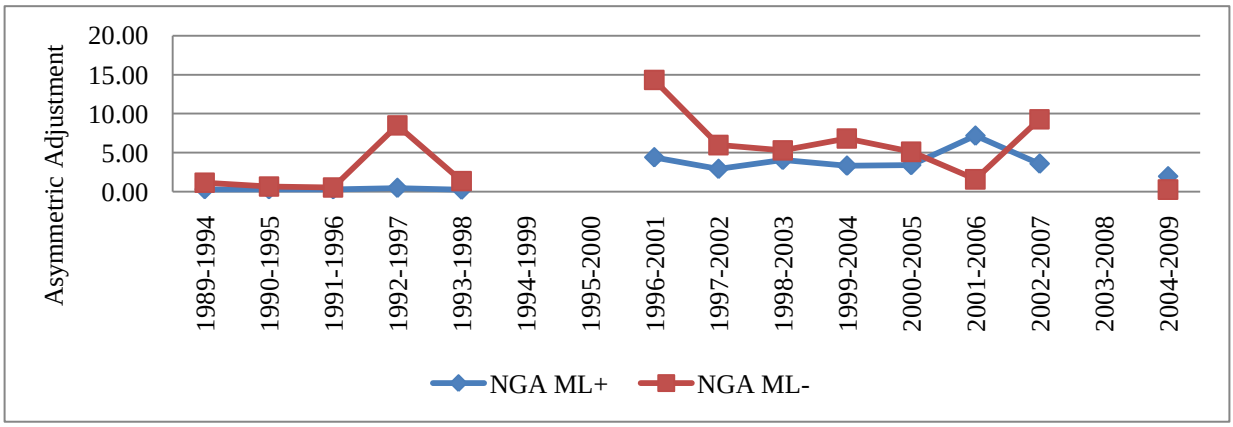
A: Gambia



B: Ghana



C: Nigeria



D: Sierra Leone

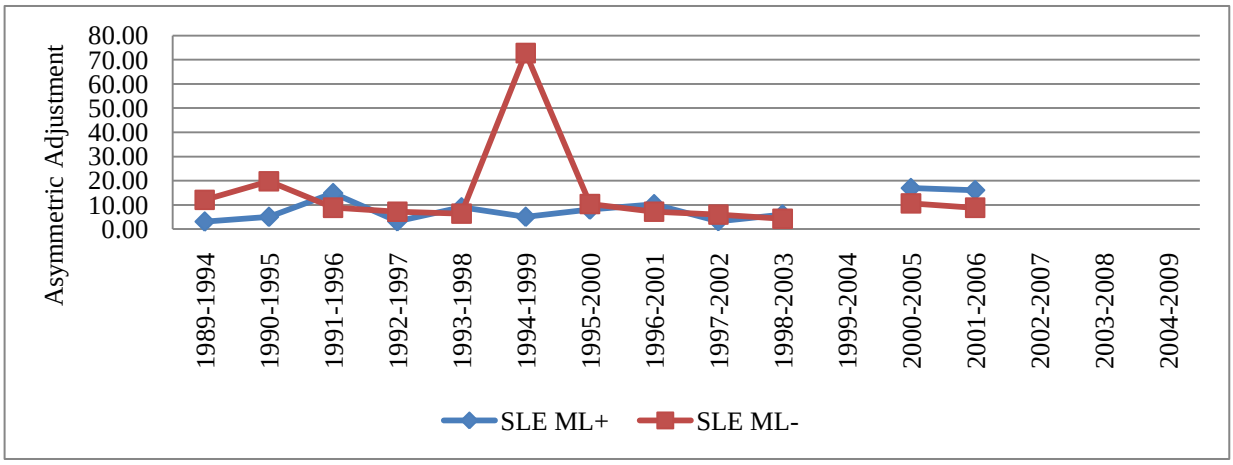


Figure 5.15: Asymmetric Adjustment: Rolling windows – Deposit Rates

Source: Author's estimates.

The analyses of the WAMZ economies continue with deposit rates. Figure 5.15 shows mixed results in terms of the adjustment rigidity and the direction of asymmetry across countries. In Gambia, the results of the rolling windows of deposit rates suggest that in six of the ten rolling windows where cointegration was found the null hypothesis of no asymmetry could not be rejected; thus, asymmetry was only found in four rolling windows. The directions of asymmetric adjustments are rigid downward in the 1989–1994 and 1993–1998 rolling windows, supporting the theory of negative customer reaction. On the other hand, in the 1999–2004 and 2004–2009 rolling windows asymmetric adjustments are rigid upward, supporting the theory collusive pricing arrangement of commercial banks.

In the case of Ghana, the null hypothesis of no asymmetry could not be rejected in three of the five rolling windows and the directions of asymmetric adjustment in deposit rates were

more rigid upward. Therefore, one could argue that there is significantly rigid upward asymmetric adjustment of commercial banks deposit rates in Ghana during the 2003–2008 and 2004–2009 rolling windows, suggesting that commercial banks have collusive pricing arrangement among them.

Asymmetry in Nigeria was not very pronounced as asymmetric adjustment in deposit rates was found in three out of the thirteen rolling windows where cointegration was found. In the rolling windows between 1992–1997 and 1993–1998, deposit rate was more rigid in downward adjustment than upward, therefore supporting the theory of negative customer reaction. In the rolling window 2004–2005, however, deposit rate was more rigid in upward adjustment than in downward adjustment, thus supporting the collusive pricing arrangement in the deposit market in Nigeria. Overall, there is weak evidence of asymmetry in Nigeria.

Finally, the results for Sierra Leone regarding asymmetric adjustments of deposit rates suggest that, out of the twelve rolling windows where cointegration was found for deposit rates, only the 1991–1996 rolling window confirmed the existence of rigid asymmetric upward adjustment in deposit rates. Thus one can conclude that there is no asymmetric adjustment in commercial bank deposit rate.

5.6 SUMMARY AND CONCLUSION

On the whole, the evidences show that there are significant differences across the WAMZ economies concerning the nature of the pass-through and speed of adjustments of changes in policy controlled interest rates to deposit and lending rates in both the full sample period and the rolling windows analysis. From the analyses several findings emerged which are worth mentioning[70]: First, the evidence in all four countries analysed suggest that the interest rate series are mainly I(1). Having confirmed the order of integration of the variables, the test for cointegration was conducted and the results suggest that both lending and deposit interest rates are cointegrated with policy interest rates for the entire sample period in all four countries. While empirical tests for the rolling window analysis of lending rates show that the null of no cointegration could be rejected in fifteen out of sixteen rolling windows in Gambia and Nigeria, five out of five in Ghana and twelve out of sixteen rolling windows in Sierra Leone. On the other hand the null of no cointegration in deposit rates was rejected in thirteen,

[70] A detailed summary of the findings are presented in Section 6.2 in chapter six.

twelve and eleven out of sixteen rolling windows in Nigeria, Sierra Leone and Gambia respectively. In Ghana, the null of no cointegration was rejected in all five rolling windows.

The results from the empirical pass-through analysis were mixed across the WAMZ countries. There were differences in the level of short-run and long-run pass-through across the WAMZ countries in the full sample and rolling windows. Overall, it was concluded that pass-through was incomplete in the WAMZ for the full sample period. The pass-throughs show some semblance of convergence towards a slower short-run pass-through in the 1994–1999 and 1993–1998 rolling windows for lending and deposit rates respectively. In the long-run pass-through, although evidence of convergence among the countries was mixed, the 2001–2006 rolling windows provided some evidence of convergence in lending and deposit rates.

The mean adjustment lags, which show how long it takes for retail interest rates to fully adjust to changes in policy rate in the long-run, suggest that the average speeds of adjustment for the full sample period were six and nine months for lending and deposit rates respectively, whereas the average speeds of adjustment for the rolling windows were four and five months for lending and deposit rates respectively. These results suggest that monetary policy transmission in the WAMZ economies is on average similar to those of emerging Asian economies. Finally, evidences of asymmetric adjustments were found in both lending and deposit rates amongst the WAMZ economies. Thus, the adjustment behaviour of commercial banks in the Gambia were considered asymmetric in both loan and deposit markets. Such behaviour of commercial banks in Gambia is consistent with negative customer reaction hypothesis and collusive pricing arrangement among banks. Also, significant evidence of asymmetry was found in lending rates adjustment in Sierra Leone implying that commercial banks in Sierra Leone have a collusive pricing arrangement. In Nigeria, weak evidence of asymmetry was found in deposit while no evidence of asymmetry was evident in Ghana.

CHAPTER SIX:
SUMMARY OF FINDINGS AND CONCLUSION

6.1 SUMMARY OF STUDY AND FINDINGS

The transmission of monetary policy in the context of developing countries has been the crux of monetary policy debate in recent years. The modes at which changes in policy stance of the monetary authorities are transmitted to their ultimate targets have posed lots of challenges for the conduct of monetary policy in developing economies. This study set out to investigate the degree of responsiveness of retail interest rates to changes in policy controlled interest rates and to determine the speed of adjustment of retail interest rates to changes in policy rates. Also, the study examines whether the interest rates set by commercial banks adjust asymmetrically or not to changes in policy rate in Gambia, Ghana, Nigeria and Sierra Leone. To this end, monthly interest series – deposit rate, discount rate, lending rate and Treasury bill rate – spanning the periods 1989 to 2009 for Gambia, Nigeria and Sierra Leone; and 2000 to 2009 for Ghana were used for the empirical analysis. The key objectives of the study were threefold. The first objective was to provide an overview of the financial system and monetary policy framework of the Anglophone West African economies; the second, to examine how lending and deposit rates respond to changes in the official rates and to see whether there is convergence among these countries over time; the final, to examine the relative adjustment of commercial banks' interest rates to changes in official rates when they are either above or below their equilibrium levels in all the four countries.

The study progressed with a review of both theoretical and empirical literature which formed the basis for the empirical analysis. Monetary policy transmission mechanism in developing countries, interest rate channel of monetary policy transmission, interest rate pass-through and its determinants were reviewed. Sundry factors determining the degree of pass-through and their implications for pass-through were discussed. The four theories of interest rates stickiness proposed by Lowe and Rohling (1992) – adverse selection, switching costs, risk sharing and consumer irrationality – were discussed, followed by other determinants of pass-through such as menu cost, structure of the financial system, asymmetric information, degree of financial market openness, implicit contract, market volatility, inflation, economic policy and regulation. Of these, the structure of the financial system was found to include other structural variables, such as the degree of competition within the banking system, the extent

of money market development and openness of the economy, ownership structure of the banking system, and the degree of the financial system development, which all have implications for the magnitude and speed of interest rate pass-through.

An extensive review of existing pass-through literature, which covered developed, emerging and developing economies, was done. The literature on the Euro area economies showed mixed results for the level of pass-through. But when the Euro area economies were compared with the CEE economies, pass-through was higher and almost complete in the CEE countries compared to the Euro area countries. Also, researches that compared the emerging and developing economies (for example, the Euro area and Asian countries) and other advanced economies (for example, USA) showed that pass-through was higher in advanced economies with well-developed financial markets, while pass-throughs in most cases were low in emerging and developing economies. Researches done on African economies are scant and the few available ones mainly focused on Southern African countries. From the review of empirical literature some noteworthy findings were revealed. First, there are significant variations in the degree of pass-through across countries. Second, less than one-to-one pass-through was observed in some advanced, emerging and developing countries implying that pass-through may be sluggish and incomplete. Third, there were differences in the degree of pass-through in lending and deposit rates; that is, no uniformity in the pass-through. Fourth, large variability in pass-through was observed and found to be dependent on the type of interest rates used. Fifth, evidences of asymmetric or symmetric adjustment were inconclusive. Finally, the speed and magnitude of pass-through were found to decline as maturity of the bank instrument increases.

To achieve the first objective stated in chapter one, an extensive overview of the financial systems of the WAMZ economies was done which revealed that for the period under review several changes have taken place in all four countries. It was apparent that the World Bank sponsored financial liberalization programmes embraced by these countries brought immense changes in the respective financial systems. The financial sectors have witnessed high level of expansion of the banking sector, and non-bank financial markets are also growing rapidly in the WAMZ. These developments have led to innovations and the introduction of new products in the financial markets which have enhanced competition in these countries. Also, the opening of a stock exchange in Sierra Leone, adoption of forward looking monetary policy framework, adoption of inflation targeting regimes in Ghana, introduction of the Repo and reverse Repos in Gambia and Sierra Leone, and an increased number of banks have laid

the ground for development of the financial system. Thus, monetary policy stance of the central bank is expected to be transmitted quickly and monetary policy would be effective.

The analyses were done at two levels, the first level covered the entire sample period and in the second level rolling windows of six years (i.e., 72 observations) were estimated. The empirical analysis started by determining the order of integration of the interest rate series, and evidence shows that the interest rate series are largely I(1). Next, four cointegration techniques were employed to examine the long-run equilibrium relationship between policy interest rates and retail interest rates. The analyses showed that the null hypothesis of no cointegration was rejected for lending and deposit rates in all the countries for the entire sample period. Whereas, for the rolling windows analyses, the null hypothesis of no cointegration between policy rates and lending rates was rejected in one, one and four out sixteen rolling windows in Gambia, Nigeria and Sierra Leone for lending rates respectively. On the other hand, the null hypothesis of no cointegration between policy rates and deposit rates was rejected in five, three and four out of sixteen rolling windows in Gambia, Nigeria and Sierra Leone respectively. In Ghana, the null hypothesis of no cointegration in both lending and deposit rates was rejected in all five rolling windows.

The second objective of the study required an examination of how lending and deposit rates respond to changes in policy rates and whether the pass-through among the WAMZ economies have converged over time. This objective was achieved by estimating an empirical pass-through model from which the long-run and short-run pass-through coefficients were obtained. The empirical pass-through results for the estimates of the full sample suggest that there is incomplete pass-through in all four countries analysed in the short-run and long-run. The long-run pass-through ranges between 50% and 81% for lending rates and 40% and 72% for deposit rates. Nigeria has the highest long-run pass-through in lending rates of 81% followed by Ghana, Sierra Leone and Gambia with a pass-through of 66%, 62% and 50% respectively. For deposit rates, Sierra Leone has the highest pass-through of 72%, closely followed by Ghana and Nigeria with 69% and 67% respectively; Gambia has the least with 40%. On the other hand, as expected, the short-run pass-through was found to be lower compared to the long-run pass-through and it ranges between -6% and 66% for lending rates and 13% and 47% for deposit rates. Nigeria has the highest short-run pass-through in lending rate of 66% followed by Sierra Leone, Gambia and Ghana with 30%, 26% and -6% respectively. The estimates of the short-run pass-through for deposits showed Nigeria has the

highest, of 47%, followed by Ghana, Gambia and Sierra Leone with 35%, 29% and 13% respectively.

The pass-through estimates for the rolling windows are mixed for both deposit and lending rates. Nigeria has the highest pass-through coefficients for both lending and deposit rates which range from -4% to 108% and -8% to 78% for short-run lending and deposit rates respectively. In the long-run pass-through coefficients range from 13% to 108% and -3% to 118% for lending and deposit rates respectively. In Gambia, short-run pass-through coefficients range from -1% to 35% and 0.1% to 51% for lending and deposit rates respectively, while the long-run pass-through estimates show the pass-through to range from 27% to 65% and 0.2% to 45% for lending and deposit rates respectively. In Ghana, short-run pass-through range from -129% to 20% and 2% to 34% for lending and deposit rates respectively while the long-run pass-through estimates range from 33% to 64% and 33% to 76% for lending and deposit rates respectively. For Sierra Leone short-run pass-through range from -6% to 41% and -2% to 20% for lending and deposit rates respectively, while the long-run pass-through estimates range from 2% to 56% and 7% to 69% for lending and deposit rates respectively. Factors such as the state of development of financial markets with limited range of financial products and alternative sources of funding for firms, a lack of competition in the banking sectors and between banks and non-bank financial intermediaries, and a high degree of concentration in the banking sector are identified as the main contributing factors for the incomplete pass-through in the WAMZ.

Evidence of convergence were found in lending rates short-run pass-through in the 1994–1999 rolling window in Gambia, Nigeria and Sierra Leone. Ghana also showed some level of convergence with other countries in the 2000–2005 to 2002–2007 rolling windows. For deposit rates, the level of convergence was mixed among the countries, but some evidence of convergence became apparent between Nigeria and Sierra Leone in the 1993–1998 rolling window, and in the 2002–2007 rolling window Ghana, Nigeria and Sierra Leone had similar pass-through. With the exception of Sierra Leone, all the other countries began to converge towards higher short-run pass-through in the 2003–2008 rolling window.

The third objective of the study was to unveil the dynamic adjustment of retail interest rates to changes in policy rate. This objective was achieved by estimating an error correction model from which the mean adjustment lags, which measure the speed of adjustment of retail interest rates, were calculated. The results for the full sample showed that it takes two, three,

seven and twelve months in Nigeria, Ghana, Sierra Leone and Gambia respectively for changes in policy rates to be fully reflected in lending rates, whereas it takes five, six, seven and eighteen months for deposit rates to fully adjust to changes in policy rate Ghana, Nigeria, Gambia and Sierra Leone. Thus, it is clear that the speed of adjustment was faster in Nigeria than the other countries, followed by Ghana. Also, the mean adjustment lags were calculated for the rolling windows in which cointegration were found. Overall, it takes lending rates to fully adjust to changes in policy rates an average period of four, three, four and eight months in Gambia, Ghana, Nigeria and Sierra Leone respectively and for deposit rates, it takes three, five, three and nine months in Gambia, Ghana, and Sierra Leone respectively. Speed of adjustments, though unstable for most countries, improved in deposit rates of Gambia, Ghana, Nigeria and Sierra Leone for the 2004–2009 rolling window. In Gambia, speed of adjustment in deposits improved from 2.58 to 1.67 months, and in Ghana from 4.41 to 2.79 months, in the 2004–2009 rolling windows. In Nigeria, speed of adjustment in deposit rates improved from 9.96 to 6.51 months, and in Sierra Leone from 12.20 to 8.41 months, in the 2004–2009 rolling window. Speed of adjustment in lending rates is becoming slower in Gambia, Ghana and Nigeria but is becoming faster in Sierra Leone in the 2004–2009 rolling window. One of the possible reasons put forward for the stickiness in lending rate adjustments could be as a result of the recent financial crisis, which increased the risk of defaults on loan agreements. Thus, commercial banks charge high interest rates to compensate for risk, causing retail interest rate adjustment to be sticky.

The second aspect of the third objective required an assessment of the speed of adjustments of commercial banks' interest rates to changes in policy interest rate when they are either below or above their equilibrium levels. The empirical tests revealed some rigidity in the adjustment of lending and deposit rates in both the full sample period and rolling windows in all four economies analysed. For instance, the full sample estimates showed evidence of upward and downward asymmetric adjustments of lending rates in Gambia and Sierra Leone respectively while downward and upward asymmetric adjustments of deposit rates were also observed in Nigeria and Gambia respectively. On the other hand, rolling windows analyses also provided some evidence of both downward and upward asymmetric adjustment in lending and deposit rates. Following Hannan and Berger (1991), Neumark and Sharpe (1992) and Scholnick (1996), two competing hypotheses were used to argue for the asymmetric adjustment of commercial banks' interest rates to changes in policy rates in the WAMZ economies. The hypotheses are the negative customer reaction and collusive pricing

arrangement among commercial banks. The results showed that, on one hand, commercial banks are quick in increasing their lending rates upward when policy interest rate increased, and rigid in adjusting it downwards when policy interest rate decreased in Gambia and Ghana. This suggests that commercial banks are in a collusive pricing arrangement and the credit markets in Gambia and Ghana are less competitive and concentrated, but these are expected to improve with the recent influx of foreign banks[71], the introduction of the Repo and reverse repo rates in Gambia, and the introduction of the inflation targeting regime in Ghana in 2007. On the other hand, in Nigeria and Sierra Leone, commercial banks are becoming more rigid in adjusting their lending rates upward when policy interest rates increase than in downward adjustment in response to a decrease in policy interest rate, suggesting commercial banks are becoming more competitive and sensitive to customer reaction.

6.2 POLICY IMPLICATIONS AND RECOMMENDATIONS

This study investigates the dynamic adjustment of commercial banks' interest rates to changes in the central bank's policy on interest rate and whether the interest rate pass-through has converged over time in Gambia, Ghana, Nigeria and Sierra Leone operating under the framework of the WAMZ. The findings from the empirical analysis have implications for both monetary and financial policies in the WAMZ economies. From a monetary policy point of view, it is fundamental to appreciate the magnitude and the speed at which monetary policy decisions influence retail interest rates on loans and deposits as they are crucial in determining the level of consumption, savings and investment in an economy. The implications and their recommendations are as follows:

First, the analyses showed that the effectiveness of monetary policy in influencing economic activities depends on the state of financial system development of the economy as the development of financial markets tends to lead to faster and larger pass-through. This study suggests that all four countries have a lower degree of financial market development compared with advanced economies. Empirical evidences on advanced countries such as US and the Euro area, where pass-through was found to be higher, show that these countries have developed financial markets, characterized by efficiency, innovations and wide range of products. Therefore, financial reforms and policies that promote financial market

[71] The number of commercial banks rose from four in 2000 to eleven in Gambia as of the end of 2008.

development should be adopted and must become the utmost priority in the WAMZ economies for the monetary policy to be effective in influencing economic activities.

Second, the incomplete pass-through, sluggish and asymmetric adjustments of commercial banks' interest rates in the region, is due in part to the lack of intense competition within the banking sector and between banks and non-bank financial intermediaries. For instance, stock markets, which are expected to serve as alternative investment outlets and spur competition in the financial system are little capitalized, are not too active in Ghana and Nigeria and are non-existent in Gambia, although Sierra Leone has opened one in 2009. This condition has reinforced the pre-eminence of bank loans as the main debt instrument available to economic agents in the region. Thus, economic agents are forced to accept whatever interest rates they faced. One possible way to circumvent this issue is for the monetary authorities to be committed in rendering the already established Ghanaian and Nigerian stock exchanges active and highly capitalized by encouraging cross border listings of companies. This would enable the diversification of assets in the WAMZ and ultimately reduce interest margin and increase the speed of pass-through in the region. It is therefore imperative on the monetary authorities in the WAMZ economies to adopt policies that stimulate competition, not only within the banking sector but also between banks and non-bank financial intermediaries.

Third, as noted in chapter three, the WAMZ financial systems are dominated by the banking sector whereas other non-bank financial intermediaries are either underdeveloped or non-existent in some countries. This left economic agents with no alternative sources of funding and investment but to rely on bank loans, which are expensive and in most cases short-term. Even though a lot of progress has been made by each country in terms of establishing a number of non-bank financial intermediaries, the pace at which they grow relative to the banking sector is sluggish. Therefore, monetary authorities in the WAMZ economies must implement policies that would attract investment into non-bank financial intermediaries especially in Gambia and Sierra Leone.

Fourth, the monetary policy orientation in the economy is also crucial for the effectiveness of monetary policy. Economies that have adopted financial reforms, market-oriented and more transparent monetary policies, tend to have a higher speed of adjustment as evident in the case of Nigeria and Ghana. Monetary policy regimes seem to be an indispensable factor for the magnitude and speed of pass-through in the WAMZ economies. This was evident in the overall level of pass-through and speed of adjustment in the results of Ghana and Nigeria.

This calls for the intervention of the monetary authorities to harmonize the monetary policies in the WAMZ countries which would enhance the speed of interest rate pass-through in Gambia and Sierra Leone.

Finally, the findings in this study have highlighted several issues in the WAMZ with regards to the transmission of monetary policy and interest rate pass-through dynamics which are crucial for the proposed launch of the common currency in the WAMZ by 2015 and the conduct of monetary policy for each member state, including the West African Monetary Institute (WAMI). Also, this study could also serve as a reference for commercial banks and investors interested in investing in the WAMZ economies and as the basis for future studies on the WAMZ economies.

6.3 AREAS FOR FURTHER RESEARCH

The study looked mainly at the adjustment of commercial banks' deposit and lending rates and the effectiveness of monetary policy in four Anglophone West African countries and assessed the level of stickiness in commercial banks' interest rates adjustment. The empirical tests show that interest rate pass-throughs in the WAMZ, though similar to some findings in emerging Asian and Euro area countries, are incomplete and sticky in some cases. A possible area for future research may be to include more market interest rates such as bank rate, money market rates and government yield to explore the dynamics of interest rate adjustment in the WAMZ.

Also, this study did not model the determinants of interest rate pass-through or factors that affect interest rate pass-through over time in the WAMZ countries. A possible area in which future studies could be extended is by modelling variables that determine the degree of interest rate pass-through. Further, as the current study has looked at the first stage of the monetary policy transmission mechanism, future studies may explore the other stages of the monetary policy transmission mechanism.

REFERENCES

ACHEAMPONG, K., (2005). "Bank interest rate channel of monetary policy transmission in Ghana". *Working Paper*, 10. Bank of Ghana.

AGÉNOR P.R., and MONTIEL, P.J., (2008). *Development Macroeconomics*. Third Edition, London: Princeton University Press.

ALLEN, F., and GALE, D., (2004). "Comparative financial systems: A survey". In Boot, A., S. Bahattacharya and A. Thakor (eds.). *Credit and the Macroeconomy*. Oxford: Oxford University Press.

AMOAH, B., and MUMUNI, Z., (2008), "Choice of monetary policy regime in Ghana". Working paper series. Bank of Ghana. WP/BOG-2008/07.

ANGELONI, I., L. BUTTIGLIONE, FERRI G., and GAIOTTI, E., (1995). "The credit channel of monetary policy across heterogeneous banks: the case of Italy", *Temi di discussione Banca d'Italia,* No. 256.

AUSUBEL, L. M., (1991) "The failure of competition in the credit card market", *American Economic Review*, 81: 50−81.

ARTIS, M. J., and ZHANG, W., (1998). "The linkages of interest rates within the EMS". *Weltwirtschaftliches Archiv*, 134(1): 117–132.

AYDIN, H. I., (2007). "Interest rate pass-through in Turkey", Research and Monetary Policy Department Working Paper No 07/05, Ankara: The Central Bank of the Republic of Turkey.

AYADI, O. F., and HYMAN, L., (2006), "Financial liberalization and price rigidity in the Nigerian banking system" *Emerald Managerial Finance,* 32(7): 557−568.

AZIAKPONO, M. J., (2006). "Financial integration amongst the SACU Countries: Evidence from interest rate pass-through analysis". *Journal for the Studies in Economics and Econometrics*, 30(2):1−23.

AZIAKPONO, M. J., KLEIMEIER, S. and SANDER, H., (2007). "Banking market integration in the SADC countries: Evidence from interest rate analyses". Maastricht Research School of Economics of Technology and Organizations (METEOR)

Working Paper RM 07/047. University of Maastricht: [Online] [Available] http://edocs.ub.unimaas.nl/loader/file.asp?id=1284. [Accessed: 10/09/2009].

AZIAKPONO, M. J., WILSON, M. K. and MANUEL, J., (2007). "Adjustment of commercial banks' interest rates and the effectiveness of monetary policy in South Africa". *The African Finance Journal*, 9(1): 1−20.

AZIAKPONO, M., (2008). "The Depth of Financial Integration and its Effects on Financial Development and Economic Performance of the SACU Countries*"***.** Unpublished PhD Thesis. Department of Economics, University of the Free State.

AZIAKPONO, M. J. and WILSON, M. K., (2010). "Interest rate pass-through and monetary policy regimes in South Africa". *Paper for Presentation at the CSAE Conference*, 21−23 March, Oxford University, UK.

BANK FOR INTERNATIONAL SETTLEMENTS (BIS), (1994). *National Differences in Interest Rate Transmission*, March, Basle: Bank for International Settlements.

BANK FOR INTERNATIONAL SETTLEMENTS (BIS), (1997). "Principles for the Management of Interest Rate Risk. Basle Committee on Banking Supervision". [Online] [Available] http://www.bis.org/publ/bcbs29a.pdf [Accessed: 10/09/2009].

BANK OF SIERRA LEONE (BSL), (2009). "Annual Report", [Online] [Available]: http://www.bankofsierraleone-centralbank.org/pdf/AnnualReport2009.pdf [Accessed 10/09/2010].

BAUGNET, V., COLLIN, M. and DHYNE, E., (2007) "Monetary policy and the adjustment of the Belgian private bank interest rates- an econometric analysis", National Bank of Belgium Research Department.

BECK, T., and AL-HUSSAINY, E., (2010). "Financial Structure Dataset". [Online] [Available]: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20696167~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html [Accessed 09/08/2010].

BECK, T., and DEMIRGUC-KUNT, A., (2009). “Financial Institutions and Markets across Countries and over Time – Data and Analysis. [Online] [Available]: http://siteresources.worldbank.org/INTRES/Resources/469232-107449512766/Financial_Institutions_and_Markets_across_Countries.pdf [Accessed 9/10/2010].

BECK, T., DEMIRGUC-KUNT, A., and LEVINE, R., (1999). “A new database on financial development and structure”. World Bank. Financial Sector Discussion Paper No. 2.

BECK, T., LEVINE, R., AND LOAYZA, N., (2000). “Finance and the sources of growth”. *Journal of Financial Economics* 58: 261−300.

BERGER, A. N., and UDELL, G. F., (1992). Some evidence on the empirical significance of credit rationing. *Journal of Political Economy*, 100: 1047−1077.

BERLIN, M., and MESTER, L. J., (1997). "Deposits and relationship lending". Working Papers 96-18/R, Federal Reserve Bank of Philadelphia.

BERNANKE, B. S., and GERTLER, M., (1995). “Inside the black box: The credit channel of monetary policy transmission”. *Journal of Economic Perspectives*, 9(4): 27−48.

BERSTEIN, S., and FUENTES, R., (2003). “Concentration and Price Rigidity: Evidence for the Deposit Market in Chile”. Central Bank of Chile internal seminar [Online] [Available]: http://www.cemla.org/pdf/redix/RED-IX-ch-Berstein-Fuentes.pdf, [Accessed 10/09/2009].

BORIO, C. E. V., and FRITZ, W., (1995). “The response of short-term bank lending rates to policy rates: A cross-country perspective”. BIS, *Financial Structure and Monetary Policy Transmission Mechanism*, March, Basle, 106−153.

BROOKS, C., (2008). *Introductory Econometrics for Finance*. Second Edition, The ICMA Centre, University of Reading: Cambridge University Press.

BUIGUT, S., (2009). “Monetary Policy Transmission Mechanism: Implications for the Proposed East African Community (EAC) Monetary Union”. [Online] [Available] www.csae.ox.ac.uk/conferences/2009-EDiA/papers/300-Buigut.pdf Accessed [02/02/2010].

BURGER, P., (2008). "Money Credit and Interest: Searching for a Credit Channel in South Africa". Development Policy Research Unit (DPRU) conference paper. University of Cape Town. [Online] [Available] http://www.commerce.uct.ac.za/Research_Units/DPRU/Conference2008/Conference2008_Papers/Burger%20credit%20channel%20paper.pdf Accessed [24/09/2010].

BURGSTALLER, J., (2005). "Interest Rate Pass-through Estimates From Vector Autoregressive Models". *Working Paper* No. 0510. Austria: Johannes Kepler University of Linz.

CARPENTER, S. B., (1999). "Informal credit markets and the transmission of monetary policy: Evidence from South Korea". *Review of Development Economics,* 3(3), 323−335.

CENTRAL BANK OF GHANA (BOG), (2008). "Annual Report", [Online] [Available] http://www.bog.gov.gh/index1.php?linkid=157&archiveid=1399&page=1&adate=31%2F12%2F2008 [Accessed 2/09/2009].

CENTRAL BANK OF NIGERIA (CBN), (2008). "Annual Report", [Online] [Available] http://www.cenbank.org/OUT/2010/PUBLICATIONS/REPORTS/GOV/ANNUAL%20REPORT%202008FINAL.PDF [Accessed 2/09/2010].

CENTRAL BANK OF NIGERIA (CBN), (2009). "Annual Report", [Online] [Available] http://www.cenbank.org/OUT/2010/PUBLICATIONS/REPORTS/RSD/ANNUAL%20REPORT%202009.HTML [Accessed 12/11/2010].

CHAROENSEANG, J., and MANAKIT, P., (2007). "Thai monetary policy transmission in an inflation targeting era", *Journal of Asian Economics,* 18:144-157.

CHIONIS, D. P., and LEON, C. A., (2006). "Interest rate transmission in Greece: did EMU cause a structural break?" *Journal of Policy Modeling*, 28:453−466.

CHONG, B. S., LIU, M-H., and SHRESTHA, K., (2006). "Monetary transmission via the administered interest rates channel", *Journal of Banking and Finance*, 30:1467−1484.

COTTARELLI, C. and KOURELIS, A., (1994). "Financial structure, bank lending rates and the transmission of monetary policy". *IMF Staff Papers*, December, (41): 587−623.

COTTARELLI, C., FERRI, G. and GENERALE, A., (1995). "Bank lending rates and financial structure in Italy: A case study". *IMF Staff Papers*, September, 42(3): 670−700.

DE ANGELIS, C., AZIAKPONO, M. J., and FAURE, A. P., (2005). "the transmission of monetary policy under the repo system in South Africa: An empirical analysis". *South African Journal of Economics*, 73(4): 657−673.

DE BONDT, G., (2002). "Retail Bank Interest Rate Pass Through: New Evidence at the Euro Area Level". *Working paper series*, No. 136, European Central Bank, Frankfurt, Germany.

DE BONDT, G., (2005). "Interest rate pass-through: empirical results for the Euro area". *German Economic Review* 6, 37–78.

DE GRAEVE, F., DE JONGHE, O., and VENNET, R. V., (2007). "Competition, transmission and bank pricing policies: Evidence from Belgian loan and deposit markets". *Journal of Banking and Finance*, 31:259−278.

DONNAY, M., and DEGRYSE, H., (2001). "Bank lending rate pass-through and differences in the transmission of a single EMU monetary policy". *Discussion Paper 17*, Center for Economic Studies, K. U. Leuven.

DOORNIK, J., and HENDRY, D., (1994). *An Interactive Econometric Modelling System.* London: International Thompson Publishing.

EGERT, B., CRESPO-CUARESMA, J., and REININGER, T. (2007). "Interest rate pass-through in central and eastern Europe: Reborn from ashes merely to pass away?" *Journal of Policy Modeling*, 29:209−225.

ENGLE, R. F., and GRANGER, C. W. J., (1987). "Cointegration and error correction: representation, estimation and testing". *Econometrica.* 55, 251−276.

FAURE, A. P., (2006). *Money, Interest and Monetary Policy*. Cape Town: Quoin Institute.

FUENTES, J. R., and AHUMADA, L. A., (2003). "Banking Industry and Monetary Policy: An Overview". Central Bank of Chile Working Papers No 240. [Online] [Available] http://www.bcentral.cl/estudios/documentos-trabajo/pdf/dtbc240.pdf [Accessed: 04/08/2010].

FRIED, J., and HOWITT, P., (1980). "Credit rationing and implicit contract theory". *Journal of Money, Credit, and Banking*, 12(3), 471–487.

GAMBACORTA, L., (2008). "How do banks set interest rates?" *European Economic Review*, 52:792−819.

GHATAK, S., and SANCHEZ-FUNG, J. R., (2007). *Monetary Economics in Developing Countries*. Third Edition. Basingstoke: Palgrave McMillan.

GIDLOW, R. M. (1998), "Instruments of Monetary Policy in South Africa", SA Financial Sector Forum. [Online] [Available] http://www.finforum.co.za/ecpolicy/impconts.htm [Accessed: 06/04/2009].

GONZALEZ, R. L., and SALAS-FUMAS, V. (2005). "Market Power and Bank Interest Rate Adjustments". Bank of Spain Working Paper. No. 0539.

GUJARATI, D. N., and PORTER, D., (2009). *Basic Econometrics*. Fifth Edition. New York: McGraw-Hill.

HAAN, J. D., OOSTERLOO, S., and SCHOENMAKER, D., (2009). *European Financial Markets and Institutions*. Cambridge: Cambridge University Press.

HANNAN, T. H., and BERGER, A. N., (1991). "The rigidity of prices: evidence from the banking industry". *The American Economic Review*, 81(4): 938−945.

HANNAN, T., and LIANG, J. N., (1993). "Bank Commercial Lending and the Influence of Thrift Competition. Finance and Economics Discussion Series 93–39. Washington: U.S. Board of Governors of the Federal Reserve System. [Online] [Available] www.econpapers.repec.org/paper/fipfedgfe/93-39.htm [Accessed 10/09/2010].

HARRIS, R. J. D., 1995. *Using Cointegration Analysis in Econometric Modelling*, London: Harvester Wheatsheaf/Prentice Hall.

HEFFERMAN, S., (1997). "Modelling British interest rate adjustment: An error correction approach". *Economica,* 1197(64): 211−231.

HUBBARD, R. G., (1994). "Is there a credit channel for monetary policy?" NBER Working Paper. No. 4977.

HUSLSEWIG, O., MAYER, E., and WOLLMERSHAUSER, T., (2009). "Bank behaviour, incomplete interest rate pass-through, and the cost channel of monetary policy transmission", *Economic Modelling*, 26:1310−1327.

JANKEE, K. (2004). "Testing for nonlinearity in the adjustments of commercial banks' retail rates to interbank rates: The case of Mauritius". Paper presented at the 9th Annual Conference on Economic Modelling for Africa. Cape Town, 30th June to 2nd July. [Online] [Available] http://www.commerce.uct.ac.za/economics/Conferences/2004/AES2004Conference/Papers/Kheswar.pdf [Accessed: 03/06/2010].

JOHANSEN, S., (1988). "Statistical analysis of cointegrating vectors". *Journal of Economic Dynamics and Control*, 12: 231−54.

KAKETSIS, A., and SARANTIS, N., (2006). "The effects of monetary policy changes on market interest rates in Greece: An event study approach", *International Review of Economics and Finance,* 15:487−504.

KAMIN, S., TURNER, P., and VAN'T DACK, J., (1998). The transmission mechanism of monetary policy in emerging market countries: an overview. BIS Policy Papers, No. 3, pp. 5−64. [Online] [Available] http://www.bis.org/publ/plcy03.pdf Accessed [03/06/2010].

KING, R. G., and LEVINE, R., (1993). "Finance and Growth: Schumpeter Might Be Right". World Bank Policy Research Working Papers. WPS 1083.

KLEIMEIER, S., and SANDER, H., (2006). "Expected versus unexpected monetary policy impulses and interest rate pass-through in Euro-zone retail banking markets." *Economica*, 71: 99−123.

KREMERS, J. J. M., ERICSSON, N. R., and DOLADO, J. J., (1992). "The power of cointegration tests". *Oxford Bulletin of Economics and Statistics,* 54(3): 325−348.

KUANG, D. O. S., (2008) "Financial market developments and their implication for monetary policy", BIS Papers No. 39. [Online] [Available] http://www.bis.org/publ/bppdf/bispap39.htm [Accessed 10/09/2010].

KWAPIL, C., and SCHARLER, J., (2010). “Interest rate pass-through, monetary policy rules and macroeconomic stability”. *Journal of International Money and Finance*, 29: 236−251.

KWIATKOWSKI, D., PHILLIPS, P. C. B., SCHMID, T, P., and SHIN, Y., (1992). “Testing the null hypothesis of stationary against the alternative of a unit root”. *Journal of Econometrics,* 54, 159−178.

LEUVENSTEIJN, M. V., SORENSEN, C. K., BIKKER, J. A., and VAN RIXTEL, A. A. R. J. M., (2008). “Impact of bank competition on the interest rate pass-through in the Euro area”. ECB Working Paper Series. No. 885.

LIM, G.C., (2001). “Bank interest rate adjustments: Are they asymmetric?” *The Economic Record,* 77(237):135−147.

LIU, M-H., MARGARITIS, D., and TOURANI-RAD, A., (2008). “Monetary policy transparency and pass-through of retail interest rates”. *Journal of Banking and Finance*, 32:501−511.

LOWE, P., and ROHLING, T., (1992). “Loan Rate Stickiness: Theory and Evidence”. *Research Discussion Paper*, Reserve Bank of Australia.

LUE, C., NASH, K., SALINGER, L. (2002). “Survey of West Africa Financial and Monetary Systems”. Nathan Associates INC. Under contract No. PCE-1-09-98-00016-00.

MADSEN, J., and YANG, Y., (1998). “Asymmetric price adjustment in a menu-cost model”. *Journal of Economics*, 68(3): 295−309.

MAHADEVA, L., and SINCLAIR, P., (2005). *How Monetary Policy Works*. London and New York: Routledge, Taylor and Francis.

MANNA, M., PILL, H., QUIROS, G., (2001). “The Eurosystem’s operational framework in the context of the ECB's monetary policy strategy”. European Central Bank, mimeo.

MAROTTA, G. (2009). “Structural breaks in the lending interest rate pass-through and the euro”, *Economic Modelling*, 26: 191−205.

McKINNON, R. I., (1973). *Money and Capital in Economic Development*. Washington: The Brookings Institution.

MIRDALA, R., (2009). "Interest Rate Transmission Mechanism of Monetary Policy in the Selected EMU Candidate Countries (SVAR approach)". MPRA Paper No. 14072. [Online] [Available] http://mpra.ub.uni-muenchen.de/14072/.

MISHKIN, F. S., (1996). "The Channels of Monetary Transmission: Lessons for Monetary Policy". NBER Working Paper Series. Working Paper 5464.

MISHKIN, F. S., (2007). *The Economics of Money, Banking and Financial Markets*. Harlow: Addison-Wesley, Alternate Edition, pp. 617−630.

MOAZZAMI, B., (1999). Lending rate stickiness and monetary transmission mechanism: The case of Canada and the United States. *Applied Financial Economics*, 9. 533−538.

MOHANTY, M. S., and TURNER, P., (2008). "Transmission mechanism for monetary policy in emerging market economies'. *BIS Papers.* No. 35: 1−59.

MOJON, B., (2000). **"**Financial Structure and the Interest Rate Channel of ECB Monetary Policy". *European Central Bank Working Paper,* European Central Bank, No. 40.

MONTIEL, P. J., (1991). "The transmission mechanism for monetary policy in developing countries". *IMF Staff Papers*. 38 (1).

NEUMARK, D. and SHARPE, S. A. (1992). "Market structure and the nature of price rigidity: Evidence from the market for consumer deposits". *Quarterly Journal of Economics*. 107(2): 657–680.

OZDEMIR, B. K., (2009). "Retail bank interest rate pass-through: The Turkish experience", *International Research Journal of Finance and Economics,* Issue: 28, pp.7−15.

RAMLOGAN, C., (2004). "The transmission mechanism of monetary policy: Evidence from the Caribbean". *Journal of Economic Studies*. 31(5): 435−447.

ROTEMBERG, J. J., and SALONER, G. (1987). "The relative rigidity of monopoly pricing". *American Economic Review.* 77: 917−926.

SAMBA, M. C., and YAN, Y., (2010). "Interest rate pass-through in the Central African economic and monetary community area: Evidence from an ADRL analysis". *International Journal of Business Management.* 5(1):31−41.

SANDER, H., and KLEIMEIR, S., (2000). "Asymmetric Adjustment of Commercial Bank Interest Rates in the Euro Area: Implications for Monetary Policy". *Paper prepared for 3rd of the Swiss Society for Financial Market Research*, Zurich, April 7, 2000 [Online] [Available] http://www.fmpm.ch [Accessed 10/09/2009].

SANDER, H., and KLEIMEIER, S., (2002). "Asymmetric adjustment of commercial bank interest rates in the Euro area: An empirical investigation into interest rate pass-through". *Kredit und Kapital* 35, 161–192.

SANDER, H., and KLEIMEIER, S., (2004). "Convergence in Euro-zone retail banking? What interest rate pass-through tells us about monetary policy transmission, competition and integration". *Journal of International Money and Finance* 23, 461–492.

SANDER, H., and KLEIMEIER, S., (2006). "Interest rate pass-through in the common monetary area of the SACU countries". *Maastricht Research School of Economics of Technology and Organisations.* Maastricht University.

SCHOLNICK, B., (1996). "Asymmetric adjustment of commercial bank interest rates: Evidence from Malaysia and Singapore". *Journal of International Money and Finance* 15, 485–496.

SCHWARZBAUER, W., (2007). "Financial Structure and Its Impact on the Convergence of Interest Rates Pass-Through in Europe: A Time-varying Interest Rate Pass-through Model". ENEPRI Working Paper No. 51.

SHAW, E. S., (1973). *Financial Deepening in Economic Development*. New York: Oxford University Press.

SORENSEN, C. K., and WERNER, T. (2006) "Bank interest rate pass-through in the Euro area: a cross country comparison", Working paper Series No. 580, Frankfurt am Main: European Central Bank.

SRIRAM, S. S., (2009). "The Gambia: Demand for Broad Money and Implication for Monetary Policy Conduct". IMF Working Paper. WP/09/192.

STIGLITZ, J. E., and WEISS, A., (1981). "Credit rationing in markets with imperfect information." *American Economic Review* 53 (June): 393−410.

SUDO, N., and Y., TERANISHI (2008). “Optimal Monetary Policy under Imperfect Financial Integration”, *Discussion Paper No*. 2008-E-25, IMES Discussion Paper Series, Bank of Japan.

TAYLOR, L., (1982). “IS-LM in the tropics: Diagrammatic of the new structuralist macro critique," In *Economic Stabilization in Developing Countries*. Washington: The Brookings Institution.

TIEMAN, A., (2004). “Interest rate pass-through in Romania and other Central European economies”, IMF Working Paper WP/04/211.

TOMASZ, C., (2003). “Interest rate pass-through in the Polish banking sector and bank-specific financial disturbances”. *Munich Personal RePEc Archive* (MPRA) Paper No. 5133.

TOOLSEMA, L. A., STURM, J. E. and DE, H. J., (2002). “Convergence of Pass-through from Money Market to Lending Rates in EMU Countries: New Evidence”. CCSO Centre for Economic Research, Groningen. *Working Paper* No.2002/6.

WAMI, (2008). West African Monetary Institute Annual Report. [Online] [Available] http://www.wami-imao.org/english/doc/WAMI%202008%20ANNUAL%20REPORT_New%20version.final29.01.pdf Accessed [24/09/2010].

WANG, K-M., and LEE, Y-M., (2009). “Market volatility and retail interest rate pass-through”. *Economic Modelling*, 26, 1270–1282.

WETH, M. A., (2002) “The pass-through from market interest rates to bank lending rates in Germany”. *Discussion Paper*, 11/02, Economic Research Centre of the Deutsche Bundesbank, Germany.

WIJNBERGEN, S. V., (1982). “Stagflationary effects of monetary stabilization policies: A quantitative analysis of South Korea. *Journal of Development Economics* 10(1982): 133−169.

WIJNBERGEN, S. V., (1983). "Interest rate management in LDCs". *Journal of Monetary Economics*, 12: 433−452.

WORLD BANK, (2007). Making Finance work for Africa: Financial Sector Integration in two Regions of Sub-Saharan Africa. [Online] [Available] http://siteresources.worldbank.org/INTAFRSUMAFTPS/Resources/Working_Paper_on_Regional_Financial_Integration_Jan07.pdf [Accessed 19/09/2010].

WORLD BANK, (2009). World Data Bank. [Online] [Available] http://databank.worldbank.org/ddp/home.do [Accessed 19/09/2010].

APPENDICES

Appendix A: Summary of Empirical Pass-Through Studies

Study	Country(s) Covered	Sample	Variables Used		Estimation Method(s)	Pass-Through		Speed of Adjustment	Asymmetric Adjustment			Remark(s)
			Policy Rate	Market Interest Rates		Short-run	Long-run		Present	Increase	Decrease	
Kwapil and Scharler (2010)	US and Euro area	1995-2003	Three-months money market rate	Sundry of deposit and lending rates	ARDL and EG Cointegration	Average PT US: DR=0.97 LR=0.79 Euro area DR=0.16 LR=0.34	Average PT US: DR=0.93 LR=0.57 Euro area DR=0.32 LR=0.48	NA	No Evidence	NA	NA	PT in the US was almost complete and symmetric. Whereas PT in the Euro area was incomplete.
Samba and Yan (2010)	CAEMC	1990-2007	Money market rate	Deposit and Lending rates	ARDL	DR=0.37 LR=0.67	DR=0.33 LR=6.21	DR=0.036 LR=0.00216	Evidence of Asymmetry	Not reported	Not reported	Long-run PT of Deposit rates is incomplete and long-run pass-through of lending rates exhibit overshooting effects.
Aziakpono and Wilson (2010)	South Africa	1980-2007	Bank rate	Lending, deposit, money market, treasury bill and government bond yield rates	EG and Johansen cointegration, CRDW and ECM-based cointegration	PT: Ranged LR = 0.40 to 1.00, DR = -0.01 to 0.81, TBR = 0.24 to 1.00, MMR = 0.32 to 1.27and GBY = 0.02 to 0.33	PT: Ranged LR = 0.93 to 1.04, DR = 0.44 to 1.20, TBR = 0.65 to 1.23, MMR = 0.68 to 1.28 and GBY = 0.04 to 0.41	ML: Ranged LR = 0.43 to 0.86, DR = 0.59 to 3.58, TBR = 0.33 to 6.83, MMR = 0.01 to 6.81 and GBY = 4.57 to 12.10	Evidence of Asymmetry	Yes	Yes	Heterogeneous PT and speed of adjustment across rates. Highest speed occurred in LR and lowest in government bond yield. Asymmetric adjustments were found in both lending and deposit rate increases and decreases.
Wang and Lee (2009)	U.S.A and nine Asian countries	1988-2004 and Hong Kong 1994-2004	Interbank, money market, Federal fund rate	Deposit and lending rates.	Asymmetric Threshold cointegration test and EC-EGARCH (1,1)-M model	US: DR=0.85 LR=0.92 Asian: DR=0.0003 to 0.47 LR=-0.004 to 0.18.	US: DR=0.99 LR=0.86 Asian: DR=0.10 to 0.87 LR=0.23 to 0.73.	NA	Present in eight countries.	NA	NA	Complete PT for U.S deposit rate and incomplete PT for Asian countries.
Marotta (2009)	Nine EMU countries including UK	1994-2003	One-month Interbank rate	Short-term business lending rate	ARDL, Dynamic OLS and EG Cointegration	Before break 0.12-1.07 After break 0.15-0.89	Before break 0.40-1.36. After break 0.20-1.01.	Before break (-0.19) to (-0.61). After break (-0.29) to (0.95)	France and Netherlands	NA	NA	PT is heterogeneous and incomplete across countries. Weak evidence of Asymmetric PT.
Hulsewig et al. (2009)	Euro area	1991-2002	Short term Euro Interbank rate	Retail bank lending rates	New Keynesian DSGE model	0.54 (54%)	NA	NA	NA	NA	NA	Pass-Through was incomplete in the Euro area

Study	Country(s) Covered	Sample	Variables Used		Estimation Method(s)	Pass-Through		Speed of Adjustment	Asymmetric Adjustment			Remark(s)
			Policy Rate	Market Interest Rates		Short-run	Long-run		Present	Increase	Decrease	
Ozdemir, B.K (2009)	Turkey	2001-2007	Money market rate	Lending and deposit rates	Symmetric and asymmetric error correction model	Incomplete	Complete PT: LR=1.19 and DR=1.05	LR= 0.35 and DR=0.12	Weak evidence	NA	Rigidity in DR decreases and rigidity in LR decreases.	Greater rigidity in deposit and lending rate decreases than increases. Pass-through from money market to deposit and lending rate is complete in the long run
Mirdala (2009)	4 EMU countries	1999-2008	Money market rates	Short-term rates	SVAR	Incomplete	Vary across countries and incomplete	NA	NA	NA	NA	PT is different for all five variable.
Leuvensteijn *et al.* (2008)	Euro area	1994-2004	3-months money market rates	Interest rates on mortgage, consumer, short and long term loans to ent., consumer and; time and current A/c deposits	Panel cointegration and ECM	PT: Ranged ML from -0.21 to 0.51 CL from -0.005 to 0.35 SL from 0.05 to 0.57 LL from 0.16 to 0.99 CA from 0.09 to 0.37 TD from 0.14 to 0.97	PT: Ranged ML from 0.84 to 1.27 CL from 0.31 to 1.33 SL from 0.32 to 1.34 LL from 0.61 to 0.98 CA from 0.06 to 0.43 TD from 0.61 to 0.92	NA	NA	NA	NA	In the long run, bank loan rates are closer in line with market rates where competition is higher. Stronger loan market competition reduces bank loan rates while changes in market rates are transmitted more rapidly to bank rates.
Liu et al. (2008)	New Zealand	1994-2004	Overnight Interbank and OCR rates	Fixed mortgage, Bond, Base lending, floating mortgage rates.	Philips-Lorentan, SEC, EG-OLS and ARDL	LR=0.51, DR= 0.44 and MR= 0.32 to 0.88.	LR=0.76, DR= 0.83 and MR= 0.18 to 0.93.	Speed of Adjustment LR=2.36, DR=1.46 and MR=0.22 to 1.96.	Weak Evidence	Mean Adjustment Lag ranges from 0.58 to 1.74	Mean Adjustment Lag ranges from 0.45 to 2.25	Long-term PT of retail rates varies across financial products. Short-term rates show higher degree of PT and faster adjustment speed than long-term rates. Evidence of asymmetry in the adjustment of retail rates.
Gambacorta (2008)	Italy	1993-2001	Repo rate	Lending rate (short term) and deposit rate	GMM estimator	LR=0.45 DR=0.45	LR=1.01 DR=0.70	LR=-0.4 and DR=-0.6	NA	NA	NA	PT is Heterogeneous. PT is lower for highly capitalised and liquid banks.
Sudo and Teranishi (2008)	Twelve Euro countries	2003-2008	ECB policy rate	Bank loan interest rates	EMC model	0.20 to 0.81	NA	(-0.07) to (-0.42)	NA	NA	NA	PT vary and sticky across countries.
Baugnet, Collin	Belgium	2003–2006	Market rate	Deposit and loan rate.	Partial Adjustment	PT ranged DR from 0.10 to	PT ranged DR from 0.10 to	PT ranged DR from	NA	NA	NA	Higher PT and speed of adjustment. Heterogeneity

Study	Country(s) Covered	Sample	Variables Used		Estimation Method(s)	Pass-Through		Speed of Adjustment	Asymmetric Adjustment			Remark(s)
			Policy Rate	Market Interest Rates		Short-run	Long-run		Present	Increase	Decrease	
& Dhyne (2007)					Model	0.98. LR from 0.50 to 0.97.	0.98. LR from 0.50 to 0.97.	0.37 to 0.92. LR from -0.93 to 1.75.				across sector, products and banks
De Graeve *et al.* (2007)	Belgium	2003-2008	Money market rate	Deposit and lending rates	Cointegration and error correction model	Range: DR=0.22 to 0.85 LR=0.19 to 98	Range: DR=0.53 to 0.98 LR=0.65 to 0.99	Range: DR=0.22 to 2.43 and LR=0.17 to 1.45	Present in Deposit rates	High speed of downward adjustment	NA	Complete PT in most LR and incomplete in Most DR. Incomplete PT in nine retail products while complete PT was found in four retail products.
Aydin (2007)	Turkey	2001-2005	Money market rate	Corporate, housing, cash and automobile loans	Panel cointegration and ECM	Corporate=0.22, housing=-0.16, cash=-0.22 and automobile=0.64	Corporate=0.63, housing=1.59, cash=1.06 and automobile=1.1	Corporate=1.19, housing=2.90, cash=1..67 and automobile= 0.84.	NA	NA	NA	Higher PT for all types of loans in the long-run. Long run co-movement between rates is more apparent when the loan market is functioning more properly. Whereas, incomplete PT in the short-run.
Aziakpono, Wilson and Manuel (2007)	South Africa	1973 - 2004	Repo rate	Prime interbank lending and negotiable certificate of deposit rates	EG cointegration and asymmetric error correction model	Range: LR=0.28 to 1.15 and NCD=0.76 to 1.09	Range: LR=0.89 to 1.21 and NCD=0.84 to 1.09	Range: LR=0.25 to 2.17 and NCD=0.01 to 1.65	Weak evidence	NA	NA	High speed of adjustment of market interest to changes in the official rate. Higher speed of adjustment during more market oriented regime than less market-oriented eras.
Egert *et al.* (2007)	5 CEE and 3Euro area countries	1994-2005	Policy rate	Deposit, lending and money market rates	EG, cointegration, Dynamic OLS and ARDL	PT vary across countries widely	PT vary across countries and over time widely	NA	Weak evidence	NA	NA	Large disparity in the PT across countries and over time. Generally higher in the CEE countries than the Euro area countries.
Charoenseang and Manakit (2007)	Thailand	2000-2006	Repo rate	Deposit and lending rates	EG cointegration and ECM	PT only complete for interbank rate	PT incomplete but complete for interbank rate	Range from 0.25 to 12.52	Weak evidence	NA	NA	PT was very low and incomplete.
Chionis and Leon (2006)	Greece	1996-2004	Money market rate	Lending and deposit rates	Cointegration and ECM	Before EMU: LR=0.09, DR=0.06. After EMU: LR=0.50 DR=0.64	Before EMU: LR=1.86, DR=1.24. After EMU: LR=0.78 DR=0.68.	NA	NA	NA	NA	Higher PT before joining the EMU than after joining the EMU.
Chong *et al.*	Singapore	1983-2002	Interbank offer	Lending and	EG	Incomplete for	Incomplete for	MAL range	Asymmetry	Range:	Range:	Incomplete PT for both

Study	Country(s) Covered	Sample	Variables Used		Estimation Method(s)	Pass-Through		Speed of Adjustment	Asymmetric Adjustment			Remark(s)
			Policy Rate	Market Interest Rates		Short-run	Long-run		Present	Increase	Decrease	
(2006)			rate	deposit rates	cointegration and ECM	all rates	in all rates`	from 5.0 to 19.50	in lending and deposit rates	LR from 6.9 to 14.7. DR from 4.2 to 10.5	LR from 10.4 to 30.1. DR from 6.0 to 18.6.	lending and deposit rate. Asymmetric adjustment in both lending and deposit rates.
Sander and Kleimeier (2006)	8 CEECs and 4 Euro area countries	1993-2003	Money market rate	Interest rates on mortgage, consumer, short and long term corporate loan, consumer and time deposits and savings A/c	TAR models, symmetric and asymmetric ECM	Incomplete	PT in LR was complete in the CEEC. Incomplete PT for deposit.	NA	NA	NA	NA	PT in the CEECs is complete and faster than in the aggregate Euro zone. PT differences within the CEECs can be explained by a handful of financial structure variables and macro-controls
De Bondt (2005)	Euro Area	1996-2001	Overnight interest rate	Loan rate and deposit rate	ECM and VAR	Incomplete	LR PT complete and DR PT incomplete	Range: LR from 2.8 to 10.2. DR from 3 to 23.8.	NA	NA	NA	Higher PT after the Euro was introduced.
De Angelis *et al*. (2005)	South Africa	1998-2004	Repo rate	Prime interbank, prime lending rates and NCD	EG cointegration and ECM	Complete	Complete PT	NA	NA	NA	NA	Higher PT in the first monetary policy regime. PT was complete in almost all interest rates.
Tieman (2004)	Romania and Eastern European Transition countries	1995-2004	Central bank policy rate	Lending and deposit rates	ECM	Incomplete PT	Incomplete but PT in DR was higher than LR.	Higher for deposit rate than lending rate.	NA	NA	NA	PT and MAL are higher in deposit rate than lending rate.
Jankee (2004)	Mauritius	1998- 2003	Interbank money market rate	Lending and deposit rates	Coinegration, ECM, TAR and M-TAR models	Incomplete LR=0.24 and DR=0.41	NA	LR=-0.60 and DR=0.64	Present in LR	LR rigid upward	LR rigid downwards	Higher PT was observed in deposit rate than lending rate. Lending rate was asymmetric.
Toolsema, Sturm, and Haan (2002)	6 EMU countries	1980-2000	3-month interbank rate	Lending rates	Distributed Lag Analysis and Error Correction Analysis	PT: Ranged from 0.08 to 0.87	PT Ranged from 0.71 to 1.027.	Speed of adjustment ranged from 0.001 to 0.248	NA	NA	NA	Major differences in the pass-through amongst EMU countries, both for the short and long term PT. Weak evidence for convergence of monetary policy

Study	Country(s) Covered	Sample	Variables Used		Estimation Method(s)	Pass-Through		Speed of Adjustment	Asymmetric Adjustment			Remark(s)
			Policy Rate	Market Interest Rates		Short-run	Long-run		Present	Increase	Decrease	
												transmission.
Scholnick (1996)	Malaysia and Singapore	1983–1992 (Singapore) 1983–1994 (Malaysia)	Money market rates	Lending and deposit rates.	Johansen cointegration and error correction model	Malaysia: LR=0.10 DR=0.08. Singapore: LR=0.12 DR=0.12	NA	Malaysia: LR=11.4 DR=6.2. Singapore: LR=7.5 DR=7.0	All rates asymmetric except Singapore LR	Malaysia: LR=6.1 DR=3.0. Singapore : LR=8.3 DR=4.7	Malaysia: LR=6.1 DR=7.5 Singapore : LR=9.9 DR=7.4	Deposit rate in both countries are more rigid when below equilibrium than when above it. Suggesting that banks in both countries tend to adjust their deposit rates downward more rapidly than upward.
Cottarelli et al. (1995)	Italy	1986-1993	Money market rate	Lending rates	Error correction model	PT=0.07	PT=0.92	NA	NA	NA	NA	Incomplete short-run PT. High degree of stickiness is explained by the constraints to competition in the banking and financial system.
Neumark and Sharpe (1992)	U.S.A	1983–1987	TBR	Certificate of deposit and money market rates	Switching model, OLS and PAM	NA	NA	NA	Strong evidence	NA	NA	Banks are quicker to adjust their deposit rates downwards when above equilibrium that they are to adjust their deposit rates upward when below equilibrium
Hannan and Berger (1991)	U.S.A	1983-1986	Three-months TBR	Deposit rate and Money market deposit A/c,	Multinomial Logit Model	NA	NA	NA	Present in deposit rate	Rigid when there is stimulus for an increase	Less rigid when there is stimulus for a decrease.	Greater price rigidity in more concentrated markets. Deposit rates were more rigid upwards than downwards.

Appendix B: Financial Systems Size and Development Indicators

Figure B - Capital Market Indicator Development Indicators

Figure B-1.1: Stock Market Total Value Traded Ration to GDP

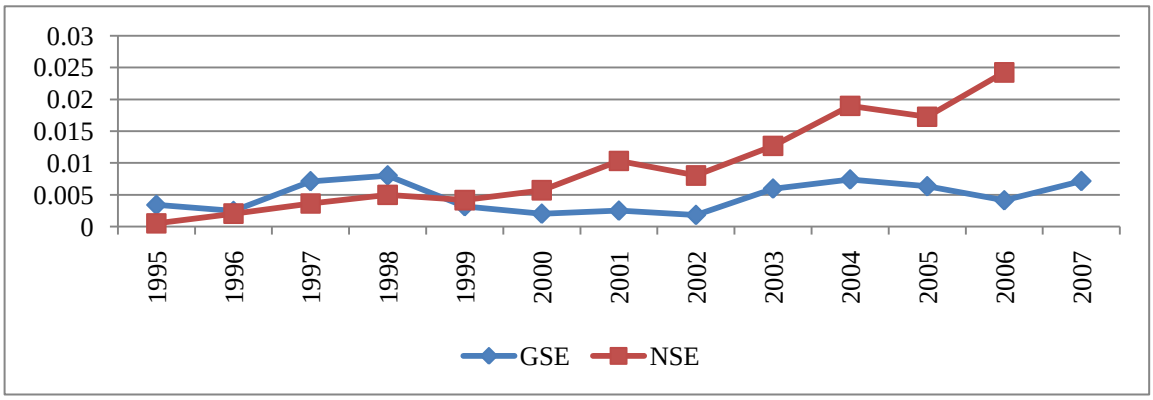


Figure B-1.2: Stock Market Turnover Ratio

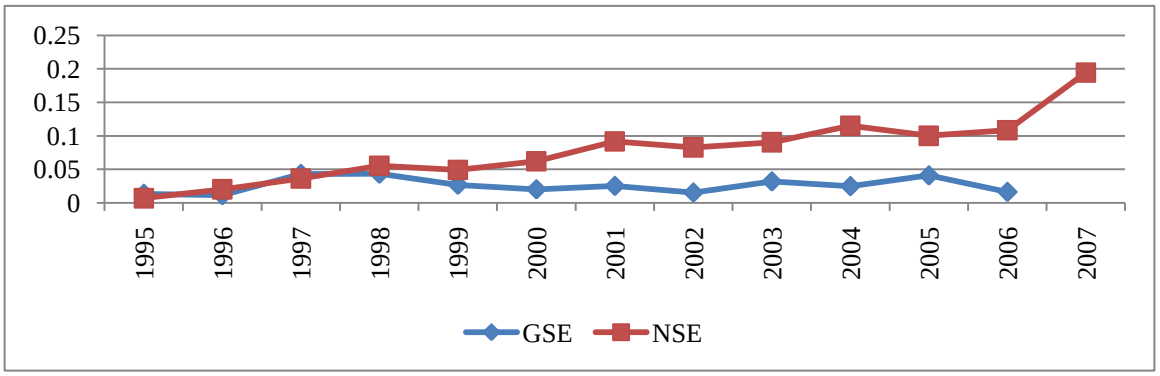
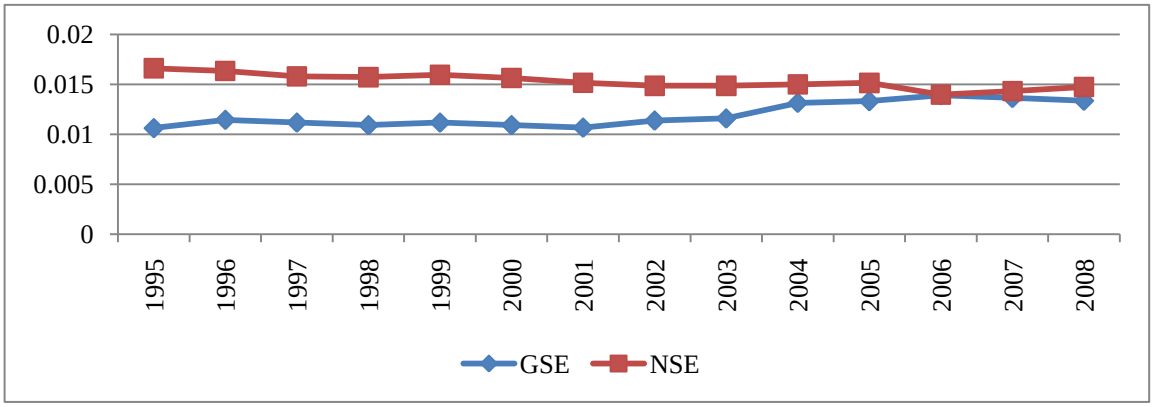


Figure B-1.3: Number of Listed Companies to Population



Sources: Compiled by author based on data from Financial Structure Dataset, Beck and Al-Hussainy (2010)

Appendix C: Results of the Unit Root Tests.

Table C-1.0: Unit Root Results for the entire sample period for all countries.

			Gambia	Ghana	Nigeria	Sierra Leone
Tests Type			**DISR**	**TBR**	**DISR**	**TBR**
ADF	Level	Intercept	-2.29	-1.57	-1.71	-2.25
		Intercept & trend	-2.32	-1.82	-2.61[B]	-2.86[B]
	1st Diff	Intercept	-4.72[A]	-5.85[A]	-15.37[A]	-12.52[A]
		Intercept & trend	-4.73[A]	-5.84[A]	-15.41[A]	-12.51[A]
KPSS	Level	Intercept	0.11[A]	0.78	0.76	0.66[B]
		Intercept & trend	0.11[C]	0.24	0.20[A]	0.10[A]
	1st Diff	Intercept	0.08[A]	0.13[B]	0.12[A]	0.05[A]
		Intercept & trend	0.07[A]	0.08[A]	0.03[A]	0.04[A]
LR						
ADF	Level	Intercept	-2.15	-1.36	-2.62[C]	-1.35
		Intercept & trend	-2.24	-2.12	-3.33[C]	-2.43
	1st Diff	Intercept	-7.89[A]	-10.70[A]	-19.59[A]	-22.26[A]
		Intercept & trend	-7.87[A]	-10.67[A]	-19.57[A]	-22.24[A]
KPSS	Level	Intercept	0.46[B]	0.95	0.73[A]	1.11
		Intercept & trend	0.15[B]	0.21[A]	0.09[A]	0.19[B]
	1st Diff	Intercept	0.08[A]	0.11[A]	0.07[A]	0.11[A]
		Intercept & trend	0.08[A]	0.09[A]	0.05[A]	0.11[C]
DR						
ADF	Level	Intercept	-2.35	-1.11	-2.26	-1.36
		Intercept & trend	-2.73	-0.40	-3.12	-2.05
	1st Diff	Intercept	-15.75[A]	-5.57[A]	-20.16[A]	-8.81[A]
		Intercept & trend	-15.73[A]	-9.39[A]	-20.12[A]	-8.80[A]
KPSS	Level	Intercept	0.46[A]	0.73[A]	0.63[B]	0.98
		Intercept & trend	0.09[A]	0.24	0.12[C]	0.23
	1st Diff	Intercept	0.07[A]	0.20[A]	0.04[A]	0.10[A]
		Intercept & trend	0.05[A]	0.09[A]	0.04[A]	0.10[A]

Note: [A]=significant at 1%; [B]=significant at 5% and [C]=significant at 10%

Table C-1.1: Unit root results of rolling windows for Ghana

			2000-2005	2001-2006	2002-2007	2003-2008	2004-2009
TBR		Assumptions					
ADF	Level	Intercept	-0.86	-1.68	-1.24	-1.80	-1.94
		Intercept & trend	-3.07[B]	-4.35[A]	-3.54[A]	-0.74	0.54
	1st Diff	Intercept	-4.86[A]	-4.66[A]	-6.39A	-4.89[A]	-2.62[C]
		Intercept & trend	-4.90[A]	-4.68[A]	-6.32[A]	-5.34[A]	-2.48
KPSS	Level	Intercept	0.91	0.98	0.98	0.55[B]	0.38[C]
		Intercept & trend	0.06[A]	0.09[A]	0.09[A]	0.23	0.25
	1st Diff	Intercept	0.12[A]	0.08[A]	0.08[A]	0.39[C]	0.25[A]
		Intercept & trend	0.07[A]	0.04[A]	0.06[A]	0.07[A]	0.10[A]
LR							
ADF	Level	Intercept	-0.17	-1.34	-1.88	-0.51	-2.79
		Intercept & trend	-2.70	-2.07	-3.56[A]	-7.81[A]	-2.65
	1st Diff	Intercept	-6.59[A]	-8.72[A]	-9.56[A]	-8.12[A]	-9.34[A]
		Intercept & trend	-6.70[A]	-8.73[A]	-9.62[A]	-7.93[A]	-9.44[A]
KPSS	Level	Intercept	0.91	1.03	1.11	1.02	0.25[A]
		Intercept & trend	0.09[A]	0.14[B]	0.12[C]	0.20[B]	0.21[A]
	1st Diff	Intercept	0.20[A]	0.09[A]	0.12[A]	0.35[C]	0.33[A]
		Intercept & trend	0.10[A]	0.04[A]	0.04[A]	0.29	0.43
DR							
ADF	Level	Intercept	-0.21	-2.40	-3.56[A]	-0.94	-0.32
		Intercept & trend	-2.03	-1.85	-6.04[A]	0.20	0.94
	1st Diff	Intercept	-6.98[A]	-8.12[A]	-12.71[A]	-8.05[A]	-8.12[A]
		Intercept & trend	-6.99[A]	-8.41[A]	-12.56[A]	-8.38[A]	-8.66[A]
KPSS	Level	Intercept	0.88	0.87	1.09	0.58[B]	0.36[C]
		Intercept & trend	0.11[C]	0.18[B]	0.12[C]	0.22	0.27
	1st Diff	Intercept	0.15[A]	0.31[A]	0.22[A]	0.35[C]	0.48[B]
		Intercept & trend	0.12[C]	0.08[A]	0.07[A]	0.13[C]	0.04[A]

Note: [A]=significant at 1%; [B]=significant at 5% and [C]=significant at 10%

Table C-1.2: Unit root results of rolling windows for Gambia

			1989-1994	1990-1995	1991-1996	1992-1997	1993-1998	1994-1999	1995-2000	1996-2001	1997-2002	1998-2003	1999-2004	2000-2005	2001-2006	2002-2007	2003-2008	2004-2009
DISR		Assumptions																
ADF	Level	Intercept	-1.24	-1.27	-1.45	-1.49	-4.10^{A}	0.58	0.16	-1.28	-0.42	1.30	0.11	-1.00	-0.72	-0.57	-0.44	-1.85
		Intercept & trend	-1.73	-2.30	-1.94	-1.75	-4.13^{A}	-0.43	-1.77	-0.74	0.65	-0.23	-1.73	0.51	-0.29	-1.53	-2.24	-0.77
	1st Diff	Intercept	-7.56^{A}	-7.49^{A}	-7.46^{A}	-7.38^{A}	-7.95^{A}	-6.81^{A}	-8.47^{A}	-8.26^{A}	-4.81^{A}	-8.53^{A}	-8.58^{A}	-7.81^{A}	-7.84^{A}	-2.14	-7.78^{A}	-7.67^{A}
		Intercept & trend	-7.54^{A}	-7.47^{A}	-7.42^{A}	-7.33^{A}	-7.95^{A}	-7.18^{A}	-8.70^{A}	-8.33^{A}	-5.20^{A}	-9.52^{A}	-8.71^{A}	-8.10^{A}	-8.49^{A}	-8.17^{A}	-7.81^{A}	-7.98^{A}
KPSS	Level	Intercept	0.41^{C}	0.69^{B}	0.84	0.61^{B}	0.43^{C}	0.50^{B}	0.85	0.90	0.40^{C}	0.55^{B}	0.89	0.77	0.29^{A}	0.44^{C}	0.87	0.82
		Intercept & trend	0.20^{B}	0.17^{B}	0.13^{C}	0.21^{A}	0.17^{B}	0.25	0.27	0.13^{C}	0.25	0.25	0.24	0.15^{B}	0.26	0.23	0.14^{B}	0.26
	1st Diff	Intercept	0.11^{A}	0.13^{A}	0.07^{A}	0.08^{A}	0.19^{A}	0.44^{C}	0.33^{A}	0.24^{A}	0.51^{B}	0.65^{B}	0.27^{A}	0.34^{C}	0.51^{B}	0.38^{C}	0.25^{A}	0.39^{C}
		Intercept & trend	0.05^{A}	0.08^{A}	0.06^{A}	0.06^{A}	0.15^{B}	0.07^{A}	0.04^{A}	0.17^{B}	0.13^{C}	0.09^{A}	0.12^{B}	0.23	0.14^{B}	0.17^{B}	0.23	0.14^{B}
LR																		
ADF	Level	Intercept	-2.94^{C}	-1.65	-1.79	-2.05	-2.24	-0.78	-0.77	-1.01	-1.46	-0.61	-0.89	-1.43	-1.55	-1.73	-1.54	-1.26
		Intercept & trend	-3.43^{C}	-2.60	-2.31	-2.13	-2.30	-1.27	-1.97	-1.97	-1.60	0.01	-2.12	-1.86	-1.55	-1.48	-2.84	-0.80
	1st Diff	Intercept	-8.39^{A}	-8.10^{A}	-8.26^{A}	-8.26^{A}	-6.94^{A}	-8.29^{A}	-8.29^{A}	-8.37^{A}	-8.37^{A}	-4.66^{A}	-3.50^{B}	-3.52^{A}	-3.75^{A}	-3.76^{A}	-8.26^{A}	-8.86^{A}
		Intercept & trend	-8.37^{A}	-8.03^{A}	-8.21^{A}	-8.23^{A}	-6.86^{A}	-8.43^{A}	-8.33^{A}	-8.31^{A}	-8.36^{A}	-5.13^{A}	-3.56^{B}	-3.51^{B}	-3.88^{B}	-4.00^{B}	-8.68^{A}	-8.96^{A}
KPSS	Level	Intercept	0.70^{B}	0.84	0.78	0.54	0.16^{A}	0.33	0.72^{B}	0.95	0.84	0.32	0.73^{A}	0.87	0.62^{B}	0.28^{A}	0.46^{B}	1.00
		Intercept & trend	0.18^{B}	0.17^{B}	0.15^{B}	0.23	0.15^{B}	0.23	0.22	0.12^{C}	0.20^{B}	0.18^{B}	0.22	0.14^{B}	0.19^{B}	0.25	0.17^{B}	0.23
	1st Diff	Intercept	0.08^{A}	0.05^{A}	0.06^{A}	0.07^{A}	0.09^{A}	0.24^{A}	0.18^{A}	0.09^{A}	0.12^{A}	0.40^{C}	0.20^{A}	0.14^{A}	0.25^{A}	0.32^{A}	0.35^{C}	0.26^{A}
		Intercept & trend	0.08^{A}	0.05^{A}	0.05^{A}	0.04^{A}	0.08^{A}	0.06^{A}	0.08^{A}	0.09^{A}	0.06^{A}	0.11^{C}	0.06^{A}	0.14^{B}	0.13^{C}	0.08^{A}	0.15^{B}	0.13^{C}
DR																		
ADF	Level	Intercept	-3.03^{B}	-2.19	-2.39	-3.63^{B}	-2.06	N/A	N/A	N/A	N/A	N/A	0.33	-1.20	-0.82	-1.26	-1.42	-1.89
		Intercept & trend	-3.34^{C}	-2.23	-2.83	-2.13	-1.79	N/A	N/A	N/A	N/A	N/A	-1.41	-0.68	-0.32	-1.51	-2.03	-1.42
	1st Diff	Intercept	-8.28^{A}	-8.25^{A}	-8.25^{A}	-8.26^{A}	-8.37^{A}	N/A	N/A	N/A	N/A	N/A	-8.57^{A}	-8.25^{A}	-8.03^{A}	-8.22^{A}	-7.28^{A}	-8.30^{A}
		Intercept & trend	-8.29^{A}	-8.19^{A}	-8.21^{A}	-8.21^{A}	-8.46^{A}	N/A	N/A	N/A	N/A	N/A	-8.79^{A}	-8.31^{A}	-8.35^{A}	-8.31^{A}	-7.18^{A}	-8.44^{A}
KPSS	Level	Intercept	0.24^{A}	0.28^{A}	0.40^{C}	0.67^{B}	0.65^{B}	0.39^{C}	3.62	3.62	0.33^{A}	0.63^{B}	0.81	0.73^{A}	0.31^{A}	0.28^{A}	0.64^{B}	0.61^{B}
		Intercept & trend	0.12^{C}	0.22	0.13^{C}	0.15^{B}	0.21^{A}	0.15^{B}	2.90	2.90	0.13^{C}	0.23	0.26	0.12^{C}	0.23	0.23	0.12^{C}	0.26
	1st Diff	Intercept	0.15^{A}	0.06^{A}	0.14^{A}	0.10^{A}	0.18^{A}	0.32^{A}	N/A	N/A	0.33^{A}	0.65^{B}	0.37^{C}	0.26^{A}	0.47^{B}	0.27^{A}	0.15^{A}	0.29^{A}
		Intercept & trend	0.11^{C}	0.06^{A}	0.10^{A}	0.08^{A}	0.05^{A}	0.12^{C}	N/A	N/A	0.13^{C}	0.20^{B}	0.07^{A}	0.19^{B}	0.15^{B}	0.12^{C}	0.15^{B}	0.09^{A}

Note: ^{A}=significant at 1%; ^{B}=significant at 5% and ^{C}=significant at 10%

Table C-1.3: Unit root results of rolling windows for Nigeria

			1989-1994	1990-1995	1991-1996	1992-1997	1993-1998	1994-1999	1995-2000	1996-2001	1997-2002	1998-2003	1999-2004	2000-2005	2001-2006	2002-2007	2003-2008	2004-2009
DISR		Assumptions																
ADF	Level	Intercept	-2.00	-1.71	-1.64	-1.59	-1.99	N/A	-1.64	-0.45	-1.46	-1.65	-1.62	-0.83	-0.19	-1.35	-1.24	-0.56
		Intercept & trend	-1.81	-1.85	-1.96	-2.12	-1.92	N/A	-1.57	-3.87^{B}	-1.16	-1.23	-2.60	-1.51	-2.78	-2.68	-2.41	-2.44
	1st Diff	Intercept	-8.25^{A}	-8.26^{A}	-8.25^{A}	-8.26^{A}	-8.31^{A}	N/A	-4.84^{A}	-6.56^{A}	-6.28^{A}	-6.86^{A}	-7.22^{A}	-8.49^{A}	-6.46^{A}	-8.64^{A}	-8.44^{A}	-8.54^{A}
		Intercept & trend	-8.29^{A}	-8.21^{A}	-8.21^{A}	-8.20^{A}	-8.33^{A}	N/A	-4.86^{A}	-6.56^{A}	-6.30^{A}	-7.00^{A}	-7.24^{A}	-8.47^{A}	-6.68^{A}	-8.60^{A}	-8.39^{A}	-8.51^{A}
KPSS	Level	Intercept	0.18^{A}	0.21^{A}	0.35^{C}	0.57^{B}	0.57^{B}	0.54^{B}	0.64^{B}	0.72^{B}	0.67^{B}	0.23^{A}	0.36^{C}	0.62^{B}	0.87	1.02	1.00	1.01
		Intercept & trend	0.10^{A}	0.14^{A}	0.15^{A}	0.09^{A}	0.19^{B}	0.19^{B}	0.11^{C}	0.07^{A}	0.08^{A}	0.13^{C}	0.12^{C}	0.17^{B}	0.09^{A}	0.10^{A}	0.06^{A}	0.05^{A}
	1st Diff	Intercept	0.14^{A}	0.08^{A}	0.10^{A}	0.07^{A}	0.12^{A}	0.13^{A}	0.14^{A}	0.09^{A}	0.11^{A}	0.19^{A}	0.18^{A}	0.13^{A}	0.28^{A}	0.07^{A}	0.05^{A}	0.07^{A}
		Intercept & trend	0.06^{A}	0.06^{A}	0.07^{A}	0.07^{A}	0.04^{A}	0.05^{A}	0.12^{C}	0.07^{A}	0.07^{A}	0.06^{A}	0.08^{A}	0.08^{A}	0.11^{C}	0.05^{A}	0.05^{A}	0.05^{A}
LR																		
ADF	Level	Intercept	-2.50	-2.27	-2.14	-1.97	-2.13	-1.84	-1.60	0.19	-1.36	-1.73	-1.47	-0.70	-0.72	-1.70	-1.87	-2.22
		Intercept & trend	-2.32	-2.31	-2.33	-3.23^{C}	-2.95	-1.48	-1.88	-1.73	-2.35	-0.92	-1.69	-1.77	-2.52	-1.79	-6.26	-1.87
	1st Diff	Intercept	-10.03^{A}	-10.28^{A}	-10.45^{A}	-10.46^{A}	-10.72^{A}	-10.07^{A}	-9.95^{A}	-9.92^{A}	-8.51^{A}	-7.93^{A}	-7.21^{A}	-7.33^{A}	-6.24^{A}	-7.53^{A}	-9.54^{A}	-13.71^{A}
		Intercept & trend	-10.07^{A}	-10.21^{A}	-10.44^{A}	-10.42^{A}	-10.66^{A}	-10.22^{A}	-10.04^{A}	-10.47^{A}	-8.55^{A}	-8.10^{A}	-7.45^{A}	-7.38^{A}	-6.23^{A}	-7.57^{A}	-9.56^{A}	-9.07^{A}
KPSS	Level	Intercept	0.23^{A}	0.16^{A}	0.27^{A}	0.67^{B}	0.73^{A}	0.37^{C}	0.32^{A}	0.80	1.00	0.57^{B}	0.26^{A}	0.65^{B}	0.96	0.97	1.03	0.40^{C}
		Intercept & trend	0.09^{A}	0.15^{B}	0.18^{B}	0.09^{A}	0.16^{B}	0.20^{B}	0.25	0.22	0.09^{A}	0.19^{B}	0.25	0.20^{B}	0.10^{A}	0.23	0.15^{B}	0.18^{B}
	1st Diff	Intercept	0.14^{A}	0.07^{A}	0.11^{A}	0.10^{A}	0.05^{A}	0.31^{A}	0.25^{A}	0.49^{B}	0.14^{A}	0.32^{A}	0.40^{C}	0.21^{A}	0.13^{A}	0.21^{A}	0.20^{A}	0.24^{A}
		Intercept & trend	0.06^{A}	0.06^{A}	0.05^{A}	0.05^{A}	0.04^{A}	0.12^{C}	0.08^{A}	0.08^{A}	0.12^{C}	0.08^{A}	0.07^{A}	0.09^{A}	0.11^{C}	0.05^{A}	0.08^{A}	0.07^{A}
DR																		
ADF	Level	Intercept	-2.28	-2.10	-1.61	-1.24	-1.81	-1.86	-1.96	-1.95	-2.62^{C}	-1.70	-2.04	-1.06	-1.89	-2.70^{C}	-2.41	-3.01^{B}
		Intercept & trend	-2.18	-2.30	-2.87	-2.92	-2.55	-1.84	-1.91	-2.99	-4.00^{B}	-1.67	-1.82	-1.32	-3.76^{B}	-3.38^{B}	-2.10	-3.16^{C}
	1st Diff	Intercept	-10.72^{A}	-4.17^{A}	-3.86^{A}	-3.81^{A}	-10.13^{A}	-5.50^{A}	-6.31^{A}	-4.07^{A}	-2.17	-12.27^{A}	-11.70^{A}	-11.92^{A}	-6.55^{A}	-8.33^{A}	-9.69^{A}	-9.35^{A}
		Intercept & trend	-10.81^{A}	-4.13^{A}	-3.89^{B}	-3.79^{B}	-10.12^{A}	-5.46^{A}	-6.28^{A}	-4.30^{A}	-11.48^{A}	-12.23^{A}	-11.74^{A}	-12.02^{A}	-6.6A6	-8.70^{A}	-9.73^{A}	-9.88^{A}
KPSS	Level	Intercept	0.12^{A}	0.27^{A}	0.37^{C}	0.80	0.80	0.32^{A}	0.19^{A}	0.41^{C}	0.82	0.56^{B}	0.23^{A}	0.25^{A}	0.73^{A}	0.98	0.57^{B}	0.27^{A}
		Intercept & trend	0.10^{A}	0.13^{C}	0.16^{B}	0.07^{A}	0.12^{C}	0.17^{B}	0.18^{B}	0.13^{C}	0.06^{A}	0.09^{A}	0.13^{C}	0.18^{B}	0.10^{A}	0.13^{C}	0.23^{A}	0.26^{A}
	1st Diff	Intercept	0.16^{A}	0.07^{A}	0.13^{A}	0.11^{A}	0.09^{A}	0.12^{A}	0.10^{A}	0.22^{A}	0.10^{A}	0.10^{A}	0.13^{A}	0.16^{A}	0.20^{A}	0.25^{A}	0.28^{A}	0.50^{B}
		Intercept & trend	0.06^{A}	0.07^{A}	0.07^{A}	0.07^{A}	0.05^{A}	0.08^{A}	0.09^{A}	0.06^{A}	0.09^{A}	0.06^{A}	0.05^{A}	0.06^{A}	0.11^{C}	0.07^{A}	0.07^{A}	0.12^{C}

Note: ^{A}=significant at 1%; ^{B}=significant at 5% and ^{C}=significant at 10%

Table C-1.4: Unit root results of rolling windows for Sierra Leone

			1989-1994	1990-1995	1991-1996	1992-1997	1993-1998	1994-1999	1995-2000	1996-2001	1997-2002	1998-2003	1999-2004	2000-2005	2001-2006	2002-2007	2003-2008	2004-2009
TBR		Assumptions																
ADF	Level	Intercept	-1.14	-1.31	-1.27	-2.40	-1.91	-1.81	-1.90	-1.95	-1.38	-1.79	-1.84	-2.61^{C}	-1.47	-1.62	-0.90	-1.15
		Intercept & trend	-1.15	-1.77	-1.69	-1.62	-1.76	-2.30	-1.60	-1.93	-1.40	-2.61^{C}	-1.38	-3.04	-1.17	-1.58	-1.45	-2.48
	1st Diff	Intercept	-6.45^{A}	-6.05^{A}	-6.33^{A}	-6.69^{A}	-6.49^{A}	-6.42^{A}	-6.85^{A}	-6.55^{A}	-6.56^{A}	-6.62^{A}	-8.14^{A}	-8.25^{A}	-8.48^{A}	-7.44^{A}	-7.08^{A}	-7.52
		Intercept & trend	-6.70^{A}	-5.99^{A}	-6.28^{A}	-6.95^{A}	-6.70^{A}	-6.41^{A}	-6.93^{A}	-6.50^{A}	-6.52^{A}	-6.62^{A}	-8.32^{A}	-8.33^{A}	-8.75^{A}	-7.40^{A}	-7.33^{A}	-7.45
KPSS	Level	Intercept	0.27^{A}	0.64^{B}	0.62^{B}	0.58^{B}	0.09^{A}	0.35^{C}	0.25^{A}	0.13^{A}	0.21^{A}	0.48^{B}	0.41^{C}	0.23^{A}	0.49^{B}	0.22^{A}	0.28^{A}	0.84
		Intercept & trend	0.24	0.15^{B}	0.14^{B}	0.22	0.09^{A}	0.09^{A}	0.08^{A}	0.13^{C}	0.19^{B}	0.12^{C}	0.25	0.19^{B}	0.18^{B}	0.19^{B}	0.14^{B}	0.07^{A}
	1st Diff	Intercept	0.27^{A}	0.13^{A}	0.09^{A}	0.29^{A}	0.28^{A}	0.10^{A}	0.13^{A}	0.11^{A}	0.13^{A}	0.23^{A}	0.32^{A}	0.26^{A}	0.19^{A}	0.11^{A}	0.28^{A}	0.08^{A}
		Intercept & trend	0.06^{A}	0.12^{C}	0.09^{A}	0.11^{C}	0.10^{A}	0.07^{A}	0.08^{A}	0.11^{A}	0.10^{A}	0.15^{A}	0.07^{A}	0.12^{C}	0.11^{C}	0.09^{A}	0.07^{A}	0.08^{A}
LR																		
ADF	Level	Intercept	-1.27	-0.84	-1.56	-1.68	-1.57	-2.00	-1.29	-1.37	-1.62	-0.47	-0.98	-1.75	-1.79	-0.86	-1.78	-2.62
		Intercept & trend	-1.33	-2.38	-2.76	-1.96	-1.91	-2.28	-1.31	-1.45	-1.66	-2.26	-1.93	-1.21	-2.22	-2.20	-1.08	-2.50
	1st Diff	Intercept	-11.86^{A}	-12.22^{A}	-12.42^{A}	-8.73^{A}	-6.97^{A}	-9.80^{A}	-7.18^{A}	-7.26^{A}	-8.41^{A}	-10.15^{A}	-9.05^{A}	-8.37^{A}	-9.39^{A}	-9.25^{A}	-8.41^{A}	-8.28^{A}
		Intercept & trend	-12.27^{A}	-12.24^{A}	-12.33^{A}	-8.74^{A}	-7.11^{A}	-9.74^{A}	-7.13^{A}	-7.21^{A}	-8.36^{A}	-10.41^{A}	-9.00^{A}	-8.65^{A}	-9.55^{A}	-9.29^{A}	-8.61^{A}	-9.16^{A}
KPSS	Level	Intercept	0.27^{A}	0.76	0.87	0.84	0.62^{B}	0.32^{A}	0.34^{C}	0.29^{A}	0.26^{A}	0.69^{B}	0.89	0.41^{C}	0.28^{A}	0.74	0.81	0.23^{A}
		Intercept & trend	0.27	0.21^{A}	0.14^{B}	0.22	0.14^{B}	0.12^{C}	0.14^{B}	0.15^{B}	0.23	0.24	0.15^{B}	0.26	0.22	0.11^{C}	0.22	0.23
	1st Diff	Intercept	0.39^{C}	0.21^{C}	0.11^{C}	0.16^{C}	0.16^{C}	0.10^{C}	0.10^{C}	0.09^{C}	0.15^{C}	0.32^{C}	0.18^{C}	0.36^{C}	0.38^{C}	0.17^{A}	0.26^{A}	0.57^{B}
		Intercept & trend	0.06^{A}	0.11^{C}	0.11^{C}	0.07^{A}	0.07^{A}	0.09^{A}	0.09^{A}	0.09^{A}	0.14^{B}	0.05^{A}	0.18^{B}	0.07^{A}	0.14^{B}	0.13^{C}	0.06^{A}	0.07^{A}
DR																		
ADF	Level	Intercept	-0.53	-0.37	-0.75	-2.59^{C}	-2.77^{C}	-2.67^{C}	-2.17	-2.09	-3.58^{A}	-2.77^{C}	-1.37	-1.06	-1.42	-1.63	-1.78	-0.13
		Intercept & trend	-1.02	-2.48	-1.10	-1.24	-1.98	-2.53	-2.24	-2.33	-3.44	-2.74	-1.37	-2.21	-1.76	-0.96	-1.08	-2.55
	1st Diff	Intercept	-4.57^{A}	-4.46^{A}	-9.31^{A}	-3.27^{B}	-7.28^{A}	-5.68^{A}	-5.64^{A}	-5.97^{A}	-6.13^{A}	-5.81^{A}	-4.83^{A}	-4.97^{A}	-6.01^{A}	-4.97^{A}	-8.41^{A}	-7.14^{A}
		Intercept & trend	-9.86^{A}	-4.56^{A}	-9.25^{A}	-7.79^{A}	-7.63^{A}	-5.73^{A}	-5.64^{A}	-5.92^{A}	-6.17^{A}	-5.88^{A}	-5.22^{A}	-5.03^{A}	-5.93^{A}	-5.16^{A}	-8.61^{A}	-7.51^{A}
KPSS	Level	Intercept	0.32^{A}	0.83	0.89	0.78	0.57^{B}	0.14^{A}	0.12^{A}	0.45^{C}	0.12^{A}	0.12^{A}	0.25^{A}	0.64^{B}	0.95	0.71^{B}	0.81	0.72^{B}
		Intercept & trend	0.27	0.20^{B}	0.16^{B}	0.26	0.18^{B}	0.08^{A}	0.10^{A}	0.14^{A}	0.07^{A}	0.13^{A}	0.24	0.23	0.12^{C}	0.22	0.22	0.22
	1st Diff	Intercept	0.58^{B}	0.31^{A}	0.18^{A}	0.44^{C}	0.64^{B}	0.19^{A}	0.13^{A}	0.12^{A}	0.17^{A}	0.19^{A}	0.44^{C}	0.23^{A}	0.14^{A}	0.29^{A}	0.26^{A}	0.43^{C}
		Intercept & trend	0.07^{A}	0.19^{B}	0.18^{B}	0.12^{C}	0.18^{B}	0.12^{C}	0.10^{A}	0.12^{C}	0.09^{A}	0.10^{A}	0.05^{A}	0.11^{C}	0.14^{B}	0.10^{A}	0.06^{A}	0.06^{A}

Note: ^{A}=significant at 1%; ^{B}=significant at 5% and ^{C}=significant at 10%

Appendix D: Summary of Interest Rate Pass-Through Analyses

Table D-1.0: Summary of IRPT analysis for the entire period

	Sample		Cointegration Tests				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
Interest rates	**From**	**To**	**JJ**	**EG**	**CRDW**	**ECM**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	
Gambia															
Lending Rate	1989	2009	yes	yes	no	yes	19.61	41.07	0.50	16.39	0.26	5.65	-0.06	-3.49	-12.84
Deposit Rate	1989	2009	no	yes	no	yes	7.77	25.11	0.40	20.00	0.29	5.62	-0.10	-3.44	-7.11
Ghana															
Lending Rate	2000	2009	yes	yes	yes	yes	17.81	21.34	0.66	19.33	-0.06	-0.36	-0.38	-5.25	-2.80
Deposit Rate	2000	2009	no	yes	no	yes	0.73	1.24	0.69	28.45	0.35	4.92	-0.12	-2.93	-5.66
Nigeria															
Lending Rate	1989	2009	no	yes	yes	yes	8.44	15.85	0.81	23.73	0.66	9.33	-0.16	-4.18	-2.10
Deposit Rate	1989	2009	no	yes	no	yes	3.63	5.27	0.67	15.14	0.47	6.84	-0.08	-2.80	-6.54
Sierra Leone															
Lending Rate	1989	2009	yes	yes	no	yes	15.13	18.83	0.62	23.72	0.30	6.34	-0.09	-3.51	-7.99
Deposit Rate	1989	2009	yes	yes	no	yes	-1.99	-2.50	0.72	27.60	0.13	3.71	-0.05	-2.47	-18.61

Note: JJ- is the Johansen method, EG- Engle-Granger method, CRDW- Cointegration Regression Durbin Watson test, ECM-Based - Error Correction Based test and PT- Pass-through, ECT_{t-1} –Lagged Error Correction Term, and ML – Mean Lag

Table D-1.1: Summary of IRPT analysis for the rolling windows of Gambia

	Rolling Sample		Cointegration Tests				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
Interest rates	**From**	**To**	**JJ**	**EG**	**CRDW**	**ECM**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	
Lending Rate	1989	1994	no	yes	yes	yes	19.48	23.91	0.44	8.38	0.20	2.23	-0.45	-4.70	-1.78
Lending Rate	1990	1995	no	yes	yes	yes	18.88	34.60	0.47	13.07	0.14	1.63	-0.26	-2.40	-3.26
Lending Rate	1991	1996	no	yes	yes	yes	19.09	40.20	0.45	14.23	0.16	1.75	-0.32	-2.75	-2.61
Lending Rate	1992	1997	no	yes	yes	yes	19.02	37.26	0.46	13.03	0.18	1.97	-0.37	-2.94	-2.23
Lending Rate	1993	1998	yes	yes	yes	yes	20.25	25.73	0.37	6.58	0.11	1.33	-0.40	-3.65	-2.21
Lending Rate	1994	1999	no	yes	yes	yes	17.29	33.12	0.58	14.93	0.00	0.02	-0.44	-6.26	-2.25
Lending Rate	1995	2000	no	yes	yes	yes	19.71	59.71	0.40	15.85	0.01	0.14	-0.23	-3.40	-4.25
Lending Rate	1996	2001	no	yes	yes	yes	19.73	58.77	0.40	15.01	0.01	0.18	-0.17	-2.77	-5.93
Lending Rate	1997	2002	no	no	no	yes	21.21	42.99	0.27	6.68	-0.01	-0.26	-0.10	-2.24	-10.39
Lending Rate	1998	2003	yes	yes	no	no	18.57	31.35	0.46	11.81	0.35	3.34	-0.14	-1.91	-4.72
Lending Rate	1999	2004	yes	yes	no	yes	16.47	27.02	0.63	18.93	0.31	3.10	-0.16	-2.88	-4.32
Lending Rate	2000	2005	yes	no	no	yes	17.01	18.52	0.65	13.92	0.26	2.93	-0.14	-3.09	-5.39
Lending Rate	2001	2006	yes	no	no	yes	20.10	17.89	0.53	9.30	0.27	2.88	-0.09	-2.37	-8.02
Lending Rate	2002	2007	yes	no	no	yes	22.66	21.47	0.43	8.01	0.29	2.99	-0.08	-2.12	-8.41
Lending Rate	2003	2008	yes	yes	no	yes	24.11	29.52	0.39	9.20	0.30	2.91	-0.14	-2.75	-5.03
Lending Rate	2004	2009	yes	yes	no	yes	23.13	64.62	0.49	23.04	0.13	2.23	-0.17	-4.15	-5.17
Deposit Rate	1989	1994	no	yes	yes	yes	9.00	6.24	0.24	2.60	0.03	0.25	-0.24	-3.36	-4.08
Deposit Rate	1990	1995	no	yes	no	no	9.66	8.44	0.20	2.63	0.03	0.28	-0.16	-2.39	-6.18
Deposit Rate	1991	1996	yes	yes	yes	yes	9.00	15.34	0.26	6.60	0.14	1.62	-0.30	-3.49	-2.89
Deposit Rate	1992	1997	yes	yes	yes	yes	7.14	15.67	0.39	12.52	0.24	2.99	-0.58	-5.02	-1.33
Deposit Rate	1993	1998	yes	yes	no	no	10.67	33.85	0.14	6.14	0.00	-0.06	-0.13	-3.07	-7.65
Deposit Rate	1994	1999	N/A	yes	yes	yes	12.49	78.07	0.00	0.14	0.00	-0.57	-1.00	-374.00	-1.00
Deposit Rate	1995	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Deposit Rate	1996	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Deposit Rate	1997	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Deposit Rate	1998	2003	yes	no	yes	yes	9.16	38.67	0.29	18.20	0.24	3.58	-0.30	-1.73	-2.51
Deposit Rate	1999	2004	yes	yes	no	no	7.37	18.83	0.44	20.76	0.21	3.15	-0.15	-2.57	-5.44
Deposit Rate	2000	2005	no	yes	no	no	7.36	16.77	0.45	20.30	0.34	5.13	-0.18	-2.73	-3.58
Deposit Rate	2001	2006	no	yes	yes	yes	7.29	16.02	0.46	19.78	0.31	4.42	-0.21	-2.99	-3.21
Deposit Rate	2002	2007	no	yes	yes	yes	7.88	16.56	0.43	17.86	0.33	4.25	-0.20	-2.80	-3.33
Deposit Rate	2003	2008	no	yes	yes	yes	8.49	18.31	0.41	17.15	0.28	2.69	-0.28	-3.22	-2.58
Deposit Rate	2004	2009	yes	yes	yes	yes	8.69	24.17	0.45	21.28	0.51	4.17	-0.30	-3.12	-1.67

Note: JJ- is the Johansen method, EG- Engle-Granger method, CRDW- Cointegration Regression Durbin Watson test, ECM-Based - Error Correction Based test and PT- Pass-through, ECT_{t-1} –Lagged Error Correction Term, and ML – Mean Lag

Table D-1.2: Summary of IRPT analysis for the rolling windows of Ghana

	Rolling Sample		Cointegration Tests				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
Interest rates	**From**	**To**	**JJ**	**EG**	**CRDW**	**ECM**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	
Lending Rate	2000	2005	yes	yes	yes	yes	19.36	24.55	0.64	23.22	0.16	2.08	-0.29	-4.69	-2.92
Lending Rate	2001	2006	yes	yes	yes	yes	19.52	33.10	0.63	26.64	0.09	1.13	-0.30	-5.17	-3.05
Lending Rate	2002	2007	yes	yes	yes	yes	19.36	35.99	0.62	21.35	0.20	2.07	-0.33	-5.01	-2.46
Lending Rate	2003	2008	yes	yes	yes	yes	20.90	16.01	0.43	5.67	-0.38	-1.20	-0.44	-3.83	-1.41
Lending Rate	2004	2009	yes	yes	yes	yes	22.22	15.19	0.33	3.63	-1.29	-2.55	-0.52	-4.37	-4.42
Deposit Rate	2000	2005	no	yes	no	yes	-1.36	-1.25	0.76	19.94	0.34	3.94	-0.11	-2.20	-6.12
Deposit Rate	2001	2006	no	yes	no	yes	1.12	1.36	0.65	19.66	0.27	2.94	-0.15	-3.10	-4.83
Deposit Rate	2002	2007	no	yes	yes	yes	5.77	11.14	0.36	13.02	0.02	0.21	-0.20	-3.02	-4.95
Deposit Rate	2003	2008	no	yes	yes	yes	5.98	12.26	0.33	11.55	0.13	1.65	-0.20	-2.87	-4.41
Deposit Rate	2004	2009	no	yes	yes	yes	2.99	5.79	0.57	17.78	0.20	1.37	-0.29	-3.28	-2.79

Note: JJ- is the Johansen method, EG- Engle-Granger method, CRDW- Cointegration Regression Durbin Watson test, ECM-Based - Error Correction Based test and PT- Pass-through, ECT_{t-1} –Lagged Error Correction Term, and ML – Mean Lag

Table D-1.3: Summary of IRPT analysis for the rolling windows of Nigeria

	Rolling Sample		Cointegration Tests				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
Interest rates	**From**	**To**	**JJ**	**EG**	**CRDW**	**ECM**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	
Lending Rate	1989	1994	yes	yes	yes	yes	5.06	4.89	1.07	18.53	0.88	7.94	-0.51	-4.60	-0.24
Lending Rate	1990	1995	yes	yes	yes	yes	5.86	6.13	1.04	19.18	0.92	8.20	-0.48	-4.37	-0.17
Lending Rate	1991	1996	yes	yes	yes	yes	5.89	6.75	1.03	20.01	0.88	7.94	-0.48	-4.47	-0.25
Lending Rate	1992	1997	yes	yes	yes	yes	5.26	6.14	1.07	20.79	0.91	7.96	-0.49	-4.47	-0.18
Lending Rate	1993	1998	yes	yes	yes	yes	4.70	6.92	1.08	25.50	1.08	10.58	-0.43	-4.07	0.18
Lending Rate	1994	1999	no	yes	no	yes	16.39	16.97	0.21	3.22	0.13	0.94	-0.12	-1.99	-7.31
Lending Rate	1995	2000	no	yes	no	yes	14.62	15.79	0.33	5.43	0.07	0.53	-0.15	-2.36	-6.27
Lending Rate	1996	2001	no	yes	no	no	10.90	10.15	0.59	8.72	0.16	1.41	-0.08	-1.40	-10.76
Lending Rate	1997	2002	no	yes	yes	yes	7.34	5.79	0.82	10.87	0.12	0.92	-0.15	-2.71	-5.71
Lending Rate	1998	2003	no	yes	no	yes	8.75	6.17	0.75	9.03	0.12	1.09	-0.14	-2.64	-6.33
Lending Rate	1999	2004	no	yes	no	yes	9.19	5.52	0.72	7.51	0.11	0.97	-0.13	-2.61	-6.87
Lending Rate	2000	2005	yes	yes	yes	yes	4.87	5.33	1.00	18.08	0.17	1.32	-0.24	-2.87	-3.49
Lending Rate	2001	2006	yes	yes	yes	yes	3.22	3.85	1.10	20.94	0.10	0.89	-0.26	-3.20	-3.51
Lending Rate	2002	2007	no	yes	yes	yes	8.29	10.68	0.78	14.68	-0.04	-0.33	-0.13	-2.45	-8.10
Lending Rate	2003	2008	no	yes	yes	yes	10.66	14.82	0.57	10.22	0.06	0.39	-0.31	-3.21	-3.07
Lending Rate	2004	2009	no	yes	yes	yes	15.98	23.11	0.13	2.22	-0.03	-0.17	-0.20	-2.16	-5.24
Deposit Rate	1989	1994	yes	yes	yes	yes	2.17	2.64	0.87	18.83	0.72	7.38	-0.54	-4.23	-0.52
Deposit Rate	1990	1995	yes	yes	yes	yes	1.78	2.32	0.89	20.44	0.78	8.10	-0.52	-4.20	-0.42
Deposit Rate	1991	1996	yes	yes	yes	yes	1.59	2.58	0.88	23.99	0.76	8.32	-0.60	-4.53	-0.40
Deposit Rate	1992	1997	no	yes	yes	yes	-1.74	-1.42	1.02	13.91	0.67	6.24	-0.12	-1.76	-2.66
Deposit Rate	1993	1998	no	yes	no	yes	-2.35	-2.13	1.02	14.81	0.78	7.24	-0.14	-2.19	-1.54
Deposit Rate	1994	1999	no	yes	no	no	7.19	3.68	0.31	2.29	0.27	1.66	-0.06	-1.80	-12.22
Deposit Rate	1995	2000	no	yes	no	no	5.91	3.30	0.37	3.10	0.20	1.23	-0.17	-1.51	-4.64
Deposit Rate	1996	2001	no	yes	yes	yes	-0.93	-0.53	0.81	7.36	0.09	0.42	-0.14	-2.11	-6.59
Deposit Rate	1997	2002	no	yes	yes	yes	-7.27	-5.00	1.18	13.62	0.24	1.25	-0.18	-2.39	-4.16
Deposit Rate	1998	2003	no	yes	yes	yes	-1.82	-1.03	0.90	8.74	0.10	0.51	-0.20	-2.46	-4.60
Deposit Rate	1999	2004	no	yes	yes	yes	2.25	1.01	0.68	5.34	0.10	0.43	-0.20	-2.63	-4.45
Deposit Rate	2000	2005	no	yes	yes	yes	-1.70	-1.03	0.94	9.45	0.09	0.34	-0.22	-2.37	-4.14
Deposit Rate	2001	2006	no	yes	yes	yes	-3.10	-2.38	1.04	12.81	0.10	0.47	-0.34	-3.46	-2.62
Deposit Rate	2002	2007	yes	yes	yes	yes	2.57	2.67	0.70	10.58	0.01	0.04	-0.18	-2.69	-5.40
Deposit Rate	2003	2008	no	yes	no	no	6.90	6.54	0.38	4.69	-0.08	-0.47	-0.11	-1.72	-9.96
Deposit Rate	2004	2009	no	yes	no	yes	11.90	13.47	-0.03	-0.36	0.05	0.44	-0.15	-3.10	-6.51

Note: JJ- is the Johansen method, EG- Engle-Granger method, CRDW- Cointegration Regression Durbin Watson test, ECM-Based - Error Correction Based test and PT- Pass-through, ECTt-1 –Lagged Error Correction Term, and ML – Mean Lag

Table D-1.4: Summary of IRPT analysis for the rolling windows of Sierra Leone

	Rolling Sample		Cointegration Tests				Intercept		Long-run PT		Short-run PT		ECT_{t-1}		ML
Interest rates	**From**	**To**	**JJ**	**EG**	**CRDW**	**ECM**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	**Coeff.**	**t-stat**	
Lending Rate	1989	1994	no	yes	yes	yes	25.80	14.29	0.52	13.34	0.41	3.95	-0.21	-2.64	-2.81
Lending Rate	1990	1995	no	yes	yes	yes	26.77	16.33	0.51	14.20	0.34	3.26	-0.19	-2.22	-3.45
Lending Rate	1991	1996	no	yes	yes	yes	24.69	14.48	0.51	13.03	0.32	3.08	-0.17	-2.34	-3.94
Lending Rate	1992	1997	no	yes	no	yes	22.62	15.66	0.51	13.60	0.23	2.35	-0.14	-2.51	-5.31
Lending Rate	1993	1998	no	yes	no	yes	19.95	9.02	0.56	5.66	0.27	2.01	-0.13	-2.42	-5.48
Lending Rate	1994	1999	no	yes	no	yes	24.58	30.55	0.12	3.58	0.04	0.76	-0.12	-2.02	-7.90
Lending Rate	1995	2000	no	yes	no	no	23.88	28.01	0.13	3.96	0.05	1.67	-0.07	-1.88	-12.77
Lending Rate	1996	2001	no	yes	no	yes	21.67	28.50	0.20	6.50	0.06	1.78	-0.11	-2.58	-8.22
Lending Rate	1997	2002	no	yes	yes	yes	21.47	52.84	0.15	8.33	0.05	1.61	-0.25	-3.38	-3.74
Lending Rate	1998	2003	no	no	no	yes	19.89	35.36	0.19	7.76	0.06	2.29	-0.10	-2.16	-9.30
Lending Rate	1999	2004	no	no	no	yes	19.52	26.43	0.19	5.89	0.04	1.59	-0.07	-2.27	-13.55
Lending Rate	2000	2005	yes	no	no	yes	20.54	26.38	0.13	3.63	0.02	0.99	-0.09	-2.55	-11.18
Lending Rate	2001	2006	yes	yes	no	yes	22.15	27.39	0.04	0.90	-0.06	-1.72	-0.07	-1.94	-15.88
Lending Rate	2002	2007	no	no	no	no	21.24	23.01	0.09	1.94	-0.05	-1.32	-0.05	-1.55	-20.42
Lending Rate	2003	2008	no	yes	no	yes	22.79	25.15	0.03	0.65	-0.05	-1.67	-0.06	-2.42	-16.18
Lending Rate	2004	2009	yes	yes	no	yes	23.35	44.72	0.02	0.74	-0.05	-1.76	-0.14	-3.46	-7.41
Deposit Rate	1989	1994	yes	yes	yes	no	8.14	5.70	0.64	20.73	0.20	-0.95	-0.12	-1.39	-6.81
Deposit Rate	1990	1995	no	yes	yes	no	4.76	2.92	0.69	19.49	0.13	1.61	-0.06	-0.89	-14.68
Deposit Rate	1991	1996	no	yes	yes	no	2.33	1.33	0.69	17.15	0.10	1.26	-0.08	-1.59	-11.11
Deposit Rate	1992	1997	yes	yes	no	yes	2.15	1.91	0.63	21.62	0.17	4.09	-0.19	-5.56	-4.32
Deposit Rate	1993	1998	yes	yes	no	yes	4.49	2.75	0.42	5.71	0.07	1.38	-0.12	-4.03	-7.76
Deposit Rate	1994	1999	yes	yes	no	yes	7.62	9.19	0.11	3.03	0.03	0.75	-0.13	-3.00	-7.73
Deposit Rate	1995	2000	yes	yes	no	yes	6.75	9.39	0.12	4.14	0.02	0.57	-0.11	-2.81	-8.60
Deposit Rate	1996	2001	no	yes	no	yes	7.01	9.79	0.11	3.90	0.01	0.37	-0.11	-2.77	-9.07
Deposit Rate	1997	2002	yes	yes	no	yes	7.28	16.89	0.07	3.42	-0.01	-0.58	-0.26	-4.61	-3.96
Deposit Rate	1998	2003	yes	yes	no	yes	6.64	27.07	0.08	7.65	0.02	1.39	-0.21	-4.23	-4.66
Deposit Rate	1999	2004	no	no	no	no	6.95	32.92	0.09	9.67	0.02	2.28	-0.09	-2.37	-11.32
Deposit Rate	2000	2005	yes	yes	no	yes	6.63	18.58	0.12	7.37	0.01	1.55	-0.07	-2.81	-13.72
Deposit Rate	2001	2006	yes	no	no	yes	5.86	13.95	0.19	8.54	0.00	-0.02	-0.08	-3.82	-12.12
Deposit Rate	2002	2007	no	no	no	yes	7.04	15.86	0.14	6.22	0.00	-0.18	-0.08	-3.77	-12.71
Deposit Rate	2003	2008	no	no	no	yes	8.32	22.06	0.08	4.49	0.00	-0.25	-0.08	-3.49	-12.20
Deposit Rate	2004	2009	no	no	no	yes	6.31	13.84	0.18	7.61	-0.02	-0.60	-0.12	-2.91	-8.41

Note: JJ- is the Johansen method, EG- Engle-Granger method, CRDW- Cointegration Regression Durbin Watson test, ECM-Based - Error Correction Based test and PT- Pass-through, ECT_{t-1} –Lagged Error Correction Term, and ML – Mean Lag

Appendix E: Summary of Asymmetric Error Correction Terms and Mean Adjustment Lags

Table E-1.0: Asymmetric Error Correction Terms and Mean Adjustment Lags for the entire sample period for all countries

			Asymmetric error correction terms								Summary		
Interest	Sample		ECT^{+}_{t-1}		ECT^{-}_{t-1}		Wald Test		Mean Lag		PT	Adjustment	Hypothesis
Rates	From	To	Coeff.	t-stat	Coeff.	t-stat	F-stat	PV	ML^{+}	ML^{-}	Mechanism	Rigidity	
Gambia													
Lending Rate	1989	2009	0.02	0.57	-0.19	-4.50	11.50	0.00	49.10	-4.01	Asymmetry	Upward	Customer reaction
Deposit Rate	1989	2009	-0.03	-0.67	-0.19	-3.07	2.84	0.09	-21.32	-3.62	Asymmetry	Upward	Collusive pricing arrangement
Ghana													
Lending Rate	2000	2009	-0.23	-1.33	-0.43	-4.71	0.89	0.35	-4.48	-2.39	Symmetric	Upward	Customer reaction
Deposit Rate	2000	2009	-0.18	-1.98	-0.08	-1.27	0.62	0.43	-3.63	-8.34	Symmetric	Downward	Customer reaction
Nigeria													
Lending Rate	1989	2009	-0.21	-3.33	-0.10	-1.23	0.86	0.35	-1.65	-3.50	Symmetric	Downward	Collusive pricing arrangement
Deposit Rate	1989	2009	-0.17	-2.81	-0.01	-0.15	2.78	0.10	-3.09	-66.27	Asymmetry	Downward	Customer reaction
Sierra Leone													
Lending Rate	1989	2009	-0.15	-3.84	0.01	0.26	4.33	0.04	-4.70	50.31	Asymmetry	Downward	Collusive pricing arrangement
Deposit Rate	1989	2009	-0.07	-2.13	-0.02	-0.57	0.81	0.37	-12.04	-43.12	Symmetric	Downward	Customer reaction

Note: ML - mean lag, ECT- error correction term, PV-Probability Value

Table E-1.1: Asymmetric error correction terms and mean adjustment lags of rolling windows for Gambia

			Asymmetric error correction terms								Summary		
Interest	Rolling Sample		ECT^{+}_{t-1}		ECT^{-}_{t-1}		Wald Test		Mean Lag		PT	Adjustment	Hypothesis
Rates	From	To	Coeff.	t-stat	Coeff.	t-stat	F-stat	PV	ML^{+}	ML^{-}	Mechanism	Rigidity	
Lending Rate	1989	1994	-0.73	-5.66	0.03	0.18	9.33	0.00	-1.25	27.48	Asymmetric	Downward	Collusive pricing arrangement
Lending Rate	1990	1995	-0.24	-1.57	-0.31	-1.19	0.05	0.83	-3.53	-2.69	Symmetric	Upward	Customer reaction
Lending Rate	1991	1996	-0.29	-2.00	-0.41	-1.49	0.11	0.74	-2.81	-2.04	Symmetric	Upward	Customer reaction
Lending Rate	1992	1997	-0.33	-2.20	-0.45	-1.73	0.14	0.71	-2.38	-1.76	Symmetric	Upward	Customer reaction
Lending Rate	1993	1998	-0.48	-3.53	-0.16	-0.61	1.02	0.31	-1.90	-5.72	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1994	1999	-0.61	-6.76	0.00	0.01	7.58	0.01	-1.65	476.71	Asymmetric	Downward	Collusive pricing arrangement
Lending Rate	1995	2000	-0.81	-6.44	0.18	1.84	26.78	0.00	-1.23	5.47	Asymmetric	Downward	Collusive pricing arrangement
Lending Rate	1996	2001	-0.79	-6.76	0.16	2.16	34.49	0.00	-1.28	6.26	Asymmetric	Downward	Collusive pricing arrangement
Lending Rate	1997	2002	0.10	1.16	-0.28	-3.35	6.36	0.01	9.63	-3.60	Asymmetric	Upward	Customer reaction
Lending Rate	1998	2003	-0.01	-0.09	-0.23	-2.12	1.27	0.26	-58.38	-3.00	Symmetric	Upward	Customer reaction
Lending Rate	1999	2004	0.10	0.63	-0.25	-3.31	3.04	0.08	7.15	-2.81	Asymmetric	Upward	Customer reaction
Lending Rate	2000	2005	-0.07	-0.88	-0.19	-2.99	1.37	0.24	-11.15	-3.86	Symmetric	Upward	Customer reaction
Lending Rate	2001	2006	-0.05	-0.57	-0.13	-1.68	0.29	0.59	-14.93	-5.87	Symmetric	Upward	Customer reaction
Lending Rate	2002	2007	-0.15	-1.09	-0.06	-0.80	0.26	0.61	-4.67	-12.86	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	2003	2008	-0.12	-0.97	-0.14	-2.26	0.02	0.88	-5.74	-4.82	Symmetric	Upward	Customer reaction
Lending Rate	2004	2009	-0.32	-4.61	0.08	0.77	6.85	0.01	-2.79	11.28	Asymmetric	Downward	Collusive pricing arrangement
Deposit Rate	1989	1994	-0.48	-3.25	-0.09	-0.86	3.45	0.06	-1.98	-10.51	Asymmetric	Downward	Customer reaction
Deposit Rate	1990	1995	-0.21	-1.40	-0.13	-1.44	0.14	0.71	-4.67	-7.22	Symmetric	Downward	Customer reaction
Deposit Rate	1991	1996	-0.31	-2.37	-0.28	-1.87	0.03	0.87	-2.74	-3.09	Symmetric	Downward	Customer reaction
Deposit Rate	1992	1997	-0.44	-2.27	-0.69	-4.03	0.76	0.38	-1.72	-1.10	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	1993	1998	-0.23	-3.16	0.23	1.03	2.73	0.10	-4.42	4.45	Asymmetric	Downward	Customer reaction
Deposit Rate	1994	1999											
Deposit Rate	1995	2000											
Deposit Rate	1996	2001											
Deposit Rate	1997	2002											
Deposit Rate	1998	2003	-0.36	-0.78	-0.25	-0.60	0.02	0.90	-2.13	-2.99	Symmetric	Downward	Customer reaction
Deposit Rate	1999	2004	0.08	0.63	-0.28	-3.21	4.03	0.04	10.18	-2.80	Asymmetric	Upward	Collusive pricing arrangement
Deposit Rate	2000	2005	-0.14	-0.87	-0.20	-1.89	0.06	0.80	-4.53	-3.20	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2001	2006	-0.23	-1.37	-0.20	-1.75	0.01	0.91	-2.97	-3.38	Symmetric	Downward	Customer reaction
Deposit Rate	2002	2007	-0.15	-0.85	-0.23	-1.78	0.10	0.76	-4.45	-2.84	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2003	2008	-0.20	-0.78	-0.32	-2.11	0.11	0.73	-3.64	-2.25	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2004	2009	0.14	0.74	-0.59	-4.05	6.70	0.01	3.64	-0.87	Asymmetric	Upward	Collusive pricing arrangement

Note: ML - mean lag, ECT- error correction term

Table E-1.2: Asymmetric error correction terms and mean adjustment lags of rolling windows for Ghana

			Asymmetric error correction terms								Summary		
Interest	Rolling sample		ECT^{+}_{t-1}		ECT^{-}_{t-1}		Wald Test		Mean Lag		PT	Adjustment	Hypothesis
Rates	From	To	Coeff.	t-stat	Coeff.	t-stat	F-stat	PV	ML^{+}	ML^{-}	Mechanism	Rigidity	
Lending Rate	2000	2005	-0.28	-2.65	-0.30	-2.12	0.00	0.95	-2.97	-2.83	Symmetric	Upward	Customer reaction
Lending Rate	2001	2006	-0.46	-4.84	-0.10	-0.81	3.93	0.05	-2.06	-9.84	Asymmetry	Downward	Collusive pricing arrangement
Lending Rate	2002	2007	-0.54	-5.04	0.01	0.05	6.09	0.01	-1.53	-5.83	Asymmetry	Downward	Collusive pricing arrangement
Lending Rate	2003	2008	0.02	0.06	-0.56	-4.07	2.37	0.12	66.46	-2.33	Symmetric	Upward	Customer reaction
Lending Rate	2004	2009	0.10	0.29	-0.69	-4.81	4.12	0.04	23.03	-3.18	Asymmetry	Upward	Customer reaction
Deposit Rate	2000	2005	-0.21	-1.73	-0.05	-0.63	0.88	0.35	-3.07	-13.15	Symmetric	Downward	Customer reaction
Deposit Rate	2001	2006	-0.32	-2.62	-0.06	-0.73	2.27	0.13	-2.32	-12.86	Symmetric	Downward	Customer reaction
Deposit Rate	2002	2007	-0.34	-2.51	-0.08	-0.67	1.42	0.23	-2.88	-12.29	Symmetric	Downward	Customer reaction
Deposit Rate	2003	2008	-0.02	-0.14	-0.46	-3.18	4.07	0.04	-55.12	-1.97	Asymmetry	Upward	Collusive pricing arrangement
Deposit Rate	2004	2009	0.14	0.66	-0.52	-3.78	4.66	0.03	6.14	-1.68	Asymmetry	Upward	Collusive pricing arrangement

Note: ML - mean lag, ECT- error correction term

Table E-1.3: Asymmetric error correction terms and mean adjustment lags of rolling windows of Nigeria.

			Asymmetric error correction terms								Summary		
Interest rates	Rolling sample		ECT^{+}_{t-1}		ECT^{-}_{t-1}		Wald Test		Mean Lag		PT	Adjustment	Hypothesis
	From	To	Coeff.	t-stat	Coeff.	t-stat	F-stat	PV	ML^{+}	ML^{-}	Mechanism	Rigidity	
Lending Rate	1989	1994	-0.51	-2.68	-0.50	-2.17	0.00	0.99	-0.24	-0.24	Symmetric		
Lending Rate	1990	1995	-0.52	-2.81	-0.45	-2.19	0.05	0.82	-0.16	-0.18	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1991	1996	-0.49	-2.81	-0.47	-2.33	0.00	0.95	-2.44	-0.25	Symmetric	Upward	Customer reaction
Lending Rate	1992	1997	-0.49	-2.65	-0.49	-2.53	0.00	0.99	-0.18	-0.18	Symmetric		
Lending Rate	1993	1998	0.02	0.07	-0.78	-4.06	4.70	0.03	-9.24	0.19	Asymmetric	Upward	Customer reaction
Lending Rate	1994	1999	0.31	1.53	-0.39	-2.88	4.91	0.03	2.83	-2.23	Asymmetric	Upward	Customer reaction
Lending Rate	1995	2000	0.21	1.20	-0.39	-3.12	4.92	0.03	4.64	-2.43	Asymmetric	Upward	Customer reaction
Lending Rate	1996	2001	0.19	1.56	-0.32	-2.82	5.85	0.02	4.83	-2.96	Asymmetric	Upward	Customer reaction
Lending Rate	1997	2002	-0.24	-2.17	-0.07	-0.69	0.79	0.37	-3.66	-11.79	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1998	2003	-0.23	-2.23	-0.06	-0.59	1.04	0.31	-3.78	-15.20	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1999	2004	-0.23	-2.38	-0.04	-0.39	1.41	0.24	-3.87	-23.84	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	2000	2005	0.06	0.40	-0.39	-2.80	2.72	0.10	14.05	-2.25	Asymmetric	Upward	Customer reaction
Lending Rate	2001	2006	-0.20	-1.65	-0.35	-2.11	0.40	0.53	-4.47	-2.57	Symmetric	Upward	Customer reaction
Lending Rate	2002	2007	-0.21	-2.31	-0.01	-0.11	1.17	0.28	-0.05	-78.06	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	2003	2008	0.24	1.17	-0.63	-4.41	8.58	0.00	3.94	-1.52	Asymmetric	Upward	Customer reaction
Lending Rate	2004	2009	0.24	1.33	-0.51	-3.57	7.63	0.01	4.44	-2.07	Asymmetric	Upward	Customer reaction
Deposit Rate	1989	1994	-0.82	-3.83	-0.22	-0.94	2.59	0.11	-0.32	-1.17	Symmetric	Downward	Customer reaction
Deposit Rate	1990	1995	-0.70	-3.52	-0.32	-1.52	1.32	0.25	-0.30	-0.66	Symmetric	Downward	Customer reaction
Deposit Rate	1991	1996	-0.74	-3.93	-0.43	-2.02	1.12	0.29	-0.31	-0.53	Symmetric	Downward	Customer reaction
Deposit Rate	1992	1997	-0.53	-2.37	0.03	0.29	3.65	0.06	-0.48	8.50	Asymmetric	Downward	Customer reaction
Deposit Rate	1993	1998	-0.64	-2.82	0.12	0.89	5.23	0.02	-0.24	1.36	Asymmetric	Downward	Customer reaction
Deposit Rate	1994	1999	0.00	-0.02	-0.09	-1.36	0.28	0.60	-273.12	-7.93	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	1995	2000	-0.14	-1.20	-0.30	-1.73	0.94	0.33	-5.51	-2.63	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	1996	2001	-0.20	-1.74	-0.06	-0.47	0.44	0.51	-4.41	-14.31	Symmetric	Downward	Customer reaction
Deposit Rate	1997	2002	-0.25	-1.53	-0.12	-0.84	0.23	0.63	-2.92	-5.98	Symmetric	Downward	Customer reaction
Deposit Rate	1998	2003	-0.22	-1.48	-0.17	-1.02	0.04	0.85	-4.07	-5.29	Symmetric	Downward	Customer reaction
Deposit Rate	1999	2004	-0.26	-1.57	-0.13	-0.72	0.19	0.66	-3.33	-6.82	Symmetric	Downward	Customer reaction
Deposit Rate	2000	2005	-0.26	-1.35	-0.18	-0.89	0.06	0.80	-3.41	-5.12	Symmetric	Downward	Customer reaction
Deposit Rate	2001	2006	-0.13	-0.67	-0.60	-2.62	1.53	0.22	-7.18	-1.59	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2002	2007	-0.27	-1.86	-0.10	-0.78	0.48	0.49	-3.59	-9.27	Symmetric	Downward	Customer reaction
Deposit Rate	2003	2008	-0.39	-3.13	0.12	1.12	6.69	0.01	-2.72	8.81	Asymmetric	Downward	Customer reaction
Deposit Rate	2004	2009	-0.48	-4.61	0.21	1.90	12.49	0.00	-1.96	-0.28	Asymmetric	Upward	Collusive pricing arrangement

Note: ML - mean lag, ECT- error correction term

Table E-1.4: Asymmetric error correction terms and mean adjustment lags for rolling windows of Sierra Leone

			Asymmetric Error Correction Terms								Summary		
Interest	Rolling sample		ECT^{+}_{t-1}		ECT^{-}_{t-1}		Wald Test		Mean Lag		PT	Adjustment	Hypothesis
Rates	From	To	Coeff.	t-stat	Coeff.	t-stat	F-stat	PV	ML^{+}	ML^{-}	Mechanism	Rigidity	
Lending Rate	1989	1994	-0.32	-2.32	-0.05	-0.25	0.93	0.33	-3.00	-20.50	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1990	1995	-0.29	-2.05	-0.04	-0.18	0.75	0.39	-2.32	-18.45	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1991	1996	-0.22	-1.79	-0.09	-0.45	0.25	0.62	-3.09	-7.98	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1992	1997	-0.16	-1.89	-0.10	-0.58	0.07	0.79	-4.78	-7.69	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1993	1998	-0.18	-2.25	-0.04	-0.37	0.66	0.42	-4.08	-16.51	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1994	1999	-0.16	-1.20	-0.08	-0.54	0.10	0.75	-6.03	-12.20	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1995	2000	0.04	0.58	-0.26	-2.37	3.27	0.07	21.35	-3.66	Asymmetric	Upward	Customer reaction
Lending Rate	1996	2001	-0.02	-0.33	-0.29	-2.88	3.77	0.05	-43.54	-3.22	Asymmetric	Upward	Customer reaction
Lending Rate	1997	2002	-0.26	-1.66	-0.25	-1.84	0.00	0.99	-3.71	-3.76	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1998	2003	-0.11	-1.02	-0.09	-1.03	0.01	0.93	-8.58	-9.98	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	1999	2004	-0.04	-0.52	-0.10	-1.40	0.18	0.67	-23.85	-9.87	Symmetric	Upward	Customer reaction
Lending Rate	2000	2005	-0.08	-0.86	-0.10	-1.29	0.02	0.89	-12.84	-10.10	Symmetric	Upward	Customer reaction
Lending Rate	2001	2006	-0.06	-0.64	-0.07	-1.09	0.00	0.95	-17.27	-15.13	Symmetric	Upward	Customer reaction
Lending Rate	2002	2007	0.05	0.55	-0.12	-1.73	1.31	0.25	19.74	-8.47	Symmetric	Upward	Customer reaction
Lending Rate	2003	2008	-0.20	-2.10	0.00	0.00	2.18	0.14	-5.24	5219.00	Symmetric	Downward	Collusive pricing arrangement
Lending Rate	2004	2009	0.00	-0.04	-0.22	-2.97	1.66	0.20	-219.96	-4.73	Symmetric	Upward	Customer reaction
Deposit Rate	1989	1994	-0.25	-1.90	0.06	0.40	1.73	0.19	-3.10	-12.07	Symmetric	Downward	Customer reaction
Deposit Rate	1990	1995	-0.17	-1.27	0.04	0.34	0.91	0.34	-5.04	19.77	Symmetric	Downward	Customer reaction
Deposit Rate	1991	1996	-0.06	-0.54	-0.10	-0.88	0.04	0.84	-14.87	-8.85	Asymmetric	Upward	Collusive pricing arrangement
Deposit Rate	1992	1997	-0.26	-4.45	-0.12	-1.84	2.04	0.15	-3.20	-7.15	Symmetric	Downward	Customer reaction
Deposit Rate	1993	1998	-0.10	-2.26	-0.15	-2.35	0.22	0.64	-8.99	-6.42	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	1994	1999	-0.19	-2.47	0.01	0.09	0.99	0.32	-5.07	72.77	Symmetric	Downward	Customer reaction
Deposit Rate	1995	2000	-0.12	-1.74	-0.10	-0.65	0.02	0.89	-8.04	-10.34	Symmetric	Downward	Customer reaction
Deposit Rate	1996	2001	-0.10	-1.46	-0.14	-1.07	0.06	0.81	-10.29	-7.14	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	1997	2002	-0.30	-4.00	-0.17	-1.48	0.83	0.36	-3.27	-5.94	Symmetric	Downward	Customer reaction
Deposit Rate	1998	2003	-0.16	-1.28	-0.23	-3.22	0.16	0.69	-6.02	-4.25	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	1999	2004	-0.06	-1.01	-0.13	-1.63	0.36	0.55	-16.53	-7.65	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2000	2005	-0.06	-1.37	-0.09	-1.62	0.16	0.68	-16.96	-10.64	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2001	2006	-0.06	-1.69	-0.11	-2.26	0.46	0.50	-16.09	-8.83	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2002	2007	-0.08	-1.79	-0.08	-1.56	0.00	0.99	-12.76	-12.65	Symmetric	Upward	Collusive pricing arrangement
Deposit Rate	2003	2008	-0.15	-2.76	-0.04	-0.93	1.80	0.18	-6.85	-26.55	Symmetric	Downward	Customer reaction
Deposit Rate	2004	2009	-0.27	-2.92	0.01	0.07	3.19	0.07	-3.77	167.77	Asymmetric	Downward	Customer reaction

Note: ML - mean lag, ECT- error correction term