

Monetary Policy Dynamics and Economic Growth in Sub-Saharan Africa: An Empirical Investigation

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DECLARATION

I, Ebenezer Gbenga Olamide hereby declare that apart from the aid acknowledged, the original work contained in this thesis for the degree PhD in Economics at North-West University (Mafikeng campus) is my own. It has not been submitted before for any degree or its equivalence at this or any other university. I also declare that all secondary information used has been duly recognised in this thesis.

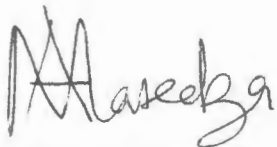


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CERTIFICATE OF ACCEPTANCE FOR EXAMINATION

This thesis entitled “**MONETARY POLICY DYNAMICS AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICA: AN EMPIRICAL INVESTIGATION**” submitted by **Ebenezer G. Olamide**, student number **26453789** of the Department of Economics in the Faculty of Economic and Management Sciences is hereby recommended for acceptance for examination.



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DEDICATION

To God be the glory, I dedicate this thesis to Almighty God and to my loving country, The Federal Republic of Nigeria.

ABSTRACT

The broad idea behind this dissertation is to undertake an empirical investigation into the nexus between monetary policy dynamics *vis-à-vis* growth in Sub-Saharan African countries. Basically, the study empirically seeks to provide answers to four major questions, namely: (i) what are the determinants of monetary policy dynamics in SSACs? (ii) What is the impact of monetary policy dynamics on growth in SSACs? (iii) What are the dynamic interactions between monetary policy variables and growth and (iv) To what extent do the identified external factors of oil and commodity price volatilities influence monetary policy dynamics in SSACs? Due to data collection constraints, 36 countries within the four major economic blocs of EAC, CEMAC, ECOWAS and SADC were selected covering a period from 1980-2015 thereby making the residuals both time series and cross sectional in nature. The overall variables of interest as identified in the literature are gross domestic product growth rate, money supply growth rate, exchange rate, inflation rate, interest rate, government expenditures, net domestic credit, oil and commodity price volatilities, and a dummy variable for the global financial crisis. The starting point in the estimation of the models is the use of Exponential Generalized Auto-regressive Conditional Heteroskedasticity (EGARCH) to examine the asymmetric effects of oil and commodity price volatilities on the economic growth of SSA. Relevant econometric tests such as tests for the stationarity of variables (unit root tests), long run relationship test (test for cointegration), Wald tests and Lag selection criteria were performed in order to avoid the problems of spurious regression and unreliable results. Basically, the study used panel data regressions and the panel results revealed the presence of cross sectional dependence which necessitated the breaking down of the analyses into individual economic blocs of CEMAC, EAC, ECOWAS and SADC. In order to capture the first objective of the study, the Panel-ARDL approach of cointegration analysis, which most satisfies the outcomes of the unit root tests was employed. The fixed and random effects models supported by dynamic panel model formed the basis of the analysis for objective two. An eight-variable Structural-VAR was employed to generate Impulse Response Functions and Variance Decompositions for the analysis of objectives three and four of the study. Under the first objective, the GDP, which represents output, was confirmed as an important determinant of monetary policy dynamics across the four economic blocs, even though, this was more grounded in SADC and CEMAC where financial deepening is very effective. The second variable investigated, which is money supply growth rate (financial deepening), is found to have a significant impact on monetary policy dynamics in SSA but the effect is more

pronounced in SADC, EAC and CEMAC. The findings further underscore the effect of financial deepening or effective money supply in monetary policy effectiveness in SSA. The next variable, which is exchange rate, was confirmed from the results as an important factor that affects monetary policy dynamics across the four economic blocs in SSA. Although it plays different roles across the economic blocs, the impact has generally been shown to be significant on monetary policy dynamics in SSA. Unlike other variables however, inflation did not display an overwhelming influence as an important variable affecting monetary policy dynamics in SSA as a whole. In spite of this, its effect was found significant in the two largest economic blocs of ECOWAS and SADC. However, government expenditure, net domestic credit and gross capital formation fail to exhibit a noticeable impact as determinants on monetary policy dynamics across all four economic unions in SSA. The result of the impact of monetary policy variables on the economic growth of SSA shows that the dynamics in monetary policy during the period under review have a significant impact on the economic growth of SSA but this varies from one economic bloc to another. For instance, exchange rate shows a more diverse result as it reveals that its impact is more pronounced in ECOWAS than the other three blocs. The influence of other macroeconomic variables such as inflation rate accounted for significant changes in the economic outlook of SSA with their attendant effects on the relationship between monetary policy and economic growth as well. The results of the dynamic interactions between monetary policy variables and economic growth of SSA show that monetary policy dynamics is greatly influenced by the external shocks from both oil and commodity price volatilities and the transmission mechanism channels indicate that this is passed through the monetary policy rate to exchange rate, and from exchange rate to GDP growth rate in CEMAC. As for the other economic blocs, the medium of transmission is through exchange rate to monetary policy rate and finally to GDP growth rate. Consequently, the medium of transmission of external shocks to the domestic economies in SSA is exchange rate for ECOWAS, SADC and EAC but in CEMAC, monetary policy rate is the medium of transmission. In summary, expansion of the economic base of the region, increase in domestic output, policy harmonization, import restrictions and improved infrastructural facilities coupled with increased agricultural productivities are some of the proffered policy recommendations for the SSACs.

Keywords: Monetary Policy Dynamics, Economic Growth, Auto Regressive Distributed Lag, Sub-Saharan Africa.

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ABREVIATIONS

| | |
|-----------|--|
| ADF – | Augmented Dickey Fuller |
| AEC – | African Economic Commission |
| AfDB – | Africa Development Bank |
| AGO – | Automated Gas Oil |
| AIC – | Akaike Information Criteria |
| ARCH – | Auto Regressive Conditional Heteroscedasticity |
| ARDL – | Auto Regressive Distributed Lag |
| BCAS – | Bank of Central African States |
| BRICS – | Brazil Russia India China and South Africa |
| CAEMU – | Central African Economic and Monetary Union |
| CB – | Central Bank |
| CEMAC – | Communaute Economiquee tMonetaire de l’ Afrique Centrale |
| CIS – | Commonwealth of Independent States |
| CMA – | Common Monetary Area |
| CPI – | Consumer Price Index |
| DOLS – | Dynamic Ordinary Least Square |
| DPK – | Dual Purpose Kerosene |
| EAC – | East Africa Community |
| EAMZ – | East Africa Monetary Union |
| ECB – | European Central Bank |
| ECOWAS – | Economic Community of West Africa |
| EGACRCH – | Exponential Generalized Conditional Heteroscedasticity |
| EMU – | European Monetary Union |

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| FMOLS – | Fully Modified Ordinary Least Square |
| FTPL – | Fiscal Theory of Price |
| GDP – | Gross Domestic Products |
| GLS – | Generalized Least Square |
| GMM – | Generalized Method of Moments |
| HIC – | Hannan-Quinn Information Criteria |
| IFS – | International Financial Standard |
| IMF – | International Monetary Fund |
| IRFs – | Impulse Response Functions |
| LCU – | Local Currency Unit |
| LDCs – | Less Developed Countries |
| LSDV – | Least Square Dummy Variable |
| LSN – | Lesotho Swaziland Namibia |
| MENA – | Middle East and North Africa |
| MA – | Moving Average |
| MPIs – | Monetary Policy Instruments |
| MPR – | Monetary Policy Rate |
| MTM – | Monetary Transmission Mechanism |
| OECD – | Organisation for Economic Cooperation and Development |
| OLS – | Ordinary Least Square |
| PMS – | Premium Motor Spirit |
| QTM – | Quantity Theory of Money |
| RISDP – | Regional Initiative Strategic Development Plan |
| RPI – | Retail Price Index |

| | |
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| SAP – | Structural Adjustment Programme |
| SADC – | Southern African Development Community |
| SIC – | Schwarz Information Criterion |
| SSA – | Sub Sahara Africa |
| SSACs – | Sub Sahara Africa Countries |
| UEMOA – | Union Economique et Monetaire oust-Africaine |
| UN – | United Nation |
| UNCTAD – | United Nation Conference on Trade and Development |
| VAR – | Vector Auto Regressive |
| VECM – | Vector Error Correction Mechanism |
| VDCs – | Variance Decompositions |
| WAEMU – | West Africa Economic and Monetary Union |
| WAMZ – | West Africa Monetary Zone |
| WDI – | World Development Indicator |

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

The nexus between monetary policy dynamics and economic growth has become an interesting topic in recent times. This is premised on the notion that countries all over the world, whether developed or developing, have the ultimate goal not only to achieve economic growth and development but also to sustain them (Senn, 1999). Since the early 1980s, when some SSACs embarked on Structural Adjustment Programme (SAP) aiming at revitalizing their economies, monetary policy had been a major mechanism towards combating possible economic shocks which resulted in its dynamics. The pursuit of economic growth is expected to lead to price and exchange rate stability, high employment rate, stimulate capital formation and growth and a sound financial system among others. However, these lofty goals are empirically still far from being a reality in SSA and therefore, the debate about the nexus between monetary policy dynamics and economic growth rages on.

Two major approaches towards achieving micro and macroeconomic objectives are expansionary and contractionary monetary policies which remain the prerogative of the Central Bank (Reserve Bank) of any country. Depending on the level of economic growth attained or to be attained in an economy, dynamics in monetary policy can either be expansionary or contractionary in nature. Expansion on one hand, with low interest rates and inflation, can result in economic instability if it fails to stimulate aggregate demand. For instance, the holding of cash may be more attractive compared with bank deposits that have a low interest yield. Contractionary monetary policy on the other hand can result in high unemployment, currency depreciation and general economic stagnation which are undesirable outcomes (Diamond and Rajan, 2006; van den Heuvel, 2002; Chiesa, 2001; Stein, 1998).

However, the global economic crisis of 2007-2009 with its attendant shock to oil and commodity prices is still a major challenge to contend with in many countries especially the developing ones like the SSA countries. Consequently, monetary policy frameworks are very vulnerable to external cyclical changes since according to Coletti *et al* (2012), commodity prices, including that of oil, are subject to the dictates of the global market rather than regional or individual country's domestic production cost or demands. This is what actually informs its

dynamics as it tries to adjust to different external shocks confronting it at a certain period of time. Virtually all the SSACs are predominantly producers of primary products and many of them depend largely on importation which makes their economies import-dependent. Hence, this constitutes another reason why many of the macroeconomic policies of many countries in the SSA are highly prone to external influences. Therefore in order to adjust to these external influences, macroeconomic policy is subject to frequent changes with the hope that this will enable them to cope with any prevailing situation presented by the external forces at a certain period of time (AfDB, 2014).

Monetary policy being one of these macroeconomic policies has its own fair share of dynamism in order to achieve the set macroeconomic objectives. The dynamics in monetary policy is reflected in its key variables such as interest rate and money supply. The volatilities in these two important monetary variables owing to external shocks have important implications for the growth of the SSACs (Quartey and Afful-Mensah, 2014). In addition, some countries in the SSA practice a fixed exchange rate system while some practice what is called a flexible or regulated flexible exchange rate system. These two systems according to Mundel (1963) have important implications on the monetary policy administrations of countries. Studies have revealed that countries with these types of exchange rate policies do experience dynamics in monetary policies. This is because an effort at making their domestic currency competitive in the foreign exchange market will usually result in frequent adjustments of interest rate as well as money supply to complement their external reserves in order to provide backing for their individual local currencies. The implication of this is a dynamic in monetary policy which is mostly characterized by interest rate volatility (Fleming, 1962).

One important reason adduced to monetary policy dynamics in the SSA is the economic recession that bedevilled most of the SSACs in the early 80s and now since the mid-2017. During the 1980s, the World Bank came with conditions to rescue many of the SSACs from their economic woes. An important aspect of these conditions at that time was the adoption of a Structural Adjustment Programme (SAP) which emphasized economic deregulation in order to achieve economic growth among other things. Notwithstanding this reform, SSACs still failed to emerge when it came to growth in comparison with the developed world (Mwega, 2003). This has given rise to the call to completely overhaul economic policies that can cope with the falling oil and commodity prices (IMF, 2015). For instance, according to the World Bank (2000), credit allocation

is expected to follow the dictates of market forces in order to achieve optimum credit allocation in the SSA. This, according to the World Bank, will bring sustainable growth in the long run. The action further brings about uncertainty in monetary policy due to its volatile nature as it tries to adjust frequently to forces of demand and supply at a certain period.

Therefore the contributions of monetary policy and its dynamics towards a sustainable economic growth is now moving to the front of policy debate in economic literature (see Kasekende and Brownbridge, 2010; Anagnostou and Papadamou, 2014; IMF, 2015). While some scholars advocate a sharp departure from monetary policy targeting inflation, others recommend the hybrid of both as being practiced in Kenya (Kamaan, 2014). Yet others have called for a complete reformation of policies where fiscal and other potent measures can be used as complements to monetary policy (Akujuobi, 2010; Oboh, 2002; Fasanya *et al*, 2013; Ogege and Shiro, 2012).

Week (2010) opines that a great deal of importance was placed on the use of monetary policy in developing countries of SSA by the IMF but unfortunately, the approach seems inappropriate because of the lack of relevant instruments to make monetary policy effective in the face of its dynamic nature. In the words of Sepe (2012), a well-designed monetary policy and regulatory reform is a major *sine qua non* for economic growth. The need for an appraisal of monetary policy in SSA was further supported in the following statement that:

There is the need to reform monetary policy framework especially in the so called “frontier markets of the Sub-Saharan Africa after the 2007-2009 global financial crisis. This is to give room for the much needed activist demand management to grow in line with economic development and the harmonization of domestic financial sectors into global markets. These reforms should include the adoption of wider set of policy objectives in addition to inflation, replacement of broad money as the intermediate target with a more sophisticated set of indicators and forecasts and reform of the operating target. This should be complimented by measure aiming at strengthening the transmission mechanism of monetary policy... (Kasekende and Brownbridge, 2010).

With the above background, this study thus has its main thrust on monetary policy dynamics by focusing on the effect of economic variables such as interest rate, inflation rate, money supply, exchange rate and government expenditure on the economic performance of SSA

with the key research question being: what is the relationship between monetary policy dynamics and economic growth in SSA? As a corollary, the study also examines the effects of commodity and oil price volatilities, net domestic credit and stock of capital as additional determinants of monetary policy dynamics in SSACs.

1.2 Statement of the problem

The relationship between economic growth and monetary policy dynamics in Africa as a continent has been an issue of concern both to policy makers and the academia in recent times. The initial optimism concerning the effect of economic downturn has now cast more doubt that the spill over effect might be with the region for some time to come (Arieff *et al* 2010). Going by the earlier prediction of the International Monetary Fund, average economic growth in Africa was expected to slow down to 1% in 2009 from an annual average of over 6% from 2004 before it can rebound back to 4% in 2010. Almost half of the countries in the region have their growth dropped while the social and economic situation of the region remains fragile and vulnerable to domestic and external shocks as a result of dwindling oil and commodity prices (Ulku, 2004; World Bank, 2013). To diversify the economic structure and boost the growth potentials of the region has therefore been limited as a result of subdued investment (Nkurunziza and Bates 2003).

Furthermore, some countries within the region have just emerged from civil wars while some are still battling with the emergence of militants and Islamic terrorists' attacks. All these have caused serious setbacks to the developmental efforts of the region (Basu *et al*, 2005; World Bank 2013). It is equally of note that the severe decline in commodity prices occasioned by drought, poor weather conditions, terms of trade deterioration and in some cases by the Ebola epidemic, increasing protectionism, the high real interest rates and decreasing net capital flows are all said to be retarding the previously recorded progress in the economic growth of the region (Nkurunziza and Bates, 2003; Ulku, 2004; Basu *et al*, 2005; IMF, 2015). Sub Saharan African growth experienced a decline from 5.1 percent in 2014 to 3.4 percent in 2015. Although average inflation declined to 9.1 percent in 2004 from an average of 14.6 percent between 1997 and 2001 (Saxegaard, 2006), SSA's economic growth may likely decelerate from 4.6 percent in 2014 to 3.7 in 2015 based on the World Bank report of 2015 (Maswanganyi, 2015). This is said to be the lowest since 2009.

While the region is battling with these challenges, policy makers across the region have continued to lay emphasis on the re-appraisal of monetary approach as an effective way of

restructuring the SSA economies. By so doing, it is expected that the economy will rebound back to a path of positive and sustainable economic growth (AfDB, 2014; IMF, 2013). In addition, the effectiveness of monetary policy in solving the myriad of challenges facing many of the countries in SSA has been debated in the literature (Kasekende and Brownbridge 2010, Lama and Medina 2010 and Mohamed 2011). Consequently, various available instruments and methods such as inflation targeting, exchange rate targeting and forward looking Philips curve as well as Taylor's principles among others that have been applied in many countries of SSA in recent years are discussed. These approaches have resulted in the incessant interplay of either contractionary or expansionary monetary policy (Romer, 2013).

By and large, the above actions have culminated in the dynamics of monetary policy in SSA (Jorda and Salyer, 2002). However, efforts of the monetary authorities in SSA to rescue their economies from their economic woes have led to continued alteration or adjustment of key monetary policy variables in order to cope with a prevailing economic situation at one particular period of time or another. For instance, in the last two years, the Central Bank of Nigeria has changed the monetary policy rates (MPR) more than seven times, the last one being in April 2016 when the MPR was increased from 10% to 12% making it the fourth time within 6 months. In South Africa, the trend has continued to be the same; the annual average interest rate rose from 5% in 2013 to 5.75% and to 5.79% in 2014 and 2015 respectively. In Kenya it rose from 8.5% to 8.6% and fell to 8.3% within the same period (Focuseconomics, 2015). It should be noted that during this period as well, the volume of money supply in SSA has been fluctuating which is as a result in the dynamism in the monetary policy. According to the IMF (2014) the monetary policy outlook in SSA has continued to exhibit an unprecedented dynamism in recent years, thereby aggravating monetary policy uncertainty.

The dynamism of the monetary policy is clearly reflected in the nature of volatility of the monetary policy rates described above. Furthermore, the resultant effects of the volatility in monetary policy rates across the SSA are evident in the impairments it caused to the interactions among the key macroeconomic variables. The interaction between the dynamics in monetary policy and key macroeconomic variables is explained within the monetary policy transmission mechanism MTM. Traditionally speaking, the two major approaches to monetary transmission mechanisms are the credit view (which emphasis bank lending) and the money view (with interest rate as instrument) (Peter, R. Senn 1999). However, further researches have revealed six possible

ways by which monetary policy transmission may affect an economy since the different kinds of money have different effects on different economies, (for instance see Mishkin, 1996; Meltzer, 1995; Kuttner and Mosser, 2002; Ford, 2003; Mies and Tapia, 2003). These channels are the bank business lending channel, the interest rate channel, the balance sheet channel, the exchange rate channel, the credit lending channel and the asset pricing channel. How the dynamism in monetary policy influence investment and growth through its interaction with some other macroeconomic variables calls for further investigation since there is lack of consensus on which channel of MTM is the most sensitive to monetary policy dynamics.

The vulnerability of the SSA economies to external influence as earlier stated appears to be making monetary policy approach highly susceptible to dynamics as well. In spite of all these efforts therefore, SSA has not been able to escape the turbulence of the international economic environment which brought about unsustainable growth rates and economic instabilities of recent years. For instance in Ghana, the prices of the major revenue earners of the country have decreased significantly. Between 2012 and 2015, the shocks in the price of gold led to a huge loss of more than \$2bn in revenue (World Bank, 2015) of the country. In the same vein, shocks in cocoa prices resulted in more than \$1b loss in revenue during the same period. The fluctuation according to the Governor of the Central Bank of Ghana, Kofi Wampah complicates monetary policy implementation and hence the need for a complete overhauling of the monetary policy framework. In addition, South Africa has been battling with economic recession in the last one decade. Countries such as Botswana, that are perceived to be having sound macroeconomic governance, have sought international financial refuge for them to be able to cope with the effects of the crisis (Arieff *et al* 2010). Nigeria, which is the largest economy in SSA, is having her own share of the shock in the prices of petroleum products with its attendant consequences on the exchange rate falling from N198/\$1 in April 2015 to N385/\$1 in February 2016 and to an alarming N500/\$1 at the end of January 2017.

Beyond the fluctuations in oil prices as established in the literature, there is also the strong link between commodity prices and government revenues in SSA. This poses serious implications for government expenditure which has its own implications for monetary policy administrations in these economies (Demachi, 2012). All these variables appear to have important influence on the dynamics of monetary policy in SSA. It is pertinent to note that a thorough investigation of the relationship between growth and monetary policy dynamics in SSA will not be complete without

incorporating the influence these external variables might likely pose to the monetary policy framework in SSA. As a matter of fact, the analysis of the study started with these exogenous variables of oil and commodity price volatilities.

However, since the monetary approach explained above has not been able to bring about sustainable economic growth to the SSA despite its dynamism, there is therefore the need to investigate the nexus between monetary policy dynamics and growth in SSA. Again, if the advice of the IMF (2014) that the causes of macroeconomic policies fluctuations in SSA need to be empirically investigated in order to work out the effectiveness of these policies on growth is anything to go by, then it appears it will be logical for this research work to first examine the determinants of monetary policy dynamics or volatility before examining its relationship with growth. The position of the IMF is that factors that are responsible for policy fluctuations vary from one country to another and from region to region.

This study therefore sets out to fill the gaps noticed above by comparing monetary policy dynamics and growth nexus in SSA among the four major economic regions: Central Africa's *Communaute Economiquee et Monetaire de l' Afrique Centrale (CEMAC)*, East Africa's Eastern Africa Community (EAC), Southern Africa's Southern Africa Development Economic Council (SADC) and West Africa's Economic Community of West African States (ECOWAS). This in the researcher's view is a clear departure from earlier studies that were country-specific or cross-country in nature.

1.3 Research questions

- i. What are the determinants of monetary policy dynamics in SSA?
- ii. What are the impacts of monetary policy dynamics on the growth of SSA?
- iii. What is the dynamic interaction among monetary policy variables and economic growth in SSACs?
- iv. To what extent do the external factors influence monetary policy effectiveness in SSA?

1.4 Objectives of the study

The broad objective of this study is to investigate monetary policy dynamics and economic growth in Sub-Saharan African countries. The specific objectives are to:

- i. Investigate empirically the determinants of monetary policy dynamics in SSA.
- ii. Examine the impacts of monetary policy dynamics on growth in SSA.

- iii. Examine the dynamic interaction among monetary policy variables and economic growth in SSA.
- iv. Analyse the influence of external factors on monetary policy dynamics in SSA.

In order to achieve the above stated objectives, empirical analyses are carried out with the use of panel econometrics techniques in the relevant chapters. Principally the study employs yearly data from 1980:1 to 2015:4 for thirty-six (36) SSA countries. The choice of this time frame and country selection is informed by data availability. Principally, the World Development Indicator (WDI) as published by the World Bank and International Financial Statistics (IFS) remain the major sources of data for this study.

1.5 Research hypotheses

The study is based on the hypothesis that monetary policy do not significantly affect the economic growth of Sub-Saharan African countries. The necessary hypotheses to be tested are as stated below:

- (i) The determinants of monetary policy dynamics are not significant in SSA.
- (ii) Monetary policy dynamics have no impact on economic growth of SSA.
- (iii) There is no significant interaction between monetary policy variables and economic growth of SSA.
- (iv) External factors have no significant influence on monetary policy in SSA.

1.6 Justification of the study

There is no doubting the fact that much had been written and researched on the nexus between monetary policy dynamics and economic growth in general. However, the majority of these empirical studies did not give an in-depth account of the reasons for the dynamics or what accounted for the dynamics in monetary policy vis-à-vis growth of SSACs especially with regional comparison. Again, evidence from the literature in recent time shows that the relationship between monetary policy and growth based on regional comparison is of great importance not only to cross country managers but also to policy makers. However, many of the available studies were country-specific or cross-country in nature. As pointed out by UN (2014), considerable economic gain is expected to be harnessed by regional integration in Africa.

In a recent study, Mishra *et al* (2010) provided cross-country evidence about interest rate as a monetary policy variable to be weak or unreliable as a pass through effect on real output in the so called Low Income Countries. On the contrary, the findings by IMF (2010) among other things show monetary policy as having meaningful impact in SSA against the usual belief. Therefore, the disparate evidence about the influence of monetary policy may signal the presence of different operating targets across the SSACs which therefore require regional investigation of monetary policy dynamics that could account for heterogeneities.

There is no doubting the fact that monetary policy which is one approach towards achieving sustainable economic growth and development has been pursued by nations. As rightly noted by Nguena (2013), good monetary policy is a *sine qua non* to the functioning of any economy. It was further adduced that monetary and credit policies offer great opportunities in stabilising, stimulating or even slowing down a modern economy if not well implemented (Papademos, 2003). Since the discussion of the role of monetary policy towards influencing macroeconomic objectives such as economic growth, price and exchange rate stability and others, monetary authorities have been saddled with the responsibility of using monetary policy variables towards achieving growth and development.

However, the ability of the changes in monetary policy variables in many SSACs to yield relevant results has been a subject of concern to scholars and monetary policy managers in recent times. It became a more topical issue after the world economic crisis of 2007-2009, from which most developing nations are still battling to get out of its grave consequences. Accordingly, the Deputy Governor of the South African Reserve Bank, Groege (2015), lamented that seven years after the global economic crisis, global full-fledged economic recovery is still a mirage in SSA despite the fact that more challenges keep rearing their ugly heads. Many have called for a complete overhaul of the present policies to accommodate other policies that can prevent or at least reduce the consequences of any future shocks. It therefore calls for an updated status of the link between monetary policy variables and growth potentials of SSACs. To a great extent, this has not been fully investigated in the literature which is one of the justifications for embarking on this study.

In the opinion of Dani Rodrik (1997):

“There is obviously great need for more research in monetary policy administration of these areas. The economies of Sub-Saharan Africa remain relatively under-researched;

especially where comparative research within the region is concerned... there is much that Sub-Saharan countries can learn from the successes and failures of their neighbours. The lessons from good practice in trade policies, institutional reforms, and the management of reform are generally more convincing when they emanate from the experiences of countries that are similarly situated (as opposed to those that are half a world away, as in the case of East Asia)".

In a nutshell this study is justified on the account that it is methodologically advantageous relative to existing studies for two reasons. (1) It not only looks at the econometric interactions among the variables of interest and growth as is commonly done, it examines the factors that determine such relationships. This is carried out through the analysis of SSA's economic and growth features before completing it with a quantitative econometric analysis. Consequently, the study combines the two types of analyses of time series and cross section that will resolve the problem of biased variables and spurious regression. (2) The long-run effects are used in an econometric sense. They express the integrating relationships among variables, such that even with short-run deviation from such relation caused by shocks, the variables always return to it. This does not necessarily mean extending the monetary policy impact to a long period of time, but they show the major link by which variables always return even after short-run disequilibrium.

1.7 Scope of the study

This study uses panel data covering the period 1980 to 2015 (36 years) which is considered minimally adequate for this analysis. Thirty-six (36) out of forty eight (48) sub-Saharan African countries are employed and this accounted for about seventy-six percent (76%) of the countries in sub-Saharan Africa. Although the choice of this sample size was informed by the extent of data availability, notwithstanding information from more than three quarters of the population as the sample could be assumed to be sufficient to generalize to the population (Svensson, 2013). Also, the choice was carefully made to maximize the available observations. The countries included are: Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, Cameroon, Chad, Congo Republic, Central Africa Republic, Equatorial Guinea, Gabon, Burundi, Kenya, Rwanda, Tanzania, Uganda, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe.

For ease of analysis, these countries are grouped under their regional blocs as follows:

Table 1.1: Sub-Sahara African Countries According to Sub Regions

| S/NO | Sub-Saharan Africa | Countries |
|------|--|---|
| | Sub-Regions | |
| 1 | Central Africa Community (CEMAC) | Cameroon, Chad, Congo Republic, Central Africa Republic, Equatorial Guinea, Gabon. (6 Countries). |
| 2 | East Africa Community (EAC) | Burundi, Kenya, Rwanda, Tanzania, Uganda. (5 Countries). |
| 3 | Economic Community of West Africa (ECOWAS) | Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, (14 Countries). |
| 4 | Southern Africa Development Community (SADC) | Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe. (11 Countries). |

1.8 Contributions to knowledge/research gap

To the best knowledge of the researcher, there is no work done in the context of monetary policy dynamics and economic growth based on a bloc-by-bloc comparison, especially in SSA countries. The few available ones are either country-specific or a handful that are cross-country in nature, by Ridhman, *et al* (2011), Nachane *et al.* (2002) and Georgoulous (2009). Understanding how policy variables do interact and their influence on economic growth and development is not only relevant on a bloc-by-bloc analysis but also germane for SSA as a whole. This could be so especially when economic growth poses a major challenge to the region. In the researcher's

opinion therefore, it will help monetary authorities of the countries concerned to formulate and implement useful monetary policy from set of economic choices and to better appreciate the inter-connections within the economies of the countries of SSA. Although it had been revealed in the literature that different policy instruments have different effects on growth, most of the studies contradict theoretical expectations (Harmse and Khabo, 2005; Kamaan, 2014). Hence, this study will take a stand about the different schools of thought.

Furthermore, of equal importance is the need to strengthen the potentials of regional currencies among the regional blocs in SSA such that the bottlenecks associated with currency conversion can be reduced or eliminated. This will further bring to the fore the urgent need for the realization of the embryonic West Africa and East Africa Monetary Zones. Borrowing from the words of Asongu (2014), introducing common currencies in East and West Africa has been faced with stiff challenges in the timing of monetary convergence and hence the need for the adoption of a common modelling and forecasting methods of monetary policy transmission as well as common structural and institutional characteristics among member states.

The contributions of this paper to the literature are therefore fivefold.

- First, it assesses the determinants and effects of monetary policy dynamics on growth based on the four major economic blocs in SSA which has not received much wider scholarly attention in the face of the current agitations for monetary policy reforms and regional integration.
- Second, there are some pertinent issues concerning monetary policy variables in the developed economies that may be irrelevant to the situation in SSACs. Example of these is financial deepening in relation to supply of money which may not be transmitted into Africa. This is due to the fact that a larger percentage of the monetary base in the region does not pass through the banking system. Coupled with this is the effectiveness of the credit mechanism of monetary policy in the SSACs with clear evidence of surplus liquidity challenges in the region, (see Saxeguard, 2006; Fouda, 2009).
- Third, the urgent need to address the increasing food prices, reduction in commodity and oil prices and reducing currency values that are currently plaguing the geopolitical terrain of SSA was emphasized in this study. This will in no small way contribute to the economic dependence of the regions rather than being political independent alone.

- Fourth, the study further established the fact that the economies of SSA that are predominantly dominated by oil and commodity exports are susceptible to external shocks which may invariably lead to monetary policy dynamics.
- Fifth is the use of well modified econometric models that accommodate growth and some other monetary policy variables.

Above all, it is expected that this study will add to the store of knowledge especially on the nexus between monetary policy dynamics and economic growth in Sub-Saharan Africa.

1.9 Limitations of the study

This dissertation focused on Sub-Saharan Africa under the four major economic blocs of West Africa, Central Africa, East Africa and Southern Africa. As noted in similar studies, inadequate data for all the countries under SSA, despite the wide scope, constitutes the major limitation to the study. Based on this, the fullness and richness associated with large cross country data could not be maximally achieved. Not only that, the span in terms of time is also limited thereby restricting some dynamics which could have been realized from the sub regional analyses of monetary policy effect on growth. One other limitation arising from this data inadequacy is the inability to cluster similar countries in order to bring out the differences in the application and implementation of monetary policy dynamics.

Despite these observed limitations, the study is expected to bring out some interesting useful findings not only for policy makers or academics but also add to the existing store of knowledge about the 'black box' of monetary policy dynamics versus growth in SSACs.

1.10 Organisation of the study

This study is organized into seven chapters. Chapter one introduces the study with a background that explains the contextual meaning of monetary policy in relation to economic growth. It further explains the problem statement, research questions and objectives with the relevant hypotheses to be tested in line with the stated objectives and why the study is worth undertaking. In chapter two, the study takes an overview look at money and monetary issues, monetary policy framework and a brief view of the four major monetary unions in SSA. It examines some monetary policy transmission mechanism channels through which money can affect an economy such as the interest rate channel, the credit channel, the exchange rate channel and the asset price channel. Chapter three focuses on theoretical discussions and literature review

as related to the study. The relevant literature will provide insights into the ways monetary policy affects growth and the magnitude of causal relationships. In chapter four, the suitable methodology for the study is discussed with the statistical description of the identified variables. This includes the model specification and the panel data approaches used in estimating the parameters. Chapters five and six present the diagnostic results of the data as well as the empirical analyses and interpretations. This includes the results of panel unit root tests, cointegration tests and their validity tests. The final chapter which is chapter seven concludes and explains the importance of the study, presents some policy recommendations that flow directly from the results of the findings. The researcher believes this will be useful for policymakers and academics. Moreover, it discusses the limitations of the study and provides suggestions for future research.

CHAPTER TWO

GENERAL OVERVIEW OF MONEY, MONETARY POLICY AND ECONOMIC GROWTH

2.1 Introduction

In this chapter, a general overview of the concepts of money and monetary issues are discussed. This is closely followed by monetary policy transmission mechanism which shows how the dynamics in some policy variables permeate into economic activities. Monetary framework in SSA is also discussed, finally touching on the four major monetary unions in SSA. In essence, this chapter provides an in-depth understanding of the workings of monetary policy through the concept of money and monetary policy transmission channels.

2.2 Definition of monetary policy

There is no consensus definition of monetary policy in the literature but the appropriate one for any country depends on the economic situation of such country and the aims of policy directions (Senn 1999). For instance, Folawewo and Osinubi (2006) see monetary policy as the combination of measures designed to regulate the value, supply and cost of money in an economy in consonance with the expected level of economic activity. In the opinion of Nzotta (2004) monetary policy is the combination of discretionary measures designed to regulate and control the money supply in an economy by the monetary authorities with a view to achieving some stated or desired macro-economic goals. By implication, any failure towards the realization of these objectives may result in policy changes. Anyawu (1993) sees monetary policy to presuppose a form of relationship between the supply and demand for money on one hand and other aggregate economic variables such as output, savings and investment and the general price level on the other hand.

The above opinions on the subject matter show a major link between monetary policy dynamics and the level of economic growth. For instance, a monetary policy expansion is always aimed at boosting economic growth while increased money supply can be controlled through contractionary monetary policy. In whatever way it is conceptualized, the influence of money remains vital such that any change in monetary policy variables is aimed at achieving and

maintaining economic growth. The need for monetary policy dynamics could therefore be necessitated by shock to any of its variables. To better understand how this works, the following section is devoted to the concept of money.

2.2.1 The Concept of Money

Opinions differ on what should be termed money within an economy at a particular point in time. Money is a liquid asset that is commonly used and accepted as a means of payment in an economy (Krugman and Obstfeld, 2006). Various categories of assets can be regarded as money, which include the currency in circulation, currency in the vaults of commercial banks, deposit and checking accounts (M1) and other near money assets as may be prescribed by the central bank of a country. Economists have equally accepted the convention that defines money in relation to the function it performs (Peter R. Senn, 1999). The level to which money and invariably money supply can enhance in the achievement of some macroeconomic objectives will determine the frequency of its dynamics.

Conventionally, the functions of money include:

- Medium of exchange
- Store of value
- Unit of account i.e. the measure of value function
- A common denominator or standard of value
- A means of deferring payments till a future date

However, these conventional functions of money exclude its function as government tool which can be used to control the reserves of deposit money banks. The importance of these reserves lies in their ability to create money within the system.

One fundamental objective of the central bank/federal reserve bank is the control of money supply in order to ensure price stability and moderate inflation level in line with the level of economic growth (Enang, 2009). In doing this, the yearly budget is usually followed by policy guidelines which state the direction of the economy and how some stated objectives are to be achieved during a particular year. However, where there is external shock or where it is conceived that the objectives are not achievable, there is always the tendency for dynamics in policy variables by the monetary authorities. For instance, inflation, which is always seen as undesirable for economic growth, has been one of the policy targets of many countries of SSA. Its damaging

effects account for why monetary theory gives absolute priority to the stability objectives and a low rate of inflation.

2.2.2 The demand for money hypothesis

This can be described as the ratio of total assets which people are willing and able to hold in the form of money rather than non-liquid assets. The desire to hold money is influenced by factors such as income, expected returns on money rather than the expected return on other assets, the risk associated with the holding of money, and the need to hold money to meet day-to-day financial commitments among others. Elaborating on the monetarists' reasons for holding money, Keynes advocated transactionary, precautionary and speculative motives for holding money which are discussed below.

1. Transactionary Motive: This according to Keynes arises from the need to meet with day-to-day financial commitments. It is the amount of money held by individuals for everyday transaction such as payments at places where only cash is acceptable. Incomes and wages come twice or once a month while expenditures are incurred daily. Money kept for this purpose is said to be a function of income. This follows that the higher the level of an individual's income the higher the amount of money kept for transactionary purpose. Invariably, this will affect the amount of money kept with banks and the quantity of money available for loans, for investment purpose and production. However, any dynamics in monetary policy that is contractionary in nature will affect the amount of money kept for this purpose and also the level of consumption will affect economic activities. Suffice to say here that this forms a small percentage of one's income nowadays as there are so many alternatives to cash such as credit cards.

2. Precautionary Motive: This is to help one meet unforeseen financial challenge. It is held to meet up with some unplanned expenses or some irregular expenditure such as bills for electricity and water whose consumptions are not static.

3. Speculative Motive: This seems to be the major contribution of the Keynesians to the motive for holding money. It is the money held to buy shares or bonds at the financial market depending on investor's expectations of future interest rates. If nominal rate of interest (r) is expected to be lower than current interest rate people will buy more bonds today thereby reducing their holding of money for speculative purpose. The logic behind this reasoning is that in the future, if their expectations come true and the price of bonds goes up, they will sell and make a profit known as "capital gains". This is usually the case because of the inverse relationship which exists between

the price of bonds and the interest rate. The lower the future rates of interest, the higher the bonds' prices. The reverse holds when the future nominal interest rates are expected to go up; bond prices will decline so that people buy bonds with their speculative cash holdings. Thus the demand for money at any particular time is a function of both current and individual's future expected nominal interest rate. In a nutshell, it is money held to play around at the stock market. Any policy change that is contractionary will therefore affect the money held for this purpose because individual consumption expenditure will reduce and consequently growth.

2.2.3 Aims of Monetary Policy

According to Peter R. Senn (1999), the aims of monetary policy are not only many but always contradictory. They include:

1. The realization of optimum sustainable economic growth.
2. Achieving improved standard of living.
3. Maintenance of price stability.
4. Achievement of low unemployment rate.
5. Ensure low or no inflation rate.
6. To achieve a stable balance of trade and payments relationship with other trading partners.

The significance of monetary policy towards achieving economic growth and development in any nation can therefore not be underestimated. Since modern day money seems to be 'fiat' in nature, its amount must be regulated in order to avoid serious economic dislocations especially the problem of hyperinflation. In most SSACs, the challenge of growth has led to dynamics in monetary policy in the last three decades.

2.3 Monetary Transmission Mechanism (MTM)

One important consensus from previous discussions is that money influences economic activities even though the channels and degree of impact may vary from country to country or region to region. Empirical and theoretical studies have shown that monetary policy does affect key nominal macroeconomic variables either in the short run or in the long run. This can equally be transmitted into the real macroeconomic objectives which include real output, employment and GDP growth (Sun 2010). Central bank's control and adjustment of interest rate, money supply or other monetary policy instruments affect target or ultimate policy objectives of monetary policy.

The monetary transmission mechanism therefore shows how monetary policy instruments exert influence on the real economy.

Traditionally speaking, the two major approaches to monetary transmission mechanisms are the credit view (which emphasis bank lending) and the money view (with interest rate as instrument) (Peter, R. Senn 1999). However, further researches have revealed six possible ways by which monetary policy transmission may affect an economy since the different kinds of money have different effects on different economies, (for instance see Mishkin, 1996; Meltzer, 1995; Kuttner and Mosser, 2002; Ford, 2003; Mies and Tapia, 2003). These channels are the bank business lending channel, the interest rate channel, the balance sheet channel, the exchange rate channel, the credit lending channel and the asset pricing channel.

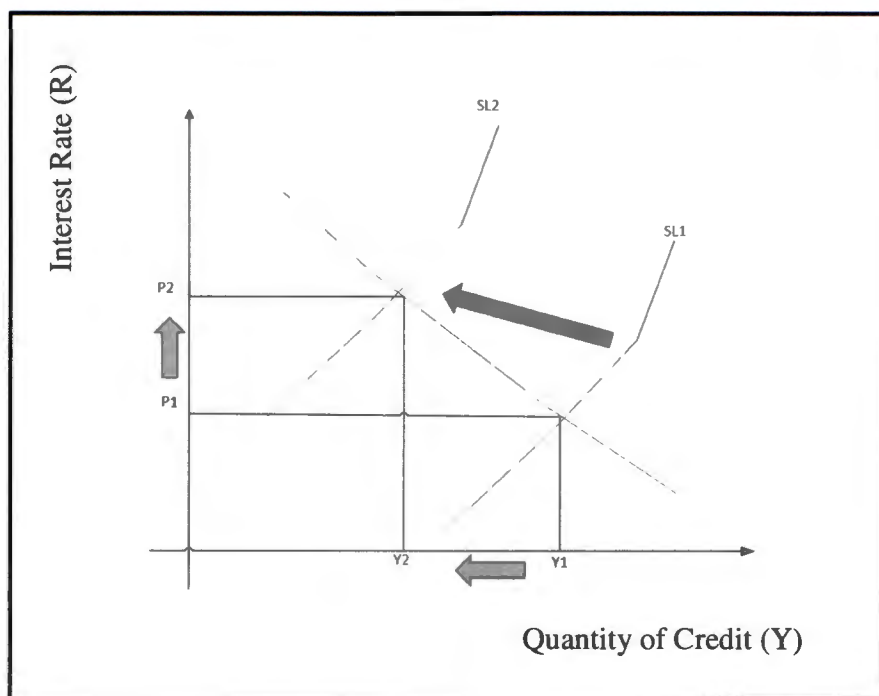
These channels explain theoretically how monetary policy variables affect growth *vis-a-vis* aggregate demand, supply of money and inflation. However, the relative importance of these channels to economic growth differs not only between regions (Fielding and Shiedds, 2005) but also from country to country as a result of the level of their developmental achievement in the area of financial markets, the economic structure and the macroeconomic environment (Dabla-Norris and Floerkemeier, 2006; Agenor and Montiel, 2007). Other factors such as exchange rate, government expenditure and oil and commodity prices have been identified as having different transmission mechanisms across countries (see Hamilton, 1988; Herrera *et al*, 2011; Eyden, *et al*. 2014; Kutu and Ngalawa, 2016; Omojolaibi and Ogunniyi, 2014).

2.3.1 Bank Business lending channel

The focus of this channel is in the way by which monetary policy affects the level of demand for credit facilities through banks and other credit-giving institutions. According to Roosa (1951) and Bernanke and Blinder (1992), it works mainly through the credit-lending role of banks. Banks are assumed to rely heavily on demand deposits as an important source of funding economic activities subject to reserve requirements of the central bank. An increase in total bank reserves with the central bank as a result of monetary policy contraction would lead to reduction in the supply of funds to the private sector which will affect economic activities and growth. When the interest rate on securities rises, banks will choose to curtail their lending and rather invest in bonds because of the high interest rate. The bank interest rate on loans will increase and borrowers will then have less access to credit for investment purposes which will subsequently affect economic activity and growth.

Economists' explanation regarding monetary policy effects was based on the assumption that bank loans and bonds are imperfect substitutes in the capital market. Thus, an increase in monetary policy instrument (e.g. a rise in interest rate) shifts the loan supply and consequently reduces the amount of credit available to make new loans. This can be explained graphically as follows:

Figure 2.1: Interest rate, Loan Supply Curve and Credit Availability Relationship



The above figure shows the relationships between changes in interest rate and the availability of credit in an economy. An increase in the rate of interest from P1 to P2 reduces the quantity of credit demanded by the public investors from Y1 to Y2 and vice versa. The implication is that to move an economy forward especially in times of economic crisis requires a reduction in the lending rate by banks. One common understanding about this channel according to scholars is that it is more pronounced in Less Developed Countries (LDCs) than in countries with established financial market. This is because the financial sector in LDCs rarely offers alternatives to firms apart from bank's finance (Shabbir, 2009).

In summary, bank deposits will fall as a result of reduction in the reserves especially if the required reserve ratio is constant or is kept upward under the condition of contractionary monetary

policy (Ford *et al.*, 2003). In a situation where this decline cannot be readily offset by decline in securities at the custody of banks, it will result in a reduction of bank loans which will in turn cause a decrease in the level of investment and thereby in total output and growth level, a situation that has led to monetary policy dynamics in many SSACs.

2.3.2 The Exchange Rate Channel

The role of exchange rate in the monetary transmission mechanism cannot be underestimated, especially in SSA. This channel links monetary policy to inflation and economic growth in two possible ways i.e. through total demand channel under the uncovered interest rate condition and interest rate differentials to expected exchange rate movements. Any policy-induced change in the domestic interest rate relative to foreign interest rate would have effect on the exchange rate which may result in balance of payment disequilibrium, (Dornbusch, 1976). The overall level of aggregate demand would therefore affect the level of economic growth.

Another route through which exchange rate effects are transmitted is the future expectation of exchange rate changes in the domestic country. This happens when nominal interest rate affects the long-term rate thereby changing expectations regarding the future exchange rates. The exchange rate mechanism under a floating condition can be expressed as follows:

An increase in m (\uparrow) causes r to decrease (\downarrow); causing e (\downarrow); causing Ne (\uparrow) and finally causing y (\uparrow).

where:

m = money supply, r = interest rate, e = exchange rate, Ne = net export, y = Output (GDP)

Any decrease in interest rate will not only result in local currency depreciation but also lead to an increase in net export and finally increase the GDP. The same objective can be achieved in a fixed exchange rate regime if monetary authority undervalues its currency. This channel's effect is bound to be much pronounced in SSACs going on the fact that they are oil and commodity producers whose prices are subject to external volatility.

2.3.3 The Interest Rate Channel

Mishkin (1996) indicates that for inflation to be controlled and growth enhanced, monetary policy is transmitted through real interest rates. It was revealed that a contractionary monetary policy will result into an increasing real rate of interest and rising rate of interest will lead to increase in cost of capital. This in turn will decrease the level of investment and consumption

spending thereby causing aggregate demand and inflation to decelerate. In the same vein, Mies and Tapia (2003) argue that a tight monetary policy will increase nominal interest rates which will translate into increasing real interest rates due to stickiness or imperfection in adjustment mechanisms of the economy. They further indicated that the cost of capital will then increase because of the decrease in the level of investment and consumption which will in turn reduce output and consequently a declining inflation.

This channel can be summarized as follows:

Decrease in M (\downarrow) causes r to increase (\uparrow); causing I to decrease (\downarrow); causing Y to decrease (\downarrow).

Where: M = contractionary monetary policy, r = real interest rate (as against nominal interest rate), I = Investment Spending, Y = Output.

The interpretation of the above analysis is that when there is an expansion in money supply M (\uparrow), expected price level P_e will increase (\uparrow) so also will the expected inflation rate rises ($\pi_e \uparrow$) and this will cause decrease in real rate of interest ($r \downarrow = I - \pi_e$). This will eventually stimulate investment and raises output.

In order for this channel to stimulate economic growth in SSACs, the dynamics in policy should be more expansionary rather than contractionary. An expansionary monetary policy will result into decreasing real interest rate which will cause the cost of capital to fall and ultimately increase aggregate demand and output.

2.3.4 The Balance Sheet Channel

Bernanke and Gertler (1989) developed this channel and it operates through the net worth of a customer or a business firm as the case may be. The underlining assumption is that interest rate charged to borrowers is a function of the borrower's financial status. A change in the financial position of the borrower will affect the quality of the borrower's balance sheet as the case may be and consequently on investment and spending decision. A borrower will be charged less interest rate premium if he has more liquid assets and profitable security to use as collateral back-up. For example, any contractionary policy is expected to cause a reduction in equity prices (which is less liquid) or reduce cash flow and lower the net worth of business firms. This will be so because of the problem of moral hazard and adverse selection which will then reduce investment and consumption lending. These problems will in turn decrease lending to financing investment and consumption. Any change in terms of high interest rate will reduce the prices of financial assets which will invariably weaken the value of the borrower's collateral. This in turn will lower the

financial position of the borrower which means higher interest rate premium should be charged and this will increase the costs of borrowing. Higher costs of borrowing will discourage investment with its attendant decline in aggregate demand and inflation rate (Bernanke and Gertler, 1995). They further show that a monetary policy innovation can affect the balance sheet directly and indirectly.

From the indirect perspective, a contractionary monetary policy makes it expensive for consumers to purchase goods on credit. This will happen because any increase in policy rate is transmitted to other market interest rates which will also increase the cost of loan-able funds. As a result, the incentive to invest is reduced thereby curtailing the levels of investment. Output growth will decline with dampening inflation condition.

In summary according to Mishkin (2001), monetary policy expansion can have a balance sheet effect as follows:

An increase in monetary policy expansion (**M**) will cause equity prices (**e P**) to rise, this will raise the net worth of business firms and consequently increase investment spending (**I**) and output (**Y**). This is as a result of the decline in adverse selection and moral hazard problems.

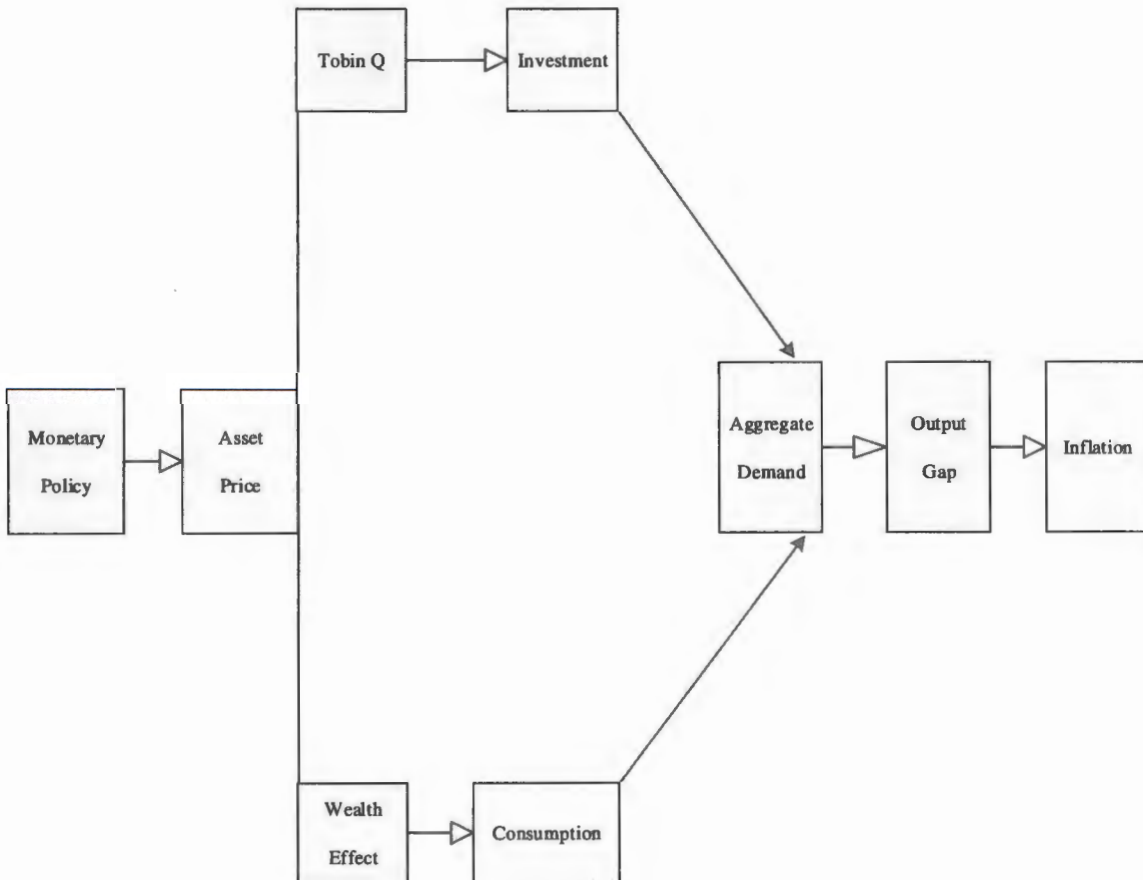
Schematically, it can be expressed as follows:

M (↑) → **e P** (↑) → adverse and moral hazard (↓) → **I** and **Y** (↑)

2.3.5 The Asset Prices Channel

Kganetsano (2007) pointed out that the monetarists' emphasized two routes through which monetary policy can affect an economy under the asset prices. These are the Tobin q route and the wealth effect route. For ease of exposition, it can be shown diagrammatically as follows:

Figure 2.2: Tobin Q and Wealth Effects



Tobin’s q Hypothesis

This hypothesis is defined as the fraction of market value of an enterprise and the market value of capital as follows:

$$q = \frac{MVe}{MV_c} \dots\dots\dots (2.1)$$

The MVe of an enterprise is given as the capitalized earnings value i.e.

$$MVe = \sum_{t=1}^n (rt - et) \frac{1}{(1-i)^t} \dots\dots\dots (2.2)$$

Where $rt - et$ is the expected surplus of receipts rt over expenditure et . i is the market interest rate.

Under the condition of expansionary monetary policy, more money will be available in the hands of the public thereby increasing their spending on stocks which will consequently cause share prices to rise. As pointed out by Mishkin (2001), higher stock prices (**P**) will cause (**q**) to increase and lead to higher investment expenditure (**I**) and growth. Since the market value of an enterprise can be calculated by the share prices, monetary policy can have effects on a firm's investment through the stock markets.

This can be schematically represented as follows:

$$\mathbf{M} (\uparrow) \rightarrow \mathbf{P} (\uparrow) \rightarrow \mathbf{q} (\uparrow) \mathbf{I} (\uparrow) \rightarrow \mathbf{Y} (\uparrow)$$

Wealth effects

The wealth effect of the monetary transmission mechanism was developed by Franco Modigliani (1971). Under the life time resources of consumers, their consumption is expected to be smoothed out over time such that the rise in the consumption arising from the increase in the value of their financial wealth will increase because of the rise in stock prices. Thus, the expansionary monetary policy will lead to a rise in prices of stock through the wealth effect channel so that the final output will be stimulated.

Again, this process can be schematically represented as follows:

$$\mathbf{M} (\uparrow) \rightarrow \mathbf{Pe} (\uparrow) \rightarrow \mathbf{wealth\ and\ consumption} (\uparrow) \rightarrow \mathbf{Y} (\uparrow)$$

Where **M** is the expansionary monetary policy, **Pe** is market stock price and **Y** represents the output.

Evidence of this channel has been established mainly in countries where the financial markets are well developed. As explained by Al-Mashat and Billmeier (2007), the assessment of this channel will need a good measure of asset prices. Therefore, due to the lack of good quality data and a less developed financial system in SSA, this channel may not be very effective.

2.3.6 The Credit Lending Channel

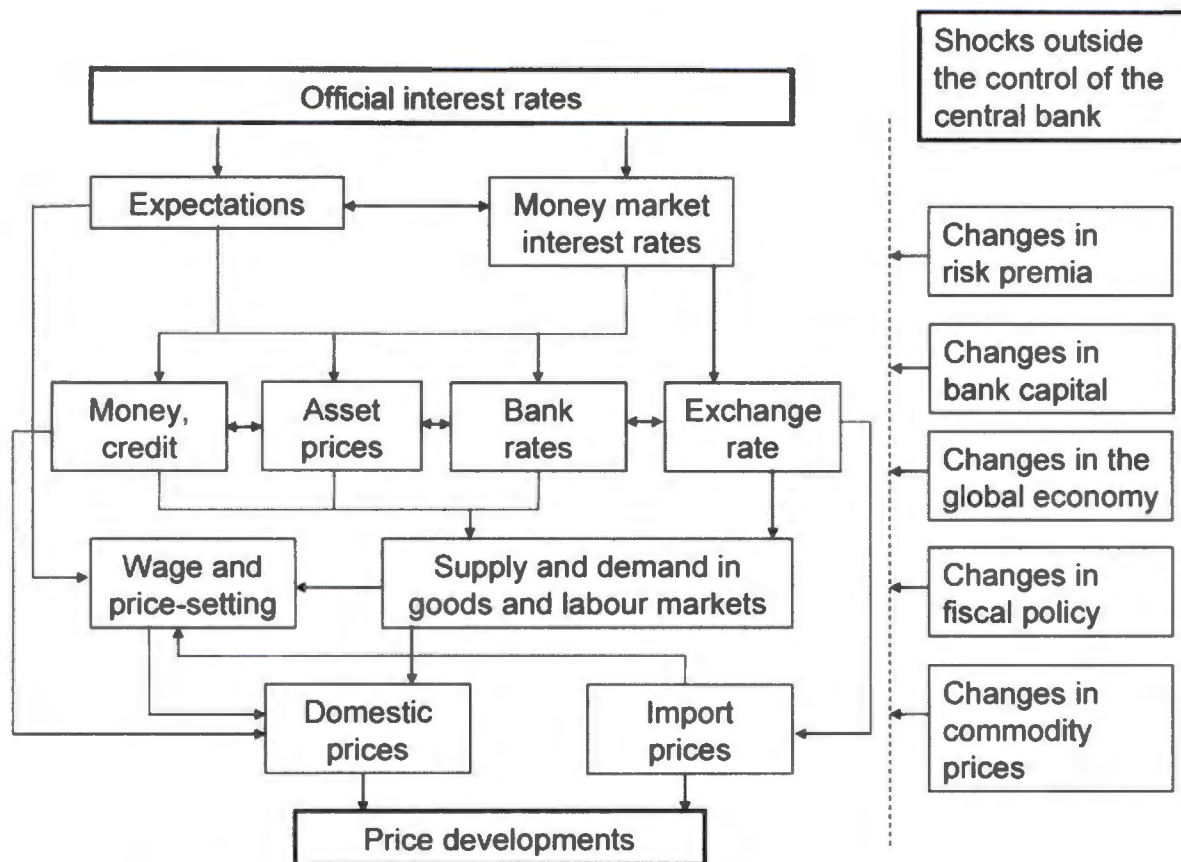
Some economists have argued that this channel of policy transmission mechanism is a subset of the interest channel because the effect of credit on the economy is through interest rate indirectly. Yet others believe that the inconsistency of this channel makes it a lesser issue. In the words of Bernanke and Getler (1995), this is so because the interest charged to any borrower depends on the borrower's financial status. For certain categories of borrowers, especially small firms, bank credit seems to be the only source of finance. Any disruption in the supply of bank loans will make borrowers who depend heavily on bank borrowings incur costs that are usually

associated with looking for new lenders. Therefore contractionary monetary policy that reduces bank deposits and even reserves will reduce the availability of bank loans (Saxegaad 2006). Since small businesses and the households rely mainly on bank finances, any reduction in the loans would lower investment and consumption and the degree of aggregate spending which hinders growth. The issue in moral hazard and adverse selection asymmetric information problem also comes in under the credit channel, (Bernanke and Gertler, 1989).

2.3.7 New developments in monetary policy transmission mechanism

Based on the empirical literature, most of the traditional approaches to MTM have been found to be obsolete. A new mechanism approach which comprises of wider variables in the mechanism has therefore evolved. The transmission mechanism is characterized by long, variable and uncertain time lags. Thus it is difficult to predict the precise effect of monetary policy actions on an economy and price level.

The chart below provides a schematic illustration of the main transmission channels of monetary policy decisions based on the new development:



The major key channels according to the new MTM are as follows:

Interest rates dynamics

The central/reserve bank provides funds to the banking system and charges interest. Given its monopoly power over the issuing of money, the central bank can fully determine this interest rate and manipulate it or change it, depending on the prevailing economic demand.

Affects banks and money-market interest rates

The changes in the official interest rates affect directly money-market interest rates and, indirectly, lending and deposit rates, which are set by banks to their customers.

Affects expectations

Expectations of future official interest-rate changes affect medium and long-term interest rates. In particular, long-term interest rates depend in part on market expectations about the future course of short-term rates. Monetary policy can also guide economic agents' expectations of future inflation and thus influence price developments. A central bank with a high degree of credibility

firmly anchors expectations of price stability. In this case, economic agents do not have to increase their prices for fear of higher inflation or reduce them for fear of deflation.

Affects asset prices

The impact on financing conditions in the economy and on market expectation triggered by monetary policy actions may lead to adjustments in asset prices (e.g. stock market prices) and the exchange rate. Changes in the exchange rate can affect inflation directly, insofar as imported goods are directly used in consumption, but they may also work through other channels.

Affects savings and investment decisions

Changes in interest rates affect saving and investment decisions of households and firms. For example, *ceteri paribus*, higher interest rates make it less attractive to take out loans for financing consumption or investment. In addition, consumption and investment are also affected by movements in asset prices via wealth effects and effects on the value of collateral. For example, as equity prices rise, share-owning households become wealthier and may choose to increase their consumption. Conversely, when equity prices fall, households may reduce consumption. Asset prices can also have impact on aggregate demand via the value of collateral that allows borrowers to get more loans and/or to reduce the risk premia demanded by lenders/banks.

Affects the supply of credit

For example, higher interest rates increase the risk of borrowers being unable to pay back their loans. Banks may cut back on the amount of funds they lend to households and firms. This may also reduce the consumption and investment by households and firms respectively.

Leads to changes in aggregate demand and prices

Changes in consumption and investment will change the level of domestic demand for goods and services relative to domestic supply. When demand exceeds supply, upward price pressure is likely to occur. In addition, changes in aggregate demand may translate into tighter or looser conditions in labour and intermediate product markets. This in turn can affect price and wage-setting in the respective market.

Affects the supply of bank loans

Changes in policy rates can affect banks' marginal cost for obtaining external finance differently, depending on the level of a bank's own resources, or bank capital. This channel is particularly relevant in bad times such as a financial crisis, when capital is scarcer and banks find it more difficult to raise capital. In addition to the traditional bank lending channel, which focuses

on the quantity of loans supplied, a risk-taking channel may exist when banks' incentive to bear risk related to the provision of loans is affected. The risk-taking channel is thought to operate mainly via two mechanisms. First, low interest rates boost asset and collateral values. This, in conjunction with the belief that the increase in asset values is sustainable, leads both borrowers and banks to accept higher risks. Second, low interest rates make riskier assets more attractive, as agents search for higher yields. In the case of banks, these two effects usually translate into a softening of credit standards, which can lead to an excessive increase in loan supply.

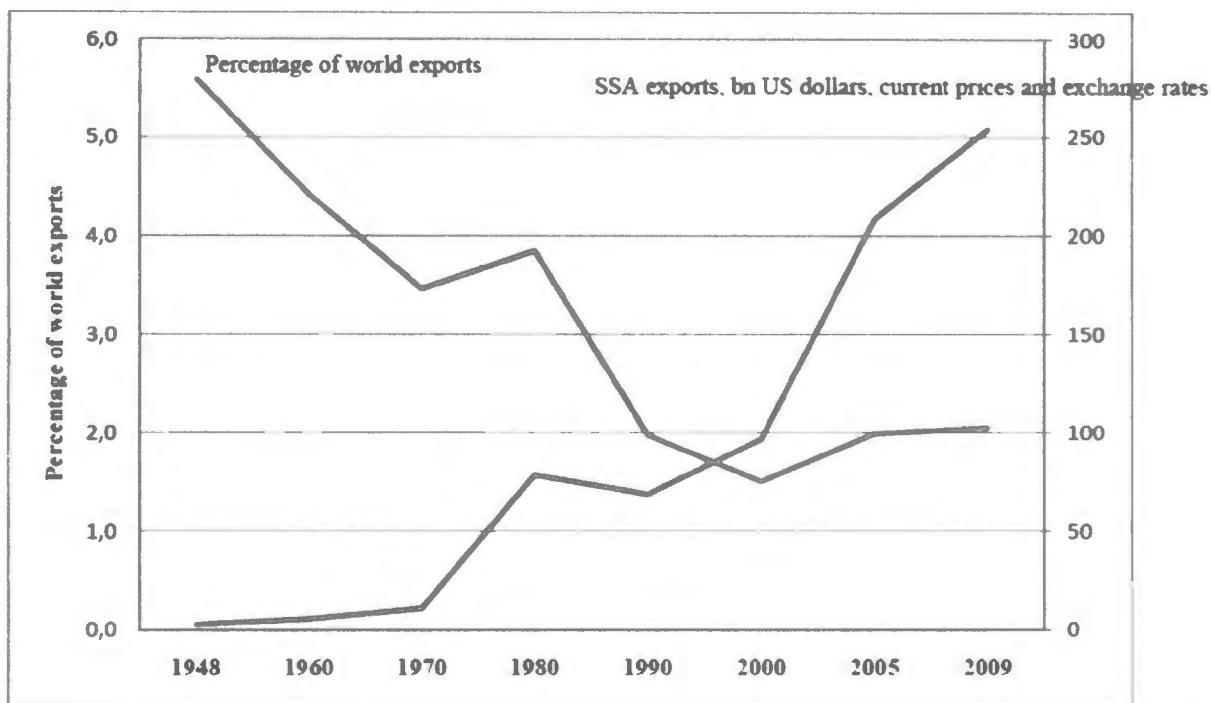
2.4 Monetary policy and growth: Sub-Saharan African Experience

This section presents some facts about the economic performance of SSA using the aggregate statistics provided by AfDB and IMF. A closer look at the economic fortune of the region even long before their independence shows that the region has been under marginalization compared with other less developed or developing regions.

2.4.1 Trends in economic performance of SSA

Historically, the dynamics in the economic fortunes of Sub-Saharan Africa (SSA) recorded little or no appreciable development in the early 1960s to 1980s compared with other developing world regions. A calculation by Subramanian and Malthijs (2007) shows the share of Africa in world export declining from above 7% in 1948 to less than 2% in the year 2004 in spite of the increase in trade orientation. The 2007 and 2009 Handbooks of Statistics of the United Nations Conference on Trade and Development (UNCTAD) recorded a decrease of 3.9%, 2.0% and 1.5% in the share of SSACs for 1980, 1990 and 2000 respectively. The figure below shows SSACs' percentage of world exports for 1948-2009

Figure 2.3: SSA Exports as percentages of World exports and Value for 1948-2009



Source: UNCTAD Statistics: <http://unctadstat.unctad.org>

The reason for the decline was attributed to the slow growth of exports compared with world exports. For UNCTAD, the reason given for the slow pace of SSACs in world trade was given as the secular reduction in their trading terms. The figure above revealed that developmental failure as against export failures is the major issue in SSA. For the period 1960s to 1980s, statistics show the average annual per capita growth in income of SSA to be 1.3% as against 2.5% globally. It becomes more disappointing with a -0.6% reduction in annual growth rate if compared with world growth rate of 2.7% recorded between 1980 and 2000. The deteriorating economic performance of the region was attributed to high real interest rates, severe reduction in commodity prices, decreasing net capital flows and incessant recession (IMF 2010) among others. In addition, Ncube (2007) further attributed poor economic and monetary policies and geographical disadvantages to have a negative effect on the economic growth of SSA.

During the years leading to the 2007-2009 global economic crisis however, the economies of the region performed creditably with real GDP growth rate between 2004-2008 recording 6.5 percent and a fall in average inflation to 8.3 percent, (ECB, 2007). Effective from late 1990, commodity prices for most of the countries in Western and Central Africa followed an upward trend with metal and crude oil prices showing the most pronounced appreciation. Gross Domestic Product of net oil exports expanded by 6.2 percent annually between 1999 and 2005. Members of

the CFA Franc Zone grew by 6.7 percent per annum GDP with output in the West African Economic and Monetary Union (WAEMU) growing at a rate of 3.2 percent annually. The Central African Economic and Monetary Union (CAEMU), which comprises five of the region's oil exporters, recorded a rise of 9.6 percent per year (IMF, 2010).

However, the global economic crisis caused reductions in the real Gross Domestic Products of SSACs. The table below shows the average GDP growth rates between 2005 and 2015:

Table 2.1: Rates of Gross Domestic Products per Capita for 2005-2015

| Country by Country Group | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Sub-Saharan Africa | 6.3 | 6.4 | 7.0 | 5.6 | 2.6 | 5.6 | 5.5 | 4.9 | 4.9 | 5.1 | 3.4 |
| O E C | 7.6 | 7.4 | 9.2 | 7.0 | 4.8 | 6.7 | 6.1 | 5.2 | 5.7 | 5.9 | 2.6 |
| M I C | 4.9 | 5.6 | 5.5 | 3.7 | -0.8 | 4.1 | 4.9 | 3.4 | 2.7 | 4.6 | 2.6 |
| L I C | 7.4 | 7.3 | 7.2 | 6.9 | 5.1 | 7.0 | 6.5 | 6.2 | 6.8 | 7.2 | 7.2 |

Source: IMF, World Economic Outlook database 2015

From the table above, the GDP of SSA per capita (units in US\$) reduced from 7.0 percent in 2007 to 5.5 percent in 2011 and 4.9 percent in 2013. With a slight improvement in 2014, it reduced drastically to 3.4 in 2015. A further look at the table reveals that the GDP of oil exporting countries was on the decline, with 2015 experiencing the worst at 2.6%. The resultant decline in the GDP of SSA arising from the global economic crisis endangers the effectiveness of monetary variables in time of shock. One can therefore ask whether monetary policy should be eased to stimulate output. Or should monetary targeting be replaced with inflation targeting in some SSACs, or a hybrid of both?

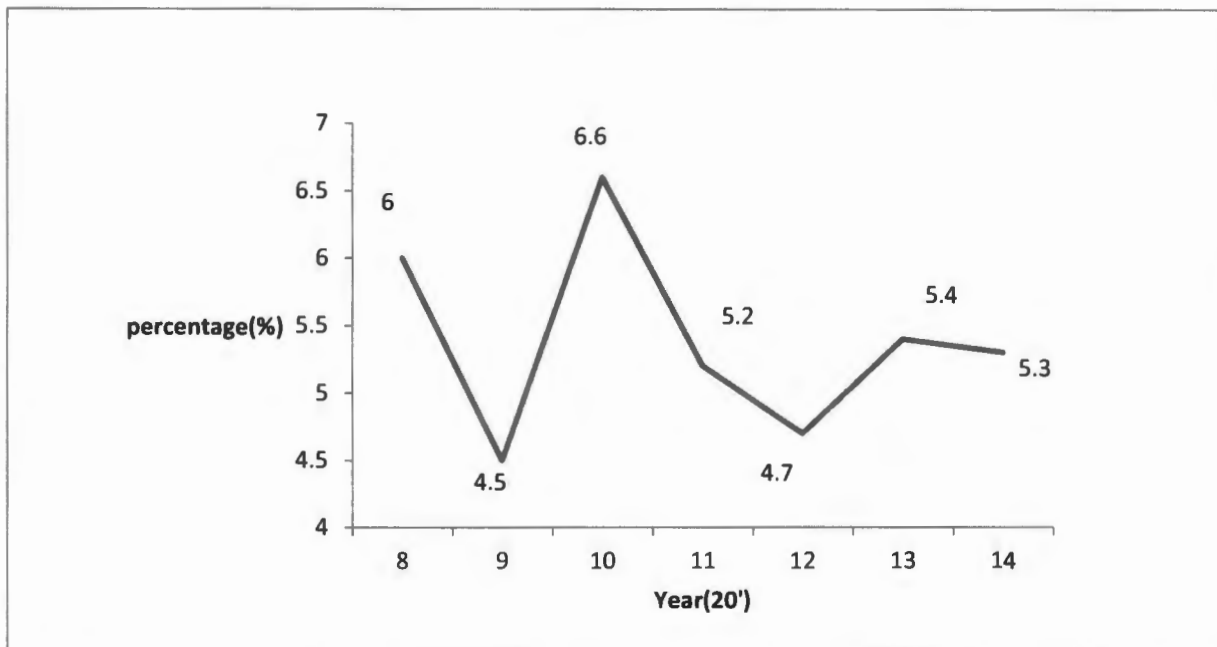
Furthermore, available statistics on inflation rate in the region showed a push from 8.8 percent in 2005 to 10.4 percent in 2009 as a result of the global fuel and price shocks. The demand for the region's export of goods and services was drastically reduced thereby affecting the net

inflows of private capital and remittances. For instance, exports fell by 4.6 percentage points in 2009 compared to the average for the period 2004-2008. This fall in demand for their products reduced GDP growth between 2005 and 2008 to 4 percentage points lower. All these led to the dynamics in monetary policy formulation and implementation within the region with the aim of reducing these challenges.

However, most affected by the crisis are the exporters of oil and the middle income nations (IMF, 2010). The oil exporters are less resilient to oil price shock than many other oil-exporting countries. This is because of their much more limited policy buffers. For example in Nigeria, which is the largest oil producer in SSA, Gross International reserves fell 20 percent to \$34.25b (6% of GDP) as a result of the draw-down by the central bank to support the Naira. The sharp depreciation of currency and losses in foreign reserves prompted adjustments in monetary and exchange rate policies. With oil prices declining in 2014, the Nigerian Naira further depreciated against the US\$ unabated. Just between June 2014 and February 2015, the Naira recorded a depreciation of more than 20 percent. As of early February 2017, it is quite disappointing that Nigerian Naira was being exchanged at N500/\$ on the black market. This prompted the central bank to end the managed float exchange rate regime and closed down the Dutch Auction System window. In March 2015, Standard and Poor ratings relegated Nigeria's credit status from B+ to BB- (World Bank, 2015). This shock take its toll on household incomes thereby reducing private consumption demand.

In Angola, the second largest oil producer and the third largest economy in SSA, the parliament approved a 25 percent cut in spending from the original budget expenditure for the year 2015.

Figure 2.4: Real GDP for SSACs for 2008-2014



Source: World Economic Outlook, 2015

The above figure shows the real GDP growth rate between 2008 and 2015. It shows the great shocks that hit most of the region’s largest economies especially the oil producing areas with the decline in their products’ prices. Although the impact of the shock may be felt across the region, it will pose a great challenge for the eight oil producers since they have limited buffers (ECB, 2015). They will therefore be required to formulate and implement some significant policy measures.

In summary, SSA countries are still being affected by some idiosyncratic factors which have nothing to do with any global financial or economic crisis but yet will still have a strong influence in most of these countries. Examples of these, according to Kasekende and Brownbridge (2011), are decline in oil production, labour strikes, shortage in rainfall, political instability etc. In addition, Week (2010), IMF (2015) and Ncube (2007) opined that the region suffers from certain unfavourable characteristics which include-wide spread dynamics in interest rates, inadequate financial innovation and products, a weak legal system, market fragmentation and poor institutional environments.

2.5 Monetary policy frameworks in SSACs

The framework of monetary policy refers to the various institutional settings by which monetary policy is formulated and the associated bottleneck under which monetary policy implementers operate (Adam, 2008). It is concerned with institutional arrangements where monetary policy decisions are formulated and implemented bearing in mind the influence of law and customs of the land (Merwe *et al.*, 2004). According to them, seven major steps are important in the designation of monetary policy framework. These are:

1. The goals and objectives of monetary policy. This was said to be the first step in the framework formulation. The goals are expected to be stated in clear terms such that the public will understand what monetary authorities aim at achieving.
2. The broad philosophy to be adopted by the authorities in the pursuit of targets or goals. For instance, should policy objectives be achieved through market oriented instruments or should the authority employ direct control measures.
3. The next step is to decide the best instrument or operational variables to be adopted in the conduct of monetary policy. These instruments include the official interest rates, direct control over the assets and liabilities of banks, the reserve requirement etc.
4. The above is followed by the type of monetary policy regime to apply. To a greater extent, this depends on the ultimate policy objectives and the economic and financial structure of the country.
5. Next is to choose either instrument rules or indicators or a hybrid of the two.
6. The next step is to decide the type of tools or operational procedures to apply for the objectives to be achieved. These can take the form of direct instruments which include interest rate ceiling, credit controls and indirect instruments of reserve requirement, open market operation and rediscount facilities.
7. Lastly, a decision must be made on the accountability, autonomy and transparency of central banks i.e. the institutional arrangement under which the central bank is to operate.

Despite taking the above into consideration in the formulation of monetary policy by SSACs, some peculiar idiosyncratic challenges confronting the region still account for periodic dynamics in policy variables.

2.5.1 Types of policy framework in SSACs

Four major types of policy targeting can be established in the literature (Merwe *et al.*, 2004). These are inflation targeting, monetary targeting, exchange rate targeting and nominal income targeting. However, monetary policy framework in SSACs can take the form of monetary policy targeting, inflation targeting and a hybrid of the two.

Inflation Targeting: Bernanke *et al.* (1999) describe the general idea behind inflation targeting as “a framework for monetary policy characterized by the public announcement of official quantitative targets for inflation rate over one or more time horizons and by explicit acknowledgement that low, stable inflation is monetary policy’s primary long-term goal”. Apart from the above, other characteristics of inflation targeting include those geared towards communicating with the public on the plans and aims of monetary authorities as well as the channels needed to enhance central bank accountability for the attainment of these objectives. While Sweden adopted some principles of inflation targeting in the mid-1930s, with New Zealand following in 1989, inflation targeting became a major monetary policy in the early 2000s. Apart from South Africa and Ghana, who are well known for practicing this type of inflation, Uganda joined in July 2011 to become the third country implementing inflation targeting monetary policy in SSA (Davoodi *et al.* 2013).

Monetary Targeting: This is based on the idea of monetary economists such as Milton Friedman. Their main argument is that for inflation to be kept under control and for the potential growth in real GDP to be realizable, there is the need to control the amount of money in circulation. It can be explained as follows using the demand for money theory.

$MV = PT$ where **M** stands for money supply, **V** stands for the velocity of circulation in money, **P** is the price level and **T** is nominal gross domestic product.

The target for growth is given as:

$$m = \eta^* + t^* - v^{\text{trend}} \dots\dots\dots (2.3)$$

Where *m* stands for growth rate target in money supply, η^* stands for desired inflation rate, t^* stands for growth rate of potential real GDP and v^{trend} is the increase in the trend value of the velocity of circulation of money. The dynamics in this policy variable therefore depend on the targeted growth rate.

Exchange Rate Targeting: Exchange rate targeting is common to countries that do not have an independent currency. This can take two major forms either an arrangement which involves the

formation of monetary unions such that the same currency circulates within the geographical boundaries of member states, or where another country's currency serves as legal tender in its country. This arrangement is usually referred to as dollarization, even though the dollar may not be the only currency being used as legal tender. A good example is the monetary arrangement between South Africa and the so called LSN (Lesotho, Swaziland and Namibia) countries. Other countries that have adopted this system include El Salvador and Ecuador in Southern America.

Nominal Income Targeting: The setting of price stability in the long term as a goal as well as stable nominal income in the short term is the ultimate aims under this hypothesis. It is the ultimate goal under this system to set price stability as a long term goal, and a stable nominal income as the short term goal. Economists such as Robert Hall, John Taylor, James Tobin and Charles Bean have come out to support the use of targets for rate of growth in the nominal GDP. Contextually, the concept might appear seems attractive for it takes into consideration the shock that may arise from demand and supply but the implementation of such a dual target may be a herculean task to accomplish. Not only could that, adopting nominal income targeting neutralizes one major advantage of inflation targeting, which is the maintenance of a low inflation rate. There is therefore the likelihood that a nominal income targeting economy will attract higher cost if a low inflation rate is to be achieved.

In the 1990s, most of the SSA countries adopted what is called the exchange rate based monetary policy as a way of bringing down the prevailing double digit inflation. The Republic of South Africa, Ghana and Mauritius are well known for the use of inflation targeting while Kenya combines elements of both monetary targeting and inflation targeting. In 2011 however, the Ugandan Central Bank changed to 'inflation targeting lite'.

One other interesting issue about the SSA approach to monetary policy management after the 2007-2009 global economic crises is the dynamics in some monetary policy stances within the region. For example, in 2011, the Central Banks of Kenya, Rwanda, Tanzania and Uganda operated a tight monetary policy. The impact of this was noticed more in Rwanda where tighter monetary policy that led to stable exchange rate kept inflation from taking off during this period (IMF, 2015).

2.6 Scope of monetary unions in SSACS

The Abuja Treaty of 1991 which established the African Economic Community (AEC) still remains a force to be reckoned with in the literature. As a treaty meant to achieve an integrated economic and monetary zone for Africa, the process is expected to be completed by the year 2028. For the objectives of the treaty to be realized therefore, regional integration of economic activities was seen as playing a vital role. Consequently, the various monetary and economic blocs in SSA are considered below.

2.6.1 The West African Monetary Zone of Economic Community of West Africa

There are two major groups of countries that constitute the Economic Community of West African States. These are the West Africa Economic Monetary Union (WAEMU) and the West Africa Monetary Zone (WAMZ). The WAMZ members are the countries that propose the idea of regional monetary union while WAEMU – the Union Economique et Monetaire ouest-Africaine (UEMOA) comprises other countries within the region which include Togo, Mali, Cote d’Ivoire, Senegal, Benin Republic, Guinea-Bissau and Burkina Faso. These Franco Phone West African countries that are using the same currency (i.e. CFA franc) were to serve as the baseline for the establishment of the West African Monetary Zone (WAMZ). Other non-West African Economic and Monetary Union countries of Gambia, Nigeria, Guinea, Sierra Leone and Ghana were expected to merge with WAEMU members to form a common currency region in the Economic Community of West African States (ECOWAS). One uniform currency in the region was expected to confer the advantage of transaction cost saving from intra-regional trade (Debrun, 2010). Not only that, Tsangarides *et al.* (2008) observed that monetary unions have the potential of creating trade within the member states.

Although the take-off dates for the single currency in WAMZ had been postponed thrice (2003, 2007, 2009), the inherent benefits of having an ECOWAS currency abound (Debrun, 2010).

2.6.2 The East African Community

The founding members of the East African Community (EAC), which comprise Kenya, Tanzania and Uganda, signed the treaty in 1999 but it was formally launched in the year 2000. The treaty provides for, among other things, the establishment of a customs union, a monetary union, a common market and ultimately a political federation. The customs union was launched in 2005 with the hope of becoming operational in 2010. In 2007 Burundi and Rwanda joined the

EAC. In 2009, the procedure for the establishment of a common market that will lead to free movement of goods and services, labour and capital was signed by heads of government of member states.

Although it may appear too early to assess the successes of the monetary union, their custom union seems not to have contributed sufficiently to intra-regional trade activities. During the anniversary of its first decade of existence, the EAC secretariat was commissioned. In 2010, the documentation for the preparation of a monetary union, which includes the institutional framework, the legal and monetary union structures and the mechanism for monitoring and enforcing of the macroeconomic convergence and protocol for negotiation, were considered. All these call for the formulation of monetary policy measures that can aid the achievement of regional economic growth.

2.6.3 The Southern Africa Development Community (SADC)

One *de facto* currency has been dominating in Southern Africa for many years. The Regional Initiative Strategic Development Plan (RISDP) adopted in 2003 by the SADC was aimed among other things at achieving a deep regional integration and the creation of a free trade area by the year 2008. Not only that, the plan was to achieve a single currency for member countries by 2018. Although there seems to be little progress towards the establishment of a common monetary union for this region, there are some indications that this goal remains a high priority of member countries (Debrun *et al.* 2010).

In this study however, the countries of interest are Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe.

2.6.4 Central Africa Economic and Monetary Community (CEMAC)

The genesis of today's CEMAC can be traced to 1964 when the then Union Douanière des Etats d'Afrique Centrale was established. In 1994 however, it was changed to CEMAC as a result of reforms aiming at not only harmonizing indirect forms of taxation but also to create a common external tariff for the zone. Five of the six countries in this community are net oil exporters. Apart from the Central African Republic, Cameroon, Chad, Equatorial Guinea, the Republic of the Congo and Gabon are net oil exporters. These countries have their exchange rates pegged to the euro which has greatly helped in stabilizing and moderating inflation within the region.

As reported by the IMF (2013), the political insecurity in the Central Africa Republic caused a sharp reduction in the GDP of the region. Apart from this, the protracted fall in the oil and commodity prices arising from the global economic mess is another threat to the economic growth of the region. The projected fall in the non-oil primary deficit of the region was put at 25.8% in 2013 to 14.8% by the year 2018. The current account deficit of the region is also expected to deteriorate by between 2-4% of the GDP within the same period. An increased momentum of monetary policy reform is therefore recommended for the developmental efforts of the region.

In conclusion, regional monetary integration remains an important agenda for SSA countries. Consequently, the formulation and implementation of a vibrant monetary policy is seen as a *sine qua non* for the successful take off in each of the regional blocs identified above. As rightly put by Debrun *et al.* (2010), the expected gains stemming from enhanced monetary union stability in SSA will off-set any perceived disadvantages.

2.7 Summary

This chapter opened with the concept of money in order to understand its connection with the identified variables of interest. Monetary transmission mechanisms such as credit channel, bank lending channel, exchange rate channel as related to monetary policy dynamics in SSACs were also discussed while the various types of monetary policy framework-cum-monetary unions in SSA concluded this chapter. Consequently, this chapter focused primarily on the importance of money in economic activities such that its excess or inadequacy could mar or boost economic growth of a nation. This accounts for frequent changes in monetary policy especially when targets are perceived not to be achievable.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

Many factors have been established in the literature to affect the growth of an economy but money supply, inflation rate, interest rate and exchange rate are the most prominent focuses of policy makers and academic researchers. The recent shocks in the prices of oil and commodities have raised a lot of concern both theoretical and empirical about the potency of monetary policy despite its dynamics, especially in less developed and developing countries such as SSA (Altar, 2003; Kasekende and Brownbridge, 2010; Weeks, 2010; Khan, 2010; IMF 2010). This has led to agitations among policy makers and academia for renewed policy formulation and implementation with the ultimate goal of forestalling future economic crises. In the words of Papademos (2003), for a better understanding of the nexus between monetary policy and economic growth, there is the need for an in-depth knowledge of the theories underpinning the two economic concepts. This theoretical explanation, according to Nick (2009), could partly be traced to the 1960s when it was affirmed that changes in the growth of money will only affect inflation in the long run without affecting other monetary policy variables. It is therefore crucial to take a review of existing relevant literature if one is to understand the dynamics in monetary policy and economic growth, most especially in SSACs.

Consequently, in this section, there is a brief review of some relevant theories of money and growth before existing empirical literature in relation to monetary policy–growth nexus is discussed with special focus on SSA. For the sake of exposition, the review will be divided into two broad sections. The following section, 3.2, contains a review of money and growth theories while section 3.3 contains the empirical literature on monetary policy and economic growth with evidence from SSA and developed countries.

3.2 Relevant Theoretical Issues

In their modification of the classicalists' quantity theory of money, the Keynes' asserted that supply of money will have indirect effect on real GDP through the transmission mechanism process. While corroborating the opinions of the Keynesians on the effectiveness of expansionary

monetary policy in the long run, they lend support to the classicalists that increasing money supply will cause rising inflation only. A policy that will account for increased real GDP without changes in price level was therefore advocated for (Lan Lord, 2008). Most of the modern economists are of the view that growth (especially in the long run) is a function of enhanced productivity. To them, a well formulated monetary policy supplemented by necessary required interest rates, adequate liquidity, robust demand coupled with soft assistance from World Bank financial institutions and debt rescheduling will ensure long term economic growth (Laurence, 2001; Russell, 2010; Economy Watch, 2011).

Although there are other sub schools of thought on the influence of money and invariably monetary policy dynamics on economies, they are grouped under two major theories in this study.

3.2.1 The Classical Monetary Theory

The belief of the classicalists is that if efforts are geared towards price stability and the elimination of inflation, an economy will automatically move towards full employment. This theory links inflation and economic growth with the total available money in an economy. As opined by Friedman, inflation will result if increase in the supply of money or the velocity of money in circulation is greater than the growth rate of an economy (Fischer, 1993; Vinayagathasman, 2013). With this, one can assume a positive relationship between growth and some level of inflation. For the desired objective to be achieved therefore, any dynamics in this policy instrument must be in line with the growth rate of inflation.

Two major approaches to this theory have been recognized in the literature. The first is the equation of exchange and the second is the cash balance equation. Each of these approaches has two versions namely the transaction’s version and the income version.

1. **Equation of Exchange:** It was credited to an American author, Irving Fischer. He said that the transaction equation is a truism in a real sense, a truism in the sense that a dollar spent is equal to a dollar received. In other words, an amount bought is equal to an amount received.

(a) The transaction version was explained through the exchange equation as follows:

$$MV = PT \dots\dots\dots (3.1)$$

Where:

M = average money supply during a period

V = number of times per period that dollar is spent (transaction velocity)

P = the price per unit for everything sold.

T = the number of items sold (transaction)

(b) Income version:

This is expressed as:

$$MV_y = P_yQ$$

Where:

M = average money supply.

V_y = number of times that dollar is spent on newly produced goods and services.

P_y = average unit price for newly produced goods and services.

Q = number of items of newly produced goods sold.

2. The Cash Balance Equation: This was credited to the Cambridge University economists.

They reached similar conclusions which led to the equation of exchange, but with a small difference. The cash balance has two facets as well, which are the transaction and income versions.

(a) The transaction version has the equation:

$$M = kPT$$

Where:

M = Money supply over a period

P = the price per unit of transaction

T = the total unit of transaction

k = the proportion of the total value of total transaction held as balance which can be called the transaction demand for money. k is also the reciprocal of V since $k = M/PT$ or $1/V$

(b) The income version:

$$M = kP_yQ$$

M is similarly money supply in a period.

kP_y is the proportion of the value of newly produced goods that is held as money balance.

Q is the newly produced goods.

3.2.2 Keynesian Theory

The starting point of the Keynesians is by rejecting the notion that an economy is self-regulating. When an economy is at the barter stage, every supply will create its own demand. In other words, if I have a yam, I cannot dispose of my yam without demanding another person's

commodity or service. The simultaneity of supply and demand is therefore, an automatic mechanism that restores equilibrium in a barter system and ensures that supply and demand do not lag behind each other.

However, when an economy moves away from barter, the supplier is no longer be preoccupied with finding someone with whom he can exchange commodities on barter terms. He will only need to convert his supply into money and keep the money for later use. In other words, he does not need to spend the money immediately and when spending it, he does not need to buy goods and services from the same person to whom he sold his own. Supply and demand decisions therefore become disjointed and independent not only as to time but also as to persons. This will disrupt the quantity theory of money which does not create room for savings or time lag in between earning income and spending. Accordingly, the quantity theory stipulates that when people earn money, they will behave as if that money will punch a hole in their pockets and therefore, spend it immediately.

Keynes observed also that the invisible hand or the automatic mechanisms for adjustments which the classical economists postulate as agent for ensuring automatic equilibrium, is not real. When stocks are unsold, productive resources are left unutilized and because of the uncertainty, investment will slow down, leading to unemployment. Keynes thus reversed the old quantity theory's belief in automatic equilibrium in the economy at all times, which in fact was the basic premise of the Fisherian equation:

$$MV=PT.$$

It is also the view of the Keynesians that money is an asset just like any other asset which has to be kept for its own purpose and not just as a conditional place of purchasing power or a *numeraire*. This is in contrast with the earlier quantity theory which believed that money is just a veil over real economic activity; that money is not held for its own sake but because of the convenience, confidence and liquidity it confers.

Perhaps the most instructive and of course, the most controversial contribution of the Keynesians to monetary theory is on the possible effects of changes in money supply on economic activities. Concurrent with this and very closely related is the Keynesians' view on how money routes its way to affect economic activities i.e. the money transmission mechanism. While the quantity theorists believe that only money matters, extreme Keynesians believe that money does not matter.

However, it cannot be said with conclusiveness that the Keynesians' position is that money does not matter at all. What the Keynesians generally seem to be saying is that money does not have a direct impact on the economy as the classical economists believe and that the impact of the supply of money on an economy depends largely on its ability to affect interest rate, and for the rate of interest to influence demand for investment funds and for investment to influence national income. In other words, the Keynesians' view on monetary policy is that if money is to affect an economy, the following three conditions must occur. They are that:

1. Any change in supply of money should exert an influence on or lead to a change in the interest rate.
2. Change in the interest rate must result in change in investment level and
3. Change in investment must have a significant effect on national income.

Thus, the major link between money supply and the economy under the Keynesian model is the interest rate even though there are two other complementary links. These are the ability of interest to influence investment and for investment to influence national income. These various links, according to the Keynesians, are very weak.

From the above two theories of growth, it is explicit that the dynamics in money supply which is a monetary policy variable will affect the direction of economic growth of an economy.

3.3 Theories of Growth

3.3.1 Classical Growth Theory

The modern school of economic thought is usually attributed to the classical economists. These set of economists include Adam Smith, John Stuart Mill, Thomas Malthus and David Ricardo. To Adam Smith, the key to the growth of an economy was the concept of division of labour. Therefore, one of the major characteristics of the classical growth hypothesis is that production involves labour and other means of production and natural resources. Accordingly, land, labour and capital are very important factors in production process, unlike some modern growth theories that consider them negligible. Realizing the importance of capital accumulation, Adam Smith was of the opinion that there is no limit in terms of labour productivity and hence the need to investigate the growth of per capital income. This he claimed to be very germane in the making of enquiry into the causes of the improvement in the productive powers of labour as a factor of production.

Adam Smith saw the process of economic growth as being a cumulative process. According to him, the activities of the farmers, producers and businessmen resulted in accumulated prosperity. Such an accumulation comes from agriculture expansion, manufacturing industries as well as commerce and will further result in capital accumulation, population increase, market expansion and technical progress, division of labour and continuous increase in profit. All these are the result in the reality of the cheerful and prosperous situation of the society.

Karl Marx (1976) opines that economic growth and development are the key economic policy objectives. He developed a model of physical capital accumulation that accounts for depreciation and technological progress. He concluded that labour-demand growth is too low to compensate for decreases in employment following technological progress. The position of the classicalists in the literature is not without criticism. As pointed out by Jhingan (2008), Adam Smith’s theory was based on the socio-economic environment prevailing in Great Britain which might not be a universal experience.

3.3.2 Neoclassical Growth Theory

The seminal by Swan (1956) and Solow (1957) made the neoclassical model the dominant method of the concept of growth in academic field. While building on the neoclassical production function, Solow’s model emphasized the effect of savings, increased population and technological improvement on the economic growth of a closed economy that has no government involvement. This model, according to Jones (2001) and Barrow and Sala-i-Martin (2003) usually come to the fore in the discussion of long run growth in the literature.

Some of the underlining assumptions of the Solow growth is that: (a) there is a one commodity economy; (b) population growth rate, capital stock depreciation rate and that the rate of technological progress are all determined exogenously; (c) labour and capital are the two recognized production factors, (d) no government participation in the economy as well as no international transactions, (e) output is taken to be net after accounting for capital depreciation; (f) prices and wages are flexible and (g) there are constant returns to scale in production.

As presented by Romer (1996) for the dynamics of capital stock per unit of effective labour (k), the starting point is the aggregate production function expressed as:

$$Y_t = A_t F(K_t, L_t) \dots \dots \dots (3.2)$$

Where Y_t , A_t , K_t and L_t are output, technological progress, capital stock and labour respectively, all at time t . Technology is treated as a public good and it is assumed to be exogenous and depends on

time. The combination of technology with labour makes labour to be effective. As a result, equation 3.2 can be re-written as:

$$Y_t = F(K_t, A_t, L_t) \dots \dots \dots (3.3)$$

This aggregate production is assumed to satisfy some conditions according to Inada (1963), Romer (2001) and Barro and Sala-i-Martin (2003). These conditions are:

- i. For all the values of $K > 0$, $F(\bullet)$ exhibits positive but diminishing marginal returns with respect to both capital and labour (i.e. $\frac{Df}{DK} > 0$, $d^2F/dK^2 < 0$ and $Df/DL > 0$, $d^2F/DL^2 < 0$)
- ii. The production function exhibits constant returns to scale $F(\lambda k, \lambda l) = \lambda y$.
- iii. As the capital – labour ratio approaches infinity (i.e. $K \rightarrow \infty$), the marginal product of capital (MPK) approaches zero and as the capital – labour ratio approaches zero, the marginal product of capital tends towards infinity (i.e. $MPK \rightarrow \infty$),

From the second condition, if $\lambda = 1/AL$, then equation 3.3 can be re-written as:

$Y/AL = f(K/AL, 1)$ or $f(K/AL)$ such that $y = Y/AL$ and $k = k/AL$, then

$$Y = f(k) \dots \dots \dots (3.4)$$

Where $f'(k) > 0$ and $f''(k) < 0$ for all k .

Equation 3.4 means that output per effective labour is a positive function of capital per effective labour and exhibits diminishing returns.

In a nutshell, the key equation of the Solow model is given as:

$$K = s f(k) - (g + n + \delta)k \dots \dots \dots (3.5)$$

This equation shows if the rate of change of capital per unit of effective labour $[(sf(k))]$ and the break-even investment is $[(g + n + \delta)k]$, the amount of investment that must be done to keep k at its existing level.

One other feature of the model is its convergence property. Based on the assumption that the lower the starting levels of real per capita Gross Domestic Product (GDP), the higher the predicted growth rate; then except for starting capital intensities which are naturally the same, the convergence would apply in an absolute sense. By implication, poor economies would tend to grow faster per capita than the rich ones. On the other hand where economies differ in all aspects such as in the propensities to save and bear children, in their willingness to work, access to technology and government policies, then the force of convergence will apply only in a conditional sense.

Obviously, one deficiency of the Solow growth model is its assumption of labour augmenting technical progress which is partly traceable to the Harrod-neutral technical progress of

the Cobb Douglas production function which has no empirical justification. Furthermore, the assumption of flexible factor prices may bring difficulties in the path towards steady growth. For instance, the rate of interest may be prevented from falling below a certain minimum level due to the problem of the liquidity trap. In addition according to Jhingan (2008), Solow ignored the causative of technical progress and treated the latter as an exogenous factor in the growth process.

3.3.3 Endogenous Growth Theory

As a result of the unsatisfactory explanation given by Solow on the growth hypothesis, further research was carried out by Nelson and Phelps (1966), Robert Lucas (1988) and Paul Romer (1996). The endogenous growth theory identified technological progress as a product of capital size, investment rate and the stock of human capital. While expanding on the work of Arrow, Romer (1996) stated that the accumulation of physical capital and investment in knowledge are the major keys to long run growth of an economy. With a modification of the aggregate production function that has endogenous technology input (A), the productivity equation is expressed as follows:

$$Y = A(R)F(R_i, K_i, L_i) \dots\dots\dots (3.6)$$

Where Y is aggregate output, A is public stock of knowledge from research and development, R, R_i are the findings from research and development by firm i with capital (K) and (L) inputs. Equation 2.5 is assumed to exhibit increasing returns to scale and the function is homogenous of degree one in all inputs. According to Romer (2001), the learning externalities had expansion potentials on the aggregate knowledge which consequently promotes the labour productivity. Thus, Romer (2001) took investment in research technology as an endogenous factor in terms of the acquisition of new knowledge by rational profit maximization firms (Jhingan 2008).

Another version of the endogenous growth model is the AK model. The model is one of the simplest endogenous growth models. According to this model, technology (A) is taken to be a constant factor while K represents the combination of both physical and human capital which is denoted by K_p^α and K_H^β respectively; α + β = 1. Thus, we have the equation:

$$Y = AK = AK_p^\alpha K_H^\beta \dots\dots\dots (3.7)$$

Equation 2.6 has been described as a model showing an investment driven growth process in which the Solow residual has no place (Crafts, 1995).

However, the AK model has been criticized as it assumes a permanent increase in economic growth in response to increased capital inputs and that it is empirically inconsistent (Jones, 2001).

3.4 Empirical Literature Review

In the following section, bloc by bloc review and submission of researchers on the theme of the study in SSA are undertaken. The experience of other countries outside Africa on monetary policy relationship with growth concludes this empirical review.

3.4.1 Evidence from West Africa

The impact of monetary policy and invariably its dynamics on growth has generated a large volume of empirical studies with mixed findings using cross sectional, time series and panel data. Some of these studies are country-specific while others are cross-country. In the words of Nkoro (2005), there is a strong agreement in the literature that changes in monetary policy stance have a strong influence on an economy. In contrast, Weeks (2010) contents that the continued reliance by the IMF on monetary policy in its programs for developing countries such as those in SSA in managing inflation and exchange rate stabilization is absurdly inappropriate since many of the governments in the region lack the required financial instruments and market to make monetary policy effective.

Onyeiwu (2012) examined the impact of monetary policy on the Nigerian economy using the Ordinary Least Squares (OLS) method with data from 1981 to 2008. The results of the analysis showed that monetary policy represented by money supply exhibits a positive impact on GDP growth and balance of payments but a negative impact on inflation. The study recommended that monetary policy should be used to facilitate a favourable investment climate through appropriate interest rates, exchange rate and liquidity management mechanisms in order to realize the objective of economic growth. It was further recommended that the money market should provide more flexible financial instruments that will meet the risk preferences and the demand of the ever-rising sophistication of financial market operators.

The influence of monetary policy on economic growth and development was further investigated by Baghebo and Stephen (2014) and Fasanya *et al.* (2013.). Employing the Error Correction Model of analysis spanning the period of 1975 to 2010 on the impact of monetary policy on economic growth in Nigeria, Fasanya *et al.* (2013) showed that a long run relationship exists among the variables used in the study. In addition, the study showed that inflation rate,

exchange rate and external reserves were significant monetary policy instruments that drive economic growth in Nigeria. The study therefore recommended the establishment of primary and secondary government bond markets that can also increase the efficiency of monetary policy and reduce the government's need to rely on the Central Bank for direct financing. This was further corroborated by Sulaiman and Migiyo (2014) where monetary policy dynamics were seen as exerting much influence on the economic growth of Nigeria while growth does not influence monetary policy significantly on an equal basis. By implication, there is evidence to show that monetary policy transmission mechanisms contribute positively to the productivity of the Nigerian economy.

Using time series data, Ogunmuyiwa *et al.* (2010) investigated the relationship between money supply and economic growth in Nigeria for the period spanning 1980 to 2006. The study employed the ordinary least squares and error correction mechanism as methods of estimation and concluded that economic growth in Nigeria was influenced by the level of money in the economy. The empirical investigation of the impact of monetary policy on some selected macroeconomic variables which included inflation, gross domestic product and balance of payments by Badhebo and Stephen (2014) in Nigeria shows that providing an investment friendly atmosphere in Nigeria has the tendency to increasing the growth rate of GDP.

The use of fiscal policy as a complement to monetary policy has also been advocated in the literature (Ogege and Shiro, 2012; Enang, 2009; Ajisafe and Folorunso, 2002; Akujuobi, 2010; Altar, 2003; Havi and Enu, 2014; Rakic and Radenovic, 2013). When an economy gets deep into depression, monetary policy manipulation becomes less effective (Akujuobi, 2010). This view was supported by Onoh (2002) who stated that monetary policy plays significant roles in boom times or in time of recession but in case of any unavoidable depression, monetary policy instruments become less effective. In order to deal with the situation and restore macroeconomic goals therefore, well-articulated internal and external monetary policy measures as well as fiscal and economic interventions would be required. The study recommended using sound fiscal policy measures alongside monetary policy as both are re-enforcing and complementary.

Balogun (2007) used simultaneous equation models to test the hypothesis of monetary policy ineffectiveness in Nigeria and discovered that, rather than promoting growth, changes in monetary policy were sources of stagnation and persistent inflation. Similar evidence was found for other countries such as Ghana, Guinea, Sierra Leone and Gambia (Fasanya *et al.*, 2013). In a

similar view, the study of Ogege and Shiro (2012) recommended the hybrid of monetary policy and fiscal policy as both contribute to economic growth in Nigeria. Their study investigated the dynamics of Nigeria's monetary policy and fiscal policy on the economic growth using the Engle-Granger and Johansen-Joselius method of co-integration in a VECM (Vector Error Correction Mechanism) setting. The empirical result demonstrated that there exists a long-run linear relationship between the dependent variable and the explanatory variables. On the other hand, Ajisafe and Folorunso (2002) discovered that monetary policy dynamics exert more influence on economic activities than fiscal policy variation in Nigeria.

In the neighbouring West African country of Ghana, Sakyi (2011) investigated the relationship between trade openness, foreign aid and economic growth in Ghana by using the data set for the period 1984 to 2007. The method of estimation of the study was an autoregressive distributed lag (ARDL) model with the conclusion that positive short run and long run relationships exist between trade openness, foreign aid and economic growth. It was also discovered that the coefficient of labour participation rate and share of government spending in GDP was significant and negatively related to economic growth in Ghana. Twumasi's (2012) study showed that government investment and transfer payments affected economic growth positively in Ghana. The study suggests that government consumption expenditure for the country should be reduced and those expenditures that can promote economic growth should be raised.

Abradu-Otoo *et al.* (2003) reported for Ghana (through a VECM) that a rise in interest rate during a tight monetary policy regime leads to a temporary increase in inflation before it starts to fall at the expense of a fall in output that lasted for 3 to 4 years. Moreover, they showed that credit growth boosts GDP, reduces inflation and depreciates the exchange rate. According to the authors this occurs because interest rates act as a cost for firms, such that higher interest rates increase costs and lead to higher prices. This was complemented by the analysis by Epstein and Heintz (2006). They simulated a monetary expansion of 5% in the money supply for 5 years and showed that output could increase by 25% with only 1.2% inflation increase. It was therefore concluded that, as against the restrictive monetary stance feature of financial programming with focus on inflation, significant higher economic growth, and then employment creation could be achieved with low inflationary sacrifices.

The Generalised Least Squares (GLS) approach was employed by Dele in his study of the relationship between monetary policy and the economic outlook of Nigeria, Ghana, Gambia,

Sierra-Leone and Guinea in the West African Monetary Zone for the period spanning 1991 to 2004. According to the result of the study which used Banking System Credit to Central Government and Exchange Rate of the national currency to the US\$, MRR, Banking System Credit to private sector and M2 as variables confirmed monetary policy changes as a major cause of stagnation which hurts the real domestic output of the countries under consideration.

In contrast, Kone (2000) used the error correction model to examine the relative effect of both monetary and fiscal policies on economic activities in the West Africa Economic Monetary Union (WAEMU). Ndiaye (2009) evaluated the relative effectiveness of fiscal and monetary policies in Senegal and submitted that these policies remain subject to sources of uncertainty which has to do with any unpredictable outside shocks arising from weak automatic stabilizers.

The study by Babalola and Aminu (nd) on the impact of fiscal revenue and government expenditure on economic growth in Nigeria also confirms the existence of long run relationship between the economic growth and the explanatory variables of fiscal and expenditures of government. The superiority of the impact of monetary policy on economic growth has also received the attention of scholars in the literature. Investigating the relative importance of monetary policy and fiscal policy on economic growth in Ghana, Havi and Enu (2014) used the Ordinary Least Squares estimation technique for the period 1980-2012. Although the findings revealed that both fiscal and monetary policies impact positively on economic growth, monetary policy was found to be more powerful in promoting economic growth in Ghana than fiscal policy. It was therefore recommended that any monetary policy to be implemented by the government should be able to promote a favourable investment atmosphere through appropriate stabilization of interest rates inflation rates, lending rates and exchange rate. This was in line with the opinion of Quarterly and Afful-Mensah (2014) that there is clearly the need for greater fiscal discipline in Ghana given that monetary policy cannot achieve the desired objective in an atmosphere of fiscal imbalances.

A new trend to the relationship between monetary policy and growth is the influence of oil to monetary policy effectiveness. According to Omolade and Ngalawa (2017), oil price shock was confirmed as having pronounced effect on growth through exchange rate in Nigeria. Although, exchange rate was shown to be exerting more influence on growth in Nigeria with flexible exchange rate than in Libya with fixed exchange rate in the study, this is an indication that increasing oil prices will cause the domestic currency to depreciate if not well managed.

Adesoye (2014) examined the dynamic interaction between monetary policy tools in stimulating economic growth, as well as stabilizing the economy from external shocks in Nigeria. The paper considered key monetary time series variables and real growth of output in formulating Vector Autoregressive (VAR) models which showed interdependence interaction between the period of 1970 and 2007. The time series properties of the selected variables are examined using the Augmented Dickey-Fuller unit root test and the results revealed that only growth of real output and broad money supply are stationary at levels, while saving, lending and exchange rates were found stationary at first difference. The long-run dynamic interaction was established through the Johansen's Trace and Maximum Eigenvalue tests. The pair-wise Granger-Causality test conducted showed that the growth rate of real output is not a leading indicator for any monetary variables. Other innovation accounting tests were also carried out like impulse responses function to test for the response of growth in real output to innovation shock on monetary variables. Also, the forecast error variance decomposition (FEVD) is used to decompose the monetary shock on the growth rate of real output in Nigeria. Proper policy recommendations were proffered based on the results emanated from the econometric analyses.

Table 3.1: SUMMARY OF SELECTED EVIDENCE FROM WEST AFRICA

| S/N | AUTHOR'S NAME | YEARS | SELECTED VARIABLES | METHODOLOGY | FINDINGS |
|-----|--|-----------|--|----------------------------------|--|
| 1 | Onyeiwu, C. (2012) | 1981-2008 | GDP, Exch. Rate, Interest Rate, Bal. of payment, Infl. Rate. | Ordinary Least Square (OLS) | There is positive relation between growth and balance of payment but a negative influence on inflation |
| 2 | Fasanya, I.O and Onakanya, A.B.O. (2013) | 1975-2010 | GDP, Inflation Rate, Exchange Rate, Ext. Reserv. | Error Correction Mechanism (ECM) | These variables drive economic growth in Nigeria |

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|---|--|-----------|---|-----------------------------------|---|
| 3 | Sulaiman, L.A. and Migiyo, S.O. (2014) | 1981-2012 | Int. Rate, Gen Price Level, Money Supply, Exch. Rate. | Error Correction Mechanism (ECM) | Monetary Policy Rate, Infl Rate, Int Rate are the major determinants of price stability while money supply and exchange rate caused instability in price level. |
| 4 | Ogunmuyiwa M.S. and Ekone, A.F. (2010) | 1980-2006 | GDP, Money Supply | OLS/ECM | The growth in money supply exerted great influence on GDP |
| 5 | Badhebo, M. and Stephen, E.T. (2014) | 1980-2011 | Inflation Rate, GDP and Balance of Payments | OLS/ECM | It was revealed that a friendly environment for investment will boost economic growth of Nigeria. |
| 6 | Balogun, E.D. (2006) | 1991-2004 | Money Supply, Inflation Rate, Interest Rate and Exchange Rate | Simultaneous Equation Model (SEM) | Dynamics in monetary policy variables was seen as a major source of stagnation and persistent inflation instead of promoting growth in Ghana, Nigeria and Gambia. |

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|---|---|-----------|---|--|--|
| 7 | Ajisafe. R.A. and Folorunso, B.A. (2002) | 1970-1998 | GDP, Monetary Policy and Fiscal Policy | Error Correction Mechanism (ECM) | The influence of monetary policy was more pronounced than fiscal in Nigeria. |
| 8 | Sakyi, D. (2001) | 1984-2007 | Trade openness, Labour participation, Foreign Aid, GDP and Government expenditure | Auto Regressive Distributed Lag (ARDL) | There is positive short and long run relationship among the variables and GDP |
| 9 | Abradu-Otoo, P., Amoah, B. and Bawumia, M. (2003) | 1969-2002 | Inflation, Exchange Rate and GDP | S-VECM | Strong evidence showing monetary policy variables affecting inflation and output in Ghana. Furthermore, exchange rate mechanism remains a strong channel through which monetary policy permeates economic activities by causing stagnation to domestic output. |

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|----|---|---------------|---|---------------------------------------|---|
| 10 | Dele, B.E. (2007) | 1991- 2004 | Money Supply, Exchange Rate, Minimum Reserve Requirement and Banking System Credit to the Central Government. | Generalised Least Squares (GLS) | Monetary policy was found to be causing stagnation to real domestic output in Ghana, Gambia, Guinea, Nigeria and Sierra Leone. |
| 11 | Babalola, J.S. and Aminu, U. (nd) | 1977- 2009 | Fiscal Revenue, Government Expenditure and GDP | ECM | Productive government expenditure impacts positively on economic growth in Nigeria. |
| 12 | Havi, E.D.K. and Enu, P. (2014) | 1980- 2012 | Government Expenditure, Labour Capital and RGDP | OLS | Both Monetary policy and Fiscal policy influence growth positively but monetary policy exerts more influence on growth than fiscal policy in Ghana. |
| 13 | Quartey P. and Afful- Mensah, G (2014) | 1997- 2012 | Private Sector Credit, Money Supply, GDP, Interest Rate and Exchange Rate. | Trend Analysis | Although monetary indicators have remarkable influence on economic activities in |

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|----|------------------------------------|-----------|--|--------------------------|---|
| | | | | | Ghana, fiscal discipline was recommended as a complement. |
| 14 | Omolade, A. and Ngalawa, H. (2017) | 1980-2010 | Exchange Rate, Oil Prices, Money Supply, Oil Output, Manufacturing Output and GDP. | S-Variance Decomposition | There were mixed effects of exchange rate on output. Exchange rate was shown to be influencing growth in Nigeria with flexible exchange rate than Libya with fixed exchange rate. |

3.4.2 Evidence from East Africa

As rightly observed by Davoodi *et al.* (2013) much has not been found in the literature on monetary policy dynamics or the nexus between monetary policy and growth in this sub region of SSA especially on a bloc analysis. The few available studies have focused on the usage of narrow methodologies and data sets. In a three-variable recursive VAR model by Buigut (2009), interest rate as a monetary policy instrument was shown to be a weak weapon in the three countries of Kenya, Tanzania and Uganda. According to the study which covers a period of 22 years (1984-2006), any change in interest rate was found to having no statistical influence on inflation or real output in any of these East African countries. The same result was confirmed by Mugume (2011) using SVAR models on quarterly data from 1999 to 2009 on monetary transmission mechanism in Uganda.

Kamaan (2014) investigated the effect of monetary policy on economic growth in Kenya using the VAR method and showed that the interest rate channel is the most operational channel of monetary policy transmission on inflation in that country. Ayubu (2013) examined the

monetarist view on the significant role of money in explaining inflation dynamics in Tanzania and concluded that inflation is more of a real factor than a monetary phenomenon in the country.

Monetary policy effects on private sector investment and by implication on output of Ethiopia was investigated by Hailu and Debele (2015) using the ARDL Cointegration approach for the period 1975 to 2011. The result of the time series econometric technique revealed that monetary policy is a key and engine for economic growth via private investment in Ethiopia with money supply exerting more influence than interest rate.

Further studies about the nexus between monetary policy dynamics and economic growth in some East African countries include that of Davoodi *et al.* (2013) and Berg *et al.* (2013). The three major methods of Factor-Augmented VAR, Bayesian VAR and Structural VAR were employed by Dawoodi *et al.* (2013) to investigate the effects of policy dynamics in the East African countries of Burundi, Kenya, Rwanda, Tanzania and Uganda. It was affirmed that negative changes in the interest rate have significant positive influence on the economies of Burundi, Kenya and Rwanda.

Employing the Structural Variance Decomposition method, Omolade and Ngalawa (2017) examined the role of exchange rate regime in determining the relationship between monetary policy transmission mechanisms and manufacturing output in the oil producing countries of Libya and Nigeria. A mixed effect of exchange rate on output in Libya and Nigeria was revealed in the study. By implication, the study shows exchange rate as an important monetary policy instrument on growth in Nigeria (which operates a flexible exchange rate) than in Libya (which operates a fixed rate of exchange). However, positive change to monetary policy in terms of the reserve money was observed as having significant increase in output in Burundi, Rwanda and Uganda. In a similar but different approach, studies by Jawaid *et al.* (2011) and Kareem *et al.* (2013) depict positive influence in money supply increase on some economies such as Nigeria and Iran.

TABLE 3.2: SUMMARY OF SELECTED EVIDENCE FROM EAST AFRICA

| S/N | AUTHOR'S NAME | YEAR | VARIABLES | METHODOLOGY | FINDINGS |
|-----|----------------------|-----------|---|---------------|--|
| 1 | Saxegaard, M. (2006) | 1990-2004 | Ratio of Private Credit to GDP, Real GDP, Lending Rate and Deposit Rate | VAR | The negative effect of contractionary monetary policy was reduced by excess reserves because the excess reserves are high. |
| 2 | Buigut, S. (2009) | 1984-2006 | Interest Rate, Inflation Rate, Real GDP and CPI | Recursive VAR | Interest rate was a weak monetary policy instrument for growth in the three countries of Kenya, Uganda and Tanzania. Hence, monetary policy is seen as a shock to interest rate. |
| 3 | Kamaan, C.K. (2014) | N/A | Interest Rate, GDP, Lending Rate, CPI and NEER. | VAR | Interest rate was found to be an effective channel of monetary policy in Kenya. |
| 4 | Ayubu, V.S. (2013) | 1993-2011 | Money Supply, Inflation, Output, Exchange Rate and | S-VAR/VECM | Inflation was seen as more of an output factor than a monetary phenomenon in Tanzania. A |

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|---|--|-----------|---|-------------------------------|---|
| | | | International Oil Prices. | | parallel monetary policy coordination with deliberate strategy that will foster economic growth was advocated in Tanzania. |
| 5 | Hailu, D.B. and Debele, F. (2015) | 1975-2011 | Private Investment, Money Supply, Real Output, Real Exchange Rate and Real Interest Rate. | ARDL | Monetary policy was a key engine for private investment rather than fiscal policy in Ethiopia through improved financial resource availability. |
| 6 | Davoodi, H., Dixit, S. and Pinter, G. (2013) | 2000-2010 | Interest Rate, Output and Reserve Money. | FAVAR, Bayesian VAR and S-VAR | Negative change in interest rate has a positive effect in Burundi, Kenya and Rwanda while reserve money dynamics showing positive effect on output in Burundi, Rwanda and Uganda. |
| 7 | Maturu, B, Adam, C., Njuguna, | 2000-2010 | Interest Rate, Real GDP, | S-VAR | Contractionary monetary policy shock reduces |

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|----|--|------------|---|-----|--|
| | N., and O'Connell, S. (2010) | | Money Supply and CPI | | output thereby causing prices to decline. All the variables were statistically significant in influencing growth in Kenya. |
| 8 | Baldini, A. and Poplawski-Ribeiro, M. (2011) | 1980-2005) | CPI, GDP and Reserve Money | VAR | Mixed effects of positive shock in reserve money on inflation in all the EAC countries with the exception of Burundi that shows positive effect. |
| 9 | Mugume, A. (2011) | 1999-2009 | Exchange Rate, Credit to Private sector, GDP and Interest Rate. | VAR | Contractionary monetary policy reduces inflation and output. Exchange rate, private sector credit and interest rate were shown to be weak monetary policy instruments. |
| 10 | Montiel, P., Mishra, P. and Spilimbergo, A. (2012) | 2001-2010 | Exchange Rate, Price Level, Money Supply, Output and | VAR | An expansionary monetary policy leads to increase in the price level. No significant effect of |

| | | | | | |
|----|--------------------|-----------|---|-------|---|
| | | | Reserve Money. | | reserve money on price and output. |
| 11 | Cheng, K.C. (2006) | 1997-2005 | Exchange Rate, Interest Rate, CPI, GDP, NEER and Commodity Price. | S-VAR | Monetary policy affect exchange rate and prices through interest rate channels. |

3.4.3 Evidence from Southern Africa

Harmse and Khabo (2005) evaluated the impact of monetary policy on a small and open economy in South Africa for the period 1960-1997 using M3 to measure monetary policy. The OLS method was employed as well as the Augmented Dickey-Fuller test to check for stationarity of variables. Results of the study indicate that money supply changes and inflation are significantly related to changes in economic growth. Peiris and Lledó (2008) found that shocks in the monetary base explain changes in prices, but not in output and exchange rates in Mozambique.

Divergent from the above, other studies find lending a transmission channel to output or other aggregate demand components, but not to prices. Uanguta and Ikhide (2002) analysed how the changes in the South African Reserve Bank (SARB) repo rate are transmitted to the Namibian economy and found that lending rates and private investment were sensitive to these operational variables.

Similarly, Rungo and Manjate (2011) found no effect of monetary policy operational variables in prices and output for Mozambique. They also found ambiguous results, that is, monetary expansionary shocks caused the nominal exchange rate appreciation with falling prices. They suggested that the credit channel is worth investigating for Mozambique and justify that the results may be linked with an accommodative policy stance and data span limitations.

In their study of economic growth in South Africa, Palesa and Precious (2014) concluded that exchange rate, repo rate and money supply are insignificant monetary policy instruments that drive growth in the country while inflation was established as an important influence on economic growth. The paper explored the role played by monetary policy in promoting economic growth in the South African economy for 2000 to 2010 and therefore recommended increased government

spending on the productive sectors in order to promote economic growth, as monetary policy alone is unable to effectively spur economic growth. This inadequacy of monetary policy towards stimulating economic growth was complemented by Khabo and Harmse (2005). They argued that an expansionary monetary policy of reduced interest rates will be counter-productive because it will result in capital outflow as interest rates drop, resulting in a contraction of money supply instead. On the other hand, contractionary policy aiming at increasing interest rates is said to attract inflows of foreign assets thereby neutralizing the intended contraction of money supply.

The result of the study by Matemilola *et al.* (2015) on the impact of monetary policy on the bank lending rate in South Africa suggested the need for more competitive and less concentrated bank markets in order to enhance monetary policy effectiveness. A momentum threshold AR and asymmetric EC models were employed in the study to examine the long run interest rate pass-through of money market to bank lending rate for monthly data spanning 1978-2012. It was further discovered in the study that the bank lending rate was adjusted to decrease the money market rate in South Africa. A further study by Hodge (2006) on the relationship between inflation and growth in South Africa shows that in the long run, inflation drags down growth while an accelerated inflation is required in the short run when growth is above the required trend. The study which employed the OLS estimation method on quarterly data from 1970-2003 further submitted that an inflationary rate above 6% will not only be counter-productive but equally retard the growth potential of the country.

Seleteng and Motelle (2015) revealed in their study on the sources of economic growth in the Southern African Development Community region that government expenditures, political stability, trade openness, inflation, financial development and human capital are the driving factors of economic growth in the region. The outcome of the study which adopted the Generalised Moments Method (GMM) further revealed that the openness of an economy to international trade is an antidote to higher economic growth. Low inflation was not just seen as a necessary condition for economic growth but also a sufficient requirement for macroeconomic stability.

On the nexus between financial deepening represented by financial innovation and economic growth in the SADC, Roux *et al.* (2016) result from the ARDL-PMG method evidenced the positive relationship between these variable in the long run. The panel Granger causality result further showed no causality direction between economic growth and financial innovation in the short and long run within the region.

The Mundell-Tobin effect that some level of inflation is desirable for the attainment of economic growth was refuted in the study by Bittencort *et al.* (2013). Using panel time series data to investigate the impact of inflation on the economic prospect of fifteen SADC countries for three decades from 1980-2009, it was discovered that inflation apart from being a major determinant of growth within the region, also displayed a negative impact thereby refuting the Mundell-Tobin effect on growth.

The impact of some fiscal policy variables on economic variables in South Africa between 1990 and 2004 was investigated by Ocran (2009) and it was revealed that capital formation, spending by consumers and tax revenues impact positively on economic growth.

A further attempt at investigating the relationship between monetary policy dynamics and economic growth was the study by Seleteng (2014). The study investigated how monetary policy implementation in South Africa will affect the Common Monetary Area (CMA) of Lesotho, Namibia, South Africa and Swaziland. The study shows the interest rate (repo rate) to be a major driving force in all the member countries. Based on the result of the impulse-response generated through the Panel Vector Autoregressive approach, a positive shock to the South African repo rate was confirmed to have significant influence on lending rate, inflation and economic growth in that order. By implication, interest rates in the member countries are tied to the repo rate which suggests that any shock to the repo rate will affect those countries. Consequently, these countries lack the power to implement their own discretionary monetary policies.

Similar study by Ikhida and Uanguta (2010) on the relative impact of monetary policy on the economies of CMA shows how a change in the repo rate of the Reserve Bank of South Africa affects the growth rate of the member countries. The summary of the study indicates that member countries are at the mercy of the repo rate dynamics as against individual country's rate.

A number of studies have added oil and commodity prices as exogenous variables affecting growth of many countries especially after the oil price shock of 1973 and 1978. In the study by Eyden *et al* (2014) that covered 1960 to 2013, oil price shock was shown as having significant influence on real output growth of South Africa economy in a period of low growth rate as against high growth economic period. Employing a Bayesian MS-VAR method with a linear VAR, the study further revealed that the low growth state can only survive in the short run than in the higher growth state.

DuPlessis *et al* (2007) used SVAR approach to discuss the dynamics of monetary policy and fiscal in South Africa since 1994. According to them, there is substantial South African literature on this topic, but much disagreement remains. Though not undisputed, there is growing consensus that monetary policy has contributed to the remarkable stabilization of the South African economy over this period. The evaluation of the role of fiscal policy in stabilization has been less favorable and there is little evidence that a countercyclical fiscal stance was a priority over this period. This paper considered these issues in an empirical framework that addresses some of the shortcomings in the literature. Specifically, it constructs a structural model in contrast with the reduced form models typically used in the South African literature, incorporates the dynamic interaction between monetary and fiscal shocks on the demand side and supply shocks on the other, and avoids controversy over ‘neutral’ base years and the size of fiscal elasticity. The model confirms the consensus on monetary policy, finding it to have been largely countercyclical since 1994. On fiscal policy, this paper finds evidence of pro-cyclicality, especially in the more recent period, though the policy simulations suggest that the pro-cyclicality of fiscal policy has had little destabilizing impact on real output.

TABLE 3.3: SUMMARY OF SELECTED EVIDENCE FROM SOUTHERN AFRICA

| S/N | AUTHOR'S NAME | YEAR | VARIABLES | METHODOLOGY | FINDINGS |
|-----|----------------------------------|-----------|---|--|--|
| 1 | Harse, O. and Khabo, V.S. (2005) | 1960-1997 | Monetary Base, Changes in Price Level and Exchange Rate | OLS | Both variables jointly affect economic growth in South Africa. |
| 2 | Uanguta,E. and Ikhide, S. (2002) | 1997-1998 | Lending Rate, Private Investment | Narrative Approach and VAR/Impulse Responses Analysis. | Changes in both variables are sensitive for Namibian economy. |
| 3 | Palesa, M. and Precious (2014) | 2000-2010 | Exchange Rate, Repo Rate, Money Supply | ECM | These variables are insignificant monetary policy |

| | | | | | |
|---|----------------------------------|-----------|--|-------|---|
| | | | and Inflation Rate. | | instruments in driving economic growth in South Africa except inflation rate. |
| 4 | Ocran, M.K. (2009) | 1990-2004 | Capital Formation, Consumer Spending and Tax Revenue. | VAR | All the variables impacted positively on growth in South Africa. |
| 5 | Seleteng, M. (2014) | 1980-2012 | Interest Rate, Lending Rate, Inflation Rate and Economic Growth. | P-VAR | The repo rate was a major driving force in Lesotho, Namibia Swaziland and South Africa. Any shock to the South Africa rate will affect other rates in Lesotho, Namibia and Swaziland. |
| 6 | Seleteng, M. and Motelle, (2015) | 1980-2012 | Government Expenditure, Financial Development, Political Stability, Inflation, Trade Openness and Human Capital. | GMM | All the variables were found to be driving factors of economic growth in SADC. |

| | | | | | |
|----|---|---------------|--|--|--|
| 7 | Hodge, D. (2006) | 1970- 2003 | Interest Rate, GDP, Cost of Labour, Import Price, CPI and Investment. | OLS | A negative relationship was established between inflation and growth in South Africa both in the medium and the long run. |
| 8 | Roux, P.C., Mugano, G. and Bawa, A. (2016) | 1985- 2014 | Ratio of Broad Money Supply to Narrow Money Supply, Mobile Banking, Banking Sector Credit to Private Sector. | Extended Aghion, Howitt and Mayer- Foulkes (AHM) Model. | No evidence of Granger causality either from growth to financial innovations to growth and vice versa. |
| 9 | Mupimpila, C. and Funjika, P. (2010) | 1990- 2007 | GDP, Fixed Capital Formation, Inflation Rate, Real Interest Rate, Money Supply and Total Debt Service on External Debt. | Pooled OLS and Panel Least Square. | Physical capital, human capital and exports have positive and significant impact on economic growth within the SADC region. |
| 10 | Bittencort, M., Eyden, R.V. and | 1980- 2009 | GDP and Inflation Rate | Panel Time Series | Inflation was found to be a major determinant of growth within |

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|----|--|-----------|--------------------------------------|--|--|
| | Seleteng, M. (2015) | | | | the SADC region with negative impact on growth. This finding refuted the Mundell-Tobin effect of positive relationship between inflation and growth and thereby causes economic activities to decline within the region. |
| 11 | Matemilola, B.T., Bany-Ariffin, A.N. and Muhtar, F.E. (2014) | 1978-2012 | Bank Lending Rate, Money Market Rate | Momentum Threshold AR and Asymmetric EC Model. | It was discovered that bank lending rates adjust to decrease in money market rate in SA. |

3.4.4 Evidence from Central Africa

Ngalawa and Viegi (2011) found significant effects of the monetary aggregates on output, but no effect on prices and exchange rates in Malawi. Bernard (2000) used a purely Keynesian and panel data approach in addressing the effect of monetary policy on economic growth with a result that is not very encouraging in the low level economic and financial development countries. According to Nguena (2013), the study failed to focus on the credibility aspect of policy issues even though with encouraging results for high income level countries.

Other surveys, besides finding no statistically significant transmission of monetary policy also have theoretically ambiguous results. Mangani (2011) found no predictive effect of money supply on prices for Malawi, and that the only variable explaining prices was the exchange rate, but the

latter was completely unresponsive to the monetary policy stance. Furthermore, he found an ambiguous negative relationship between money supply and the broad monetary aggregates, with the latter reducing under expansionary shocks. He suggested that a credit channel should be surveyed.

Analysing the nexus between economic growth, inflation and money in circulation in Cameroon, Hondo and Tabi (2011) employed the VAR model to cover the period 1960 to 2007. The finding shows sequential effects of money in circulation causing growth and growth causing inflation. However, it was revealed that increase in money supply does not necessarily lead to an increase in the general price level. This is an indication that a supply of money that is in line with the economic reality of the country may not lead to inflation thereby confirming the monetarists' postulation that inflation is not totally harmful.

Samba (2013) employed the traditional interest and bank lending rates to evaluate the impact of monetary policy on growth in CEMAC and submitted that the traditional interest rate channel of monetary policy has little or no effect within the CEMAC region. It was also established that a common currency policy has differing effects among the countries within the region. A similar study by Lionel (2014) with different variables on the impact of monetary policy on economic growth for fourteen Franc Zone countries with data covering 1985 to 2012 showed a significant positive relationship on economic growth by money supply. On the other hand however, domestic credit provision by the banking sector exerted a negative influence on growth thereby necessitating the need for the allocation of funds to projects that have highest social returns.

In the study by Kabudi (2012), both the external and internal variables of interests in the study accounted for inflation dynamics in Uganda. A single equation ECM for a period of thirteen years (monthly data for 1999-2011) was used in its short and long run analysis and found evidence to show inflation as a factor to contend with in that country. More explanatory variables were used by Njimanted *et al.* (2016) to examine the inter connectivity between monetary policy and growth in CEMAC from 1981 to 2015. The study adopted the principal components selection method by interacting economic growth, money supply, inflation rate and interest rate among others, with lagged value of VAR analytical approach. Mixed results with different directions were observed for the variables with inflation and lending rate having destabilizing effects on growth within the

region. By implication, monetary authorities within CEMAC should create a favourable enabling environment for sustainable growth.

In another study by Crepin (2016) on what determines economic growth in the region, the panel Data Approach was employed for the period 2000-2013 to show foreign direct investment exerting significant and positive influence on the economic growth drive of the region. On the other hand however, loan was significant to growth but with a negative effect. This is an indication that loans were not channelled to the appropriate sectors of the economies such that the impact could be felt on growth generally.

TABLE 3.4: SUMMARY OF SELECTED EVIDENCE FROM CENTRAL AFRICA

| S/N | AUTHOR'S NAME | YEAR | VARIABLES | METHODOLOGY | FINDINGS |
|-----|----------------------------------|-----------|---|-------------|---|
| 1 | Ngalawa, H. and Viegli,N. (2011) | 1988-2005 | Reserve Money, Bank Rate, Money Supply, Exchange Rate, CPI and GDP. | S-VAR | There was weak response from consumer prices to monetary impulses. This suggests that inflation in Malawi may not be solely dominated by monetary policy factors. |
| 2 | Mangani, R. (2011) | 1994-2009 | Exchange Rate, Money Supply, Lending Rate, Reserve Money and CPI. | VAR | Money supply has no effect on price level but exchange rate has. |

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|---|--|---------------|---|-----------------------------------|--|
| 3 | Samba, M.C. (2013) | 1990- 2007 | Interest Rate, Bank Lending Rate, GDP and Price Level. | VAR | The study shows that the traditional interest rate channel of monetary policy has little effect within the CEMAC region. |
| 4 | Hondoa, H.A. and Tabi, H.N. (2011) | 1960- 2007 | Economic Growth, Inflation and Money Supply. | VAR | It shows sequential effects of money supply on growth and from growth to inflation in Cameroon. |
| 5 | Kabudi, A. (2012) | 1999- 201 | Inflation, | Single Equation ECM | Inflation was seen as a major factor to contend with in Uganda. |
| 6 | Njimanted, F.G., Akume, D. and Mukete, E.M. (2016) | 1981- 2015 | Growth, Inflation Rate, Interest Rate, Money Supply and others. | Principal Component Selection. | Mixed effects of variables as they affect the countries from different dimensions. Inflation rate and lending rate were show to have a destabilizing effect on growth within the region. |

| | | | | | |
|---|-------------------------|---------------|---|-------------------------------|--|
| 7 | Crepin, N. G. (2016) | 2000- 2013 | Loan, FDI, GDP, Inflation Rate and Human Capital | Panel Data Approach | FDI exerts great influence on economic growth of the region. The impact of loan was negative and significant. |
| 8 | Lionel, T. (2014) | 1985- 2012 | Domestic Credit, Money Supply | Dynamic Panel Model of GMM | A positive effect of money supply on growth while domestic credit by banks shows negative impact on growth. Hence, the need to allocate funds to projects with highest social returns. |

3.4.5 Evidence from other Countries

The result of the study by Aslam (2016) on the effect of money supply on economic growth in Sri Lanka confirmed some economists' argument of positive relationship between growth and money supply. Using a multivariate econometric method of analysis, money supply maintained a positive effect on growth in Sri Lanka at the 1% level of significance.

Ivrendi and Yildirim (2013) employed the Structural VAR model to investigate the macroeconomic parameters and monetary policy shocks in the emerging nations of Brazil, China, India, Russia, South Africa and Turkey and the result showed exchange rate to be the most important transmission mechanism in these countries. The study further reveals that a tight monetary policy in most of these countries not only adds value to legal tender and rate of interest

but also reduce inflationary pressure on output. Chaudhry *et al* (2012) examined the relationships between inflation, monetary policy and growth in the Pakistan economy between 1972 and 2010 and it was discovered that credit to private sector, real exchange rate, financial depth and deficit budget were elastic and relevant in explaining real GDP. A similar but different study by Mehrara and Sujoudi (2015), on the relationship between government spending, inflation, money supply and some other variables in Iran from 1959 to 2010 showed liquidity ratio to GDP, growth rate of money supply and energy prices had a great impact on inflation. The study therefore recommended the control of inflation via a declining liquidity growth rate and prices of energy.

Rafiq and Mallick (2008) examined the effects of monetary policy on output in Germany, France and Italy using the new VAR identification procedure. Quarterly observations from 1981-2005 were used. The results suggested that monetary policy innovations were at their most potent only in Germany while it remained ambiguous as to whether a rise in interest rates coincided with a fall in output, thereby showing a lack of homogeneity in the responses.

Berument and Dincer (2008) measured the effects of monetary policy for Turkey through Structural VAR (SVAR) technique covering the period 1986-2000. The empirical results showed that a tight monetary policy had a temporary effect on output, causing output to decline for three months in a statistically significant fashion. The findings confirmed the work of previous studies (Sousa and Zaghini, 2008; Sims, 1992; Eichenbaum and Evans, 1995). The same applied to the Czech Republic where the result showed a rather persistent domestic currency appreciation after a monetary policy tightening. In their study on the relationship between monetary policy and economic growth in the Czech Republic, Borys *et al.* (2009) used the VAR, structural VAR and Bayesian VAR with signs restrictions to show that a contractionary monetary policy shock has negative impact on the degree of economic activities and the general price level. This confirms the findings by Us (2004), where a zero correlation was detected between money and inflation in Turkey

Arratibel and Michaelis (2014) examined the impact of monetary policy and exchange rate shocks in Poland. Using a time-varying VAR method they found significant time-varying effects from exchange rate shock on output to consumer prices. Specifically, consumer prices are more responsive to exchange rate than the response from other macroeconomic variables. Mohammad *et al.* (2009) examined the long-run relationship among M2, inflation, government expenditure and economic growth in Pakistan during the period 1977 to 2007. The method of estimation was

cointegration. The results indicated that public expenditure and inflation have significant negative influence on economic growth in Pakistan while M2 had a significant and positive effect on economic growth in the long run.

Employing the same estimation technique, Bhuiyan (2008) investigated the effects of monetary policy shock in Canada by using the overnight target rate as the monetary policy instrument, and the findings of the study indicated that the transmission of the monetary policy shock to real output operated through both the interest rate and the exchange rate.

Nouri *et al* (2011) examined the impact of monetary policy on economic growth in Iran during the period 1974 to 2008. The method used was the ordinary least squares technique. They found that there was a positive and significant relationship between money supply and economic growth in Iran.

One important nexus to growth that has been of interest in the literature is in the context of financial deepening of a country. Investigating the direction of causality between financial deepening and economic growth in the Middle East and North African countries, Kar *et al* (2011) used panel causality testing approach with the result showing no clear consensus on the direction of causality between the explanatory and dependent variables. The six indicators of financial deepening (which include the ratio of money supply [M1 and M2] to income and the ratio of deposit money bank liabilities to income) shows that the direction of causality between financial deepening and economic growth is sensitive to the measurement of financial deepening in the MENA countries under consideration. However, financial deepening which is an integral part of monetary policy variables is not an all-inclusive instrument for measuring economic growth.

A further attempt at investigating the nexus between monetary policy dynamics and output was made by Kutu and Ngalawa (2016). The study was based on changes in monetary policy and the industrial outputs of the so-called BRICS countries and the result showed changes in exchange rate as having the greatest influence on the industrial products in BRICS countries. Not only that, the result of the P-SVAR model with a nine-variable matrix further revealed that money supply has a significant impact on inflation and therefore advised monetary authorities to always exercise caution in their formulation of policies aiming at bringing down inflation because of the spill over on to industrial output.

The study by Sahinoz and Cosar (2010) assessed the sectorial growth circles and monetary policy effect on growth in Turkey using a vector AR. Although the response of output to

contractionary monetary policy varies from one firm to the other, the declining response of the manufacturing sector was more pronounced. Similarly, exchange rate variation was shown to have a noticeable impact on the output of the manufacturing sector more than the overall economic growth in Malaysia (Amin and Ibrahim, 2005). In essence, tight monetary policy results in negative response from real activities.

In the study by Mirdala (2009) on interest rate transmission mechanism of monetary policy in some European Monetary Union (EMU) countries, a positive relationship was established between monetary policy changes in the Visegrad countries and the real GDP instead of variations in monetary policy impulses. Using SVAR model for the countries of the Czech Republic, Hungary, Poland and the Slovak Republic (the V4 countries), the study showed a mixture of policy responses in terms of inflationary developments.

The study by Popescu (2012) on the effect of monetary policy shock on some real economic aggregate variables (including the general price level), the result of the SVAR shows a negative response from the consumer price index, gross domestic product and aggregate money supply to monetary policy dynamics in Romania. However, the nominal exchange rate exerted positive response to monetary policy in the study. Another study that has to do with the cross-country effect on monetary policy dynamics is that of Mojon and Peersman (2001) in which monetary policy was adjudged to be a major influencing factor on GDP of the economies of the Euro Area. Not only was monetary policy an effective mechanism that drives economic activities but also the effects were similar in all the 10 countries under investigation.

TABLE 3.5: SUMMARY OF SELECTED EVIDENCE FROM OTHER COUNTRIES

| S/N | AUTHOR'S NAME | YEAR | VARIABLES | METHODOLOGY | FINDINGS |
|-----|----------------------|-----------|--|--------------------------|---|
| 1 | Aslam, A.L.M. (2016) | 1959-2013 | Money Supply, Exchange Rate, CPI, Export Earnings and Import Earnings. | Multivariate Econometric | Positive relationship was confirmed between money supply and growth in Sri Lanka. |

| | | | | | |
|---|--|-----------|--|-------------------------------|--|
| 2 | Ivrendi, M. and Yildirim, Z. (2013) | 1995-2008 | Exchange Rate, Export, Import, Domestic Output. | S-VAR | Findings reveal exchange rate as an important transmission mechanism in BRICS-Turkey. Tight monetary policy adds value to legal tender value and also reduced inflationary pressure on output. |
| 3 | Chaudhry, I.S., Zakariya, B. and Qamber, Y. (2012) | 1972-2010 | Inflation Rate, Monetary Policy, GDP, Private Sector Credit, Real Exchange Rate, Financial Development and Budget Deficit. | OLS | All the variables are relevant in explaining real GDP in Pakistan. |
| 4 | Mehrara, M. and Sujoudi, A. (2015) | 1959-2010 | Government Spending, Inflation, Money Supply, Liquidity Ratio to GDP and Energy Prices | Bayesian Econometric Approach | Liquidity, energy prices and money supply had an impact on inflation in Iran while growth rate was having the |

| | | | | | |
|---|--------------------------------------|-----------|---|-------------------------------------|--|
| | | | | | greatest influence on inflation. |
| 5 | Abdulrahman, B.M.A. (2010) | 1990-2004 | Real GDP and Money Supply | OLS | Monetary policy exerts little or no impact on economic growth in Sudan. |
| 6 | Rafiq, M.S. and Mallick, S.K. (2008) | 1981-2005 | Interest Rate and Output. | The New VAR Identification Approach | Monetary policy instruments are more potent in Germany than the other two countries, Italy and France. |
| 7 | Berument, H. and Dincer, I.N. (2008) | 1986-2000 | Output, Money Supply and Interest Rate. | S-VAR | Tight monetary policy has temporary effect on output thereby causing it to decline in Turkey. |
| 8 | Borys, M.H. and Horvath, R. (2008) | 1998-2006 | Price Level, GDP, Nominal Exchange Rate, Tradable and Non-Tradable Goods. | VAR, S-VAR and FA-VAR | Contractionary monetary policy shock has negative impact on economic activities and the general price level in the Czech Republic. |
| 9 | Arratibel, O. and | 1962-2012 | Exchange Rate, Consumer | Bayesian Time-Varying VAR | The study reveals time varying |

| | | | | | |
|----|---|---------------|--|------------------------------------|---|
| | Michaelis, H. (2014) | | Prices and Output. | | effects from exchange rate shock on output to consumer prices. |
| 10 | Mohammad, S.D. (2009) | 1977- 2007 | Public Expenditure, Inflation Rate, Output and Money Supply. | Cointegration | Public expenditure and inflation affect economic growth negatively in Pakistan with money supply having negative impact on economic growth in the long run. |
| 11 | Bhuiyan, R. (2008) | 1994- 2007 | Overnight Target Rate and Exchange Rate | S-VAR/Bayesian Sampling Method. | Result shows monetary policy transmission shock on real output through both the interest rate and exchange rate. |
| 12 | Nouri, M. and Samimi, A.J. (2011) | 1974- 2008 | Money Supply and Economic Growth | OLS | Positive and significant relationship between monetary supply and economic growth in Iran. |

| | | | | | |
|----|--|-----------|--|-------------------------------|--|
| 13 | Hüseyin, S. and Ayşe, K. (2015) | 2001-2014 | Interest Rate and Economic Growth | S-VAR | The study confirmed the superiority of monetary policy over fiscal policy. Interest rate exerted more influence on growth than other policy variables under consideration in Turkey. |
| 14 | Dinca, G. and Dinca, M.S. (2013) | 2002-2012 | Government Expenditure, National Defence, General Public Services and Economic Affairs | Linear Multiple Regression. | Government expenditure influences economic growth negatively in the selected European Countries. |
| 15 | Kar, M., Nazlıoğlu Ş. and Ağır, H. (2011). | 1980-2007 | Money Supply, Deposit Money Bank Rate to Income. | Panel Data Causality Testing. | The direction of causality between financial development and economic growth is sensitive to how financial development is measured in |

| | | | | | |
|----|-----------------------------------|-----------|---|---------------------|--|
| | | | | | selected MENA countries. |
| 16 | Peersman, G. and Smet, F. (2002) | 1980-1998 | Interest Rate and Output | Panel Cointegration | Result confirmed asymmetric monetary policy effect on financial structure of the industries in European economies. |
| 17 | Kutu, A.A. and Ngalawa, H. (2016) | 1994-2013 | Exchange Rate, Money Supply, Export, Inflation Rate, Interest Rate, Industrial Output and Federal Fund Reserve. | P-SVAR | Changes in exchange rate exert most influence on industrial output in BRICS countries. |
| 18 | Popescu, I. (2012) | 2005-2012 | GDP, Aggregate Money Supply, CPI, Exchange Rate and General Price Level. | S-VAR | Nominal exchange rate exhibits greater influence on growth as a monetary policy instrument in Romania. |
| 19 | Runnemark, E. (2013) | 1993-2007 | Interest Rate, Inflation Rate and Exchange Rate. | VAR | Changes in monetary policy show asymmetric effects while |

| | | | | | |
|----|--|-----------|--|--|---|
| | | | | | employment fell significantly in some regions of Sudan. |
| 20 | Kubowon, P. C., Ndambiri, H. K. Ritho C., Ng'ang'a S. I., Mairura F.C., Nyangweso P.M., Muiruri E. M. and Cherotwo F. H. (2012). | 1982-2000 | Human Capital Development, Capital Formation, Foreign Aid, Investment, Government Expenditure, Trade openness and Government expenditures. | GMM | Human capital formation, Physical capital formation and a vibrant export section have significant contributions to economic growth in some selected SSACs. On the other hand, foreign and government expenditure impacted negatively on growth. |
| 21 | Thornton J. (2008) | 1960-2007 | Money Supply and Inflation Rate. | Cross-Section and Panel Data Analysis. | Weak long run relation when growth in money supply and Inflation is less than 10% but strong relationship if more in selected |

| | | | | | |
|----|--|-----------|--|------------------------|---|
| | | | | | African Countries. |
| 22 | Omojolaibi, J.A. and Ogunniyi, M.B. (2014) | 1975-2010 | Trade openness, government expenditure, FDI and economic growth. | Dynamic Panel Analysis | Trade openness Granger caused government expenditure and finally economic growth. |

3.4.6 Further empirical issues

Further contribution in the literature is contained in the work of Cooray (2009) where the Cobb–Douglas production function approach was employed in assessing the effects of government expenditure and governance on economic growth. The study was based on data from 71 countries of different levels of development and governance covering 1996-2003 and found that an increase in both public spending and good governance can enhance economic growth with the two variables (public spending and good governance) being positively correlated. This was corroborated by the study of Greiner (2015) which showed a balanced government budget offers higher balanced growth rate with lower inflation than a situation with permanent public deficits. Using a monetary endogenous growth model to analyse the effects of monetary and fiscal policy in a utility function, the study concluded that a tight debt policy can lead to both higher growth in the long run and also a higher welfare generally.

On the other hand, Graude and Polan (2005) examined the link between money supply and inflation in 160 countries using a 30-year data range. Though the study accepted that inflation is a monetary phenomenon, it was shown that the link between inflation and money supply is much stronger only in the countries with a high inflation rate. They further submitted that in countries with a relatively low inflation rate, the long run linkage cannot be easily identified. This view was supported by Thornton (2008) where he employed panel and cross-sectional analyses to empirically estimate the applicability of Quantity Theory of Money (QTM) to 36 countries in Africa. He concluded that money strongly determines inflation in countries with more than 10% inflation and money growth rate.

Other factors such as human capital development, capital formation, foreign aid, investment, research and development, economic policies and macroeconomic conditions and openness to trade have been identified in the literature to be major determinants of growth (Kubowon *et al.*, 2012). In their research on the determinants of growth in some selected SSACs, the Generalised Methods of Moments of dynamic panel data was employed and the results show that human capital formation, physical capital formation and a vibrant export sector have significant contributions to the economic growth among sub-Saharan African countries. Contrary to expectations however, foreign aid and government expenditures impact negatively on economic growth. It was therefore recommended that relevant policies need to be formulated in order to promote those sectors that are relevant to economic growth of the region which invariably signifies the need for some dynamics in monetary policy formulation and implementation.

The continued postponement of regional monetary zones in SSA countries has received further attention in the literature. The proposed West African Monetary Zones have been postponed twice with the plan of having the East African Monetary Zone being feared to be over-ambitious by experts in the Central Bank. Asongu (2014) used dynamic panel GMM estimation with data from different non-overlapping intervals to assess real monetary and fiscal policy convergence within the proposed WAMZ and EAMZ. The findings of the study among other things reveal overwhelming lack of convergence in policy formulation and implementation. In essence, financial development, IMF- backed financial reform programs and fundamental features of a common monetary policy framework were being implemented differently across member countries. This calls for member nations to work towards harmonizing cross-country differences which may hinder the effective convergence in monetary policy and hence the growth potentials.

Graude and Polan (2005) confirmed that inflation can only be harmful to an economy if, and only if, it is above a certain percentage. In their study of one hundred and sixty countries using thirty years data range, they claimed that inflation and supply of money relationship is much stronger in countries with high inflation rates than those with lower rates. This was supported by Thornton (2008) in his study of the applicability of Quantity Theory of Money to 36 African countries. The study found a weak long run relationship between growth in money supply and inflation when the growth in money and inflation is fewer than 10 percent and a strong relation when above this level.

A further research on the relationship between growth and government expenditure has also attracted the interest not only of researchers but also that of policy makers in relation to monetary policy changes. This stems from the fact that an increase in government spending will result in monetary policy dynamics and ultimately economic growth (Mahmoodi and Mahmoodi, 2014; Omojolaibi and Ogunniyi, 2014; Loizides and Vamvoukas, 2005). Arising from the above empirical analysis, the impact of government expenditure on economic growth cannot be underestimated. This suggests that some fiscal policy variables such as government spending do affect the growth rate of an economy.

In their examination of the relationship between determining factors of growth in some selected SSACs, Omojolaibi and Ogunniyi (2014) concluded that trade openness Granger caused government expenditure and finally, economic growth both in the short run and the long run. A greater participation in international trade that will increase the revenue of the countries under consideration was advocated so as to boost their growth potential. By implication, any shock to the prices of oil and commodities in which SSACs have no control over will adversely affect their income, expenditure and invariable the growth potentials. This submission was in agreement with the result of Loizides and Vamvoukas (2005) where government size (which was measured as the share of total expenditure in GNP of the affected countries) was shown to Granger-cause economic growth. The combined analysis of both the bivariate and trivariate tests on the data from Ireland, Greece and the United Kingdom reveals government expenditure as an important driving force for economic growth not only in the short run but also in the long run in the three individual economies.

In Tobin's (1965) model, savings for future by economic agents through investment in capital assets will increase output under the condition of an expansionary monetary policy. This suggests that an increase in money supply will cause inflation to rise which will reduce returns on money and thereby cause portfolio adjustment; this will eventually lead to increase in output per person in the long run.

Furthermore, theories such as Sidrauski's (1970) and Stockman's (1981) have challenged the idea behind Tobin's theory that in the long run, output growth rate is an independent function of money supply growth rate. Yet others such as Lucas (1973), Issing (2003) and Fischer and Modigliani (1978) asserted that the relationship between monetary policy and growth is a negative

one. These divergent opinions about the relationship between changes in monetary policy and the effect on growth rate therefore calls for further empirical investigation (Papademos, 2003).

The relative potency of the exchange rate channel will differ from one country to another depending on the type of exchange rate regime being adopted by individual an country (Al-Mashat and Billmeier, 2007; Goeltom, 2008). Goeltom (2008) explained that the exchange rate channel will be stronger in a country adopting a flexible exchange rate regime compared with that of a fixed or managed regime because under a fixed rate of exchange, variations in the exchange rate are limited and as such, will produce little effect on inflation and output and with a longer time lag. Making use of the two rate of exchange systems, Al-Mashat and Billmeier (2007) investigated how effective monetary policy could be in Egypt. Their result revealed that the effects of the monetary policy when using a fixed exchange rate were much smaller than the condition of flexible exchange rate even though monetary policies are similar. This channel may not be effective however in most SSA countries where their exchange rates are pegged against foreign currencies such as the Francophone countries.

Cheng (2006) adopted a VAR in his study and found that monetary policy shocks affect exchange rate and prices substantially through this interest rate channel. It was further observed that positive shock in interest rate policy resulted in decrease of prices and nominal change rate appreciation consistently for one year. This was further corroborated by the work of Peiris and Lledo (2008) that shocks in the monetary base of Mozambique explain changes in the prices but not in output *per se*.

On the contrary, however, Hung and Pfau (2008) investigated the interest rate transmission mechanism of monetary policy in Vietnam. They found that this channel was not active in an economy with a liberalized interest rate. They submitted that the interest rates in such a setup are independent of what happens in the money market. In this context, high interest rates have little or no effect on economic activity.

The result of the study by De Miguel *et al* (2003) on the effect of oil price shock on business fluctuation in economic activities in Spain showed an inverse relationship with the welfare of the people. Engemann *et al* (2010) employed the Markov Switching approach to investigate oil price volatility effect on some countries under recession with a confirmation that oil price changes is capable of aiding economic recession of a nation.

From the literature reviewed above, there were divergent opinions about the variables that affect or determine monetary policy and growth of an economy. The available evidences show researchers' conclusions either revealing partial effects of monetary policy on output or no effects or ambiguity in effects. Not only that, the data span and methodological problems presented by some of these studies may undermine the credibility of their findings. For instance, in the study by Ngalawa and Viegi (2011), interest rate was wrongly chosen as a variable of operation in Malawi when monetary base was actually the issue. In the same vein, Uanguta and Ikhide (2002) erroneously considered South Africa Reserve Bank's repo rate as endogenous to Namibia's macroeconomic variables rather than Namibian aggregate demand, which is somehow implausible (Mishra *et al.*, 2010). Furthermore, the review clearly shows that money supply, exchange rate, interest rate, capital formation, government expenditure, oil and commodity price variations are the major variables responsible for monetary policy dynamics. Therefore, this study is set out to shed more light on the level of influence these variables have on each of the four major blocs in SSA.

3.5 Summary

In this chapter, a comprehensive review of three major theories of money and three theories of growth as related to the topic has been undertaken. This serves as the basis upon which the gaps that form the rationale of the study were identified. Most importantly, the endogenous growth model, which forms the basis upon which the model in chapter four was developed, was briefly discussed. In a nutshell, it was clear from the studies reviewed that dynamics in monetary policy versus growth is still a subject which is under-researched in SSA. Most importantly is the fact that little or nothing has been done in the area of regional or bloc-by-bloc analysis of the nexus between monetary policy and growth especially in SSA. This forms the stand point of the empirical investigation of this study.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

This chapter presents the research methods through which the investigation of the effects of monetary policy dynamics on growth in Sub Saharan African countries would be achieved. Controversies abound in the literature on the nature of the existing relationship between monetary policy and growth in both developed and developing countries of the world. There are also differing views of scholars on the variables to be used as proxy for monetary policy. However, a bloc-by-bloc examination of monetary policy dynamics and growth nexus are still under-researched in the literature and this is the motivation for carrying out this study.

Consequently in this section, the underpinning philosophy of the study, the theoretical background, the methodology and the underpinning philosophy of the study are examined. The section also contains the model specification which postulates the existing functional relationship between the dependent and independent variables. The descriptions of variables as well as sources of data are also described.

4.2 The Underpinning Philosophy of the Study

According to Saunder *et al* (2007) and Bryman (2012), a research philosophy refers to some set of beliefs regarding the reality nature of any study under investigation. This can either be positivism (empiricism) or constructivism (interpretism); positivism implies the existence of real life situation in any study while constructivism suggests that each observation in a study creates its own problem. To this extent one can say that the philosophy of any research provides the justification for its methodology.

The guiding philosophy of this study therefore is more of positivism rather than constructivism. This can be justified from the starting point of the methodology that dwells on the elementary demand for real money balances equation of $M/P = L(r,y)$ which has been established to be a decreasing function of rate of interest and also an increasing function of income. This to a greater extent is very close to real life situation.

4.3 Theoretical background

In the modification of the work of Solow on learning economies through doing, Romer (1996) acknowledged a strong tie between investment in knowledge and productivity increment. Barro and Sala-i-Martin (2003) further opined that one important source of growth is human capital. Qualitative human capital as entrenched in the literature includes investment in school enrolment rates, mathematical and scientific skills among others. Therefore, the starting point will be Romer's (1996) symbol of experience through cumulative investment that takes the following production function form:

$$Y_{it} = F(K_{it}, A(t)L_{it}) \quad (4.1)$$

where: Y_{it} represents the output of country i at time t , $A(t)$ stands for the stock of knowledge at time t , K_{it} and L_{it} are respectively capital and labour at t period. In the opinion of Romer (1996), because knowledge accumulation depends on experience, labour is seen to be more productive. This means that experience depends on investment in the past and consequently, the rate of growth in output is expressed in terms of experience indexes of accumulated investment thus:

$$G(t) = \int_{-\infty}^t I(v)dv = k(t) \quad (4.2)$$

Here, $G(t)$ represents output growth rate, $I(v)dv$ stands for accumulated investment which equals stock of capital $k(t)$. Also, output growth rate according to Romer (1996) is the per capita production function which is expressed as:

$$y = k(t) \quad (4.3)$$

Substituting equation 4.3 into equation 4.2 will give:

$$G(t) = y \quad (4.4)$$

Here, y represents the real output.

Furthermore, Romer (2013) established a relationship between interest rate, growth of money and inflation rate under the demand for money function definition. The demand for real money balances was also established to be a decreasing function of rate of interest and also an increasing function of real income as follows:

$$\frac{M}{P} = L(r, y) \quad (4.5)$$

Here, $\frac{M}{P}$ is the supply of real money balances, the function L describes the demand for real balances with the nominal rate of interest (r) and income (y). Hence, this function shows an increasing income and a decreasing interest rate.

Linearizing equation 4.5 will result in:

$$\frac{M}{P} = \alpha y - \beta r \quad (4.6)$$

Therefore, with simple mathematical manipulation, making αy the subject of the formula will give:

$$\alpha y = \frac{M}{P} + \beta r \quad (4.7)$$

Dividing both sides by α will lead to:

$$y = 1/\alpha \left(\frac{M}{P} \right) + \alpha/\beta(r) \quad (4.8)$$

Where $1/\alpha$ and α/β stand respectively for the elasticity of real money balance and rate of interest.

If equation 4.8 is substituted into equation 4.4, it becomes:

$$G(t) = 1/\alpha \left(\frac{M}{P} \right) + \alpha/\beta(r) \quad (4.9)$$

The implication of the above equation is that growth rate $G(t)$ is expressed as a function of real money balances (money supply) plus rate of interest.

Apart from the above two variables, others that are considered important as determinants of growth in this study are exchange rate and inflation rate. Another variable of interest that is related to monetary policy is called “financial sector development.” It is usually expressed as the proportion of the volume of credit extended to the private sector to gross domestic product. The argument is that if a country’s financial sector is not well developed to transmit the signals of monetary policy decisions, the effectiveness of monetary policy dynamics on growth will be undermined. Furthermore, capital formation and government expenditure are included as explanatory variables while commodity and oil prices volatilities are used as control variables. The inclusion of government expenditure is premised on the fact that monetary policy cannot work in

isolation without fiscal policy (Foloruso and Ajisafe, 2002). Not only that, fiscal policy plays an important role in aiding money supply fluidity in an economy which is very germane to monetary policy dynamics especially in developing countries such as SSACs where central allocation of resources constitutes an important amount of money in circulation (Obinyeluaku, 2004). The growth rate of GDP, which is the dependent variable in this study, is used to represent output following the empirical literature models on the relationship between output and growth.

Equation 4.9 is therefore modified to take account of these additional explanatory variables. All these variables, according to Ngalawa and Vieg (2012) and Omolade and Ngalawa (2014), have been identified to have direct linkages with monetary policy dynamics.

With the above background, the next step is the procedure leading to the estimation of objective one.

4.4 Assessment of the determinants of monetary policy dynamics in SSA (Objective one)

One objective that is central to this study as discussed in chapter one is to examine the determinants of monetary policy dynamics in SSA. Using the conventional money demand function as presented in equation 4.5 above and the linear form as:

$$\frac{M}{P} = \alpha y - \beta r \tag{4.9a}$$

Making interest rate the subject of the equation gives:

$$r = \frac{\alpha y - M/P}{\beta} \tag{4.9b}$$

The implication of equation 4.9b is that the central bank policy rate or prime rate which is usually referred to as monetary policy rate (MPR) in some economies is expressed as a function of GDP growth rate and real money supply (Delis and Kouretas, 2011).

4.4.1 Model Specification for objective one

The model to analyse the determinants of monetary policy dynamics evolves from equation 4.9b. The interest rate (monetary policy rate or lending rate) which describes the changes in monetary policy stance of a country is used as proxy for monetary policy indicator (see de Groot *et al.*, 2011 and Omolade and Ngalawa, 2014). Thus the function in equation 4.9b is modified to accommodate other variables ascertained in the literature as very germane to the dynamics of

monetary policy in most developing countries especially in SSA. Generally, the model is specified below:

$$R = f(Y, MSGR, EXR, INF, GE, NDC, COMPVOL, OILPVOL, DUM) \quad (4.9c).$$

Consequently, the econometric panel form of equation 4.9c can be expressed as follows:

$$R_{i,t} = \beta_0 + \beta_1 Y_{i,t} + \beta_2 MSGR_{i,t} + \beta_3 EXR_{i,t} + \beta_4 INF_{i,t} + \beta_5 GE_{i,t} + \beta_6 NDC_{i,t} + \beta_7 COMPVOL_{i,t} + \beta_8 OILPVOL_{i,t} + \beta_9 DUM_{i,t} + \mu_t \quad (4.10)$$

Where: i =individual country in the model, t time period which is 1980-2015, β_{is} are the parameters to be estimated ranging from 1, 2, 3.....9, R is the monetary policy rate, Y is the real output or $GDPGR$, $MSGR$ is the money supply, EXR is exchange rate, INF is the rate of inflation, GE is government expenditure, NDC is net domestic credit, $COMPVOL$ and $OILPVOL$ are commodity and oil price volatilities respectively. The dummy variable (DUM) is created to capture the 2007-2009 financial crisis effect of monetary policy dynamics on growth in SSA. Further explanations of the variables are done below.

4.4.2 Major Variables of Interest

The central bank policy rate (prime rate) of the countries of interest in the study is the dependent variable here. It is measured as the annual growth rate of the GDP of each of the countries under investigation. According to Delis and Kouretas (2011), adopting this policy rate as measurement will not give much difference to its result. In addition to being the usual monetary policy indicator, this rate remains the major weapon available to central banks in their implementation of monetary policy.

The explanatory variables are grouped below as internal and external factors:

The Internal Factors

- (i) Money supply growth rate (msgr), also measured in (%).
- (ii) Exchange rate (exr) (local currency unit per US\$)
- (iii) GDP growth rate (y)
- (iv) Net domestic credit (ndc) in aggregate figures
- (v) Government expenditures (ge) which include both recurrent and capital expenditures

External factors

- (i) Dummy variable to capture global financial crises of 2007-2009
- (ii) Commodity and Oil prices which have been confirmed as having influence on the dynamics of monetary policy (see Mork 1989, Chisadza et al 2013 and Aye *et al* 2014).

Equation 4.10 will be estimated using the panel data analysis, precisely the dynamic panel data. The estimated technique is discussed under the appropriate heading.

4.5 Examining the impact of monetary policy dynamics on the growth potentials of SSA (Objective two)

4.5.1 Model Specification for objective two

Firstly the monetary policy dynamics is derived from the data on monetary policy rates from all the countries investigated. However, since there have been arguments concerning the possible asymmetric effects of monetary policy dynamics or volatility, the monetary policy dynamics is therefore derived via EGARCH process. as explained as follows:

Derivation of monetary policy dynamics; EGARCH process

Firstly monetary policy volatility or dynamics is developed via the exponential generalized autoregressive conditional heteroskedasticity EGARCH [1,1]. The monetary policy dynamics is measured by estimating the following EGARCH model

$$MPR_t = \varphi + MPR_{t-1} + \mu_t \dots \dots \dots (4.11)$$

Note that MPR is the monetary policy rate which is the prime lending rate in the economies.

The AR[1] approach is followed. The following EGARCH model is estimated

$$\ln \sigma^2 = \omega + \ln \sigma_{t-1}^2 + \alpha \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| + \gamma \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| \dots \dots \dots (4.12)$$

In the equations 4.11 and 4.12 above, μ_t is residual, and σ denotes the conditional variance obtained from equation (4.11). Here, if $\gamma < 0$, it indicates the asymmetric character of monetary policy rate movements on volatility. This means that a negative monetary policy rate shock has a larger influence on volatility than a positive monetary policy rate shock. In the VAR analysis this estimate of the conditional variance is used for crude oil price volatility. The conditional variance equation residual is used as the monetary policy dynamics.

Following equation 4.9c the model is expressed thus:

$$G_{i,t} = \omega_0 + \omega_j \sum_{j=2}^7 \omega_j K_{i,t} \omega_j M_{pi,t} + \mu_{i,t} \quad (4.13)$$

Where: $G_{i,t}$ is the output growth rate of country i at time t , $M_{pi,t}$ embodies the policy variables of money supply, interest rate, real exchange rate, inflation rate and net domestic credit in country i at time t . Furthermore, $K_{i,t}$ represents the quantity of capital in country i at time t and finally, $\mu_{i,t}$ is the country specific stochastic variable. Suffice to note that i is N— number of countries in the sample which is 36 and t is the number of years (which is also 36). More explicitly for the panel analysis, the model is presented as follows:

$$\begin{aligned} GDPGR_{i,t} = & \alpha_{i,t} + \beta_{i,t} INT + \lambda_{i,t} MSGR + \theta_{i,t} EXR + \delta_{i,t} INF + \sigma_{i,t} GE \\ & + \rho_{i,t} NDC + \pi_{i,t} K + \mu_{i,t} \end{aligned} \quad (4.14)$$

Where: i =individual country in the model, t the time period which is 1980-2015, $GDPGR$ is real gross domestic product, INT is the interest rate, $MSGR$ is the real money supply, EXR is the exchange rate, INF is the inflation rate, NDC is net domestic credit, K is stock of capital and GE is government expenditure.

4.5.2 Variables explained

Dependent variable

The growth rate of the countries (g_t) is the regressand and it is measured as the annual growth rate of GDP of each of the countries.

Explanatory variables

Monetary variables ($M_{pi,t}$):

- (i) Monetary policy instruments: These comprise monetary policy instruments such as interest rate, to be precise the central bank rate (int), which is referred to as monetary policy rate in some countries (%), and money supply growth rate (msgr). It is measured as the average annual interest rate of countries in (%).
- (ii) The policy variables are specifically the inflation rate and exchange rate i.e. local currency per unit of US dollar.
- (iii) The Net Domestic Credit at constant USD. It is used here to represent financial sector indicator.

- (iv) Physical capital is represented as K in our model. Its measurement is through capital formation (gross) in each country. It includes any addition to fixed assets and inventories in the economy and the data are usually in constant US\$.

4.5.3 Control variables

These are the factors that are important in influencing monetary policy and ultimately growth that are also recognised in the literature. In this study, they are the oil and commodity price volatilities. These are the external factors that cause disturbance to monetary policy and thereby causing its dynamics to change periodically. The prices of oil and commodities are uniform and being determined at the international markets. Equation 4.15 will be estimated using dynamic panel data analysis. However, the procedure of the dynamic panel data analysis is basically divided into three. These are the panel unit root test, the panel cointegration test and the dynamic panel estimation. These processes are explained as follows:

4.6 The technique for estimation

The panel data error correction mechanism as developed by Westerlund (2007) will be employed in this study. This panel cointegration test, instead of residual dynamics, adopted the structural dynamics which does not impose any common factor as is the case in residual one, (Demetriades and Fielding, 2011 and Ishibashi, 2012). Procedurally as noted above, the first test under this approach is the conducting of the test for stationarity of the variables of interest, i.e. the panel unit root test. Next is the cointegration test of error correction based panel and the last stage is to estimate for both the short and long run equations. One major reason for the choice of the Westerlund panel cointegration approach is that it is error correction based that gives attention to short run relationship or dynamics. This is because according to literature (for example Mundel, 1963; Tobin, 1965; Rittenberg and Tregarther, 2008), the long run relationship between monetary policy and real variables is usually weak or at times, no relationship at all. Not only that, panel cointegration test involves many tests which are normally distributed. This not only lends credence to unit specific short run dynamics but also accommodates unit specific trend, the slope parameters and cross-sectional dependence.

The Westerlund (2007) panel unit root test and the cointegration error correction based panel are to test for the alternative hypothesis that at least one cross sectional unit is cointegrated. The other

test is for the hypothesis that the whole panel is cointegrated. Starting with the first test, the steps are as follows:

4.6.1 Panel Unit Root Test

The panel unit root test for the study is the popular Im, Pesaran and Shin (IPS) test. The need for the test for the presence of unit root is to ensure that each of the variables used is stationary so as to avoid spurious regression. Hence, panel unit root test is known for taking into consideration the features of the data in the panel before advancing to test the panel cointegration. A variable, as noted by Engle and Granger (1987) may not be stationary but the linear combination of the non-stationary variables may be stationary and therefore the reason to test for cointegration. Apart from the fact that it is suitable to establish variables stationarity in panel data, the IPS test is also preferred generally due to its small sample property (Pesaran *et al.* 2003; Maddala and Wu, 1999). The IPS test is computed as the average Augmented Dickey Fuller (ADF) statistics and its basic specification is given as:

$$\Delta y_{i,t} = \alpha y_{i,t-1} + \sum_{j=1}^{p_i} \gamma_{ij} \Delta y_{i,t-j} + \beta_0 + \beta_1 t + \beta_1 x_{i,t} + \varepsilon_{i,t} \tag{4.15}$$

Where: β_0 is the intercept; $\Delta y_{i,t}$ is the regressand; $x_{i,t}$ stands for the regressors; p_i is the needed lag length; $\beta_1 t$ is time trend. The required null hypothesis under the IPS is expressed as $H_0: \alpha_1 = 0$ for every ‘i’ and $H_1: \alpha_1 < 0$ for the alternative hypothesis. The Akaike Information Criterion (AIC) will be used for lag length selection. One important condition before the Westerlund approach can be employed is that the series must be stationary after first difference i.e. I(1).

To check the robustness of the model, the Levin, Lin Chu (LLC) panel unit root test is also carried out. The condition here is that the data must be pooled together. The test is based on the equation below:

$$Z_{it} = \rho_i y_{i,t-1} + Y'_{it} \gamma + u_{it} \tag{4.16}$$

$i = 1, \dots, N; t = 1, \dots, T$

Where: Z_{it} refers to deterministic component; u_{it} is the stationary process. The test assumes residuals to be independent and identically distributed with mean zero and variance σ_{it}^2 where $\rho_i = \rho$ for all values of i. Null hypothesis can be constructed as $H_0: \rho = 1$ which shows that all the series in the panel have a unit root. The alternative hypothesis of $H_1: \rho < 1$ signifies that all the series are stationary.

However, one distinguishing factor between the LLC and the IPS is that while the LLC test allows for heterogeneity in the intercept alone, the IPS test allows for both intercept and slope trends for the cross section units. The LLC is the restriction of ρ_i which is kept identical across individuals in both the null and alternative hypotheses. IPS (2003) relaxes this assumption of identical first-order autoregressive coefficients of the LLC test and thus allows ρ_i to vary across individuals under the alternative hypothesis. The IPS tests the null hypothesis of $\rho_i = 0$ for all i as against the alternative of $\rho_i < 0$ for all i

The mean group approach which includes average of $t\rho_i$ statistics is used by the IPS test to carry out the \tilde{Z} statistics as follows:

$$\tilde{Z} = \frac{\sqrt{N(\tilde{t} - E(\tilde{t}))}}{\sqrt{Var(\tilde{t})}}$$

Where:

$$\tilde{t} = \left(\frac{1}{N}\right) \sum_{i=1}^N t\rho_i,$$

The term $E(\tilde{t})$ and $Var(\tilde{t})$ stand for the mean and variance respectively of each $t\rho_i$ statistic and \tilde{Z} converges to a standard normal distribution. In line with the Monte Carlo experiment results, IPS illustrates that the test has more favourable finite sample properties than the LLC test. If the variables are stationary at level, equation (4.4) will be estimated. If on the other hand, the IPS panel unit root test suggests that the series are non-stationary at their levels but at their first difference, this means that the series are order of one $I(1)$. Other available tests are the ADF-Fisher and PP-Fisher chi square tests.

4.6.2 Error-Correction based Panel Cointegration Test

When the stationarity of the variables has been confirmed through the panel unit root tests, the next stage is the test for cointegration. The Westerlund (2007) error-correction based panel cointegration test will be employed with the model specified as:

$$\Delta gdpgr_{i,t} = \alpha_i + \theta_i ECT_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta gdpgr_{i,t-j} + \sum_{j=0}^{p_i} \pi_{ij} \Delta X_{i,t-j} + \varepsilon_{i,t} \quad (4.17)$$

In the equation above, $X_{i,t}$ and the $gdpgr_{i,t}$ are respectively the explanatory variables and the gross domestic product growth rate. The α_i , β_i and π_i are the parameters to be estimated. ECT stands for the error correction term while parameter θ_i determines the speed of adjustment through which the system corrects itself back to equilibrium in case of sudden shock. In a situation where $\theta_i < 0$, it

means there is error correction i.e. msg_{it} and mp_{it} are cointegrated. However, if $\theta_i = 0$ then there is no cointegration and hence no error correction. The null hypothesis for all the countries included in the panel is expressed thus:

$$H_0: \theta_i = 0 \text{ for all } i = 1, \dots, N$$

while the alternative hypothesis depends on the assumption made about the homogeneity of θ_i and this varies in the four panel cointegration test (see Ishibashi 2012; Demetriades and Fielding 2010 and Westerlund 2007).

In a situation where the variables are stationary at level i.e. $I(0)$, then both the pooled and random effects using the LM test and the pooled and the fixed effects will be estimated using the F-test. This shall be followed by running the Hausman test as a guide to the best option among the fixed and the random effects before performing the diagnostic tests. However, if the variables are $I(1)$, i.e. the stationarity of the variables takes first differential order, there follows a test for cointegration among the variables using the Pedroni or Kao or Johansen Cointegration tests before estimating the long run cointegration by Fully Modified Ordinary Least Square (FMOLS) or the Dynamic Ordinary Least Square (DOLS).

4.6.3 The group-mean tests estimation procedure

The major steps involved are as follows:

$$G_{\tau} = \frac{1}{N} \sum_{i=1}^N \frac{\hat{\theta}_i}{SE(\hat{\theta}_i)} \tag{4.18}$$

$$G_{\alpha} = \frac{1}{N} \sum_{i=1}^N \frac{T\hat{\theta}_i}{SE\hat{\theta}_i(1)}. \tag{4.19}$$

These two equations are employed to test for the presence of cross-sectional unit cointegration. The formulated null hypothesis is that both the elements in G_{τ} and G_{α} are not cointegrated across the sectional country units, (i.e. $H_0^G: \theta_i = 0$ for all i). Alternatively, the hypothesis is formulated that at least one cross-sectional country is cointegrated, (i.e. $H_1^G: \theta_i < 0$ for at least one i). By implication, if the null hypothesis is rejected, it means cointegration exists in at least one cross-sectional unit and otherwise if accepted.

4.6.4 The Panel test estimation procedure

This is the second test under the panel cointegration tests and can be expressed thus:

$$P_{\tau} = \frac{\hat{\theta}}{SE(\hat{\theta})} \tag{4.20}$$

$$P_{\alpha} = T\hat{\theta} \tag{4.21}$$

The usual null hypothesis of no cointegration is formulated as $H^p_0: \theta_i = 0$ for all i with the corresponding alternative hypothesis as $H^p_1: \theta_i < 0$ for all i . If the null hypothesis is rejected, it means there is cointegration for the panel as a whole.

4.6.5 Hausman Test – (Fixed and Random Models)

The Hausman test for panel data is used to show the differences between random and fixed effects models under panel data. The fixed effect model assumes that error terms (ϵ_{it}) are fixed time invariant parameters, and the predictors are independent of the error term (ϵ_{it}) for all cross sections (countries in this study) at all times. That is, the model specification recognizes the heterogeneity of the cross section and also with the assumption of different intercepts for each of the countries in our sample size. This helps to reduce statistical endogeneity in the analysis. The relationship between independent and dependent variables of each country in the panel is assumed to possess individual characteristics which may influence the panel predictors or outcome of the variables analysis. There is more reason why there is a need to control these individual characteristics in order not to be biased or not to affect both the dependent variable and independent variables. In order to bring out the net effect of the independent variables on the dependent variables, the time variant characteristics effect is removed by the fixed effects.

The econometric form of the fixed effect model is stated as:

$$y_{ij} = x_{ij} + u_i + e_{ij} \tag{4.22}$$

Random effects on the other hand show models which assume that the error term is not correlated with the predictors and this allows for time-invariant variables to play a role as explanatory variables. If there are reasons to believe that some omitted variables are constant over time but vary between cases, and others are fixed between cases but vary over time, then one includes both types by using random effects. This implies that time-invariant variables are included in random effects as this allows more degrees of freedom than fixed effects, because rather than estimating an intercept for virtually every cross-sectional unit, one can just estimate the parameters that describe distribution of the intercepts. The random effect allows generalization of the

inferences beyond the sample used in the model. The random effect is appropriate when the random process is conducted from a large population. However, Greene (2007) shows that random effects approach may suffer from inconsistency due to omitted variables since the treatment of the individual effects are uncorrelated with the other regressors.

The econometric form of the random effects model is given as:

$$y_{ij} = x_{ij}\beta + Z_{ij}u_i + e_{ij} \dots\dots\dots (4.23)$$

The Hausman test is used in deciding the most appropriate model between the fixed and random effects model. This is to avoid reporting spurious regression results and drawing wrong inferences.

4.6.6 Cross-sectional dependence

Consequently, Westerlund (2007) developed bootstrap values which take care of any unexpected cross-sectional dependence (Ishibashi 2012 and Demetriades and Fielding 2010). The *P* values obtained here are referred to as the robust *P* values even in the presence of common factors in time series. In this study the lags and the leads are set using the Akaike Information Criterion (AIC) as used by previous studies (see Westerlund and Pedroni, 2007; Ishibashi, 2012; Demetriades and Fielding, 2010).

In this type of study, there is every possibility for the presence of common factor that will affect the result of the panel cointegration test. It is therefore exigent to test for cross-sectional dependence after estimating the model. One identified way of solving for this presence of a common factor is the bootstrapping method (Westerlund and Pedron, 2007; Demetriades and Fielding, 2010; Ishibashi, 2012). The use of this method will involve the Bartlett Kernel window width formula of $4(T/100)^{2/n}$. Despite the presence of a common factor, the result of the *P* value will still be a robust one.

In case the results are not integration of order one (which is another condition for the use of Westerlund panel cointegration test), the Panel Autoregressive Distributed Lag, (Panel-ARDL) will be employed. This method is described below:

4.6.7 Procedure of estimation with Panel-ARDL

The two approaches here are the Pesaran and Smith’s mean group and the Pesaran, Shin and Smith’s pooled mean group. These methods are aimed at satisfying the cointegration or the existence of long run relationships condition among variables. With these methods, it is possible

to have estimated parameters that are consistent and efficient in a long run relationship whether they are stationary at levels or are of $I(1)$ in a panel data structure. The two methods are discussed below:

A. Pooled Mean Group

This method is a good alternative to approaches such as the Dynamic Ordinary Least Square and the Fully Modified OLS in heterogeneous cointegration panels, (Shin 1998). One major feature of this approach is that it gives room for the short run coefficients including the intercepts, speed of adjustment to long run equilibrium values and the error variances to be heterogeneous country by country. With this condition at the same time, the long run slope coefficients are homogeneous across countries. This condition is found useful especially when it is expected that the long run equilibrium relationship among the variables is the same across countries or at least between a sub-sections of the countries. For this condition to be valid, efficient and consistent, the followings are the pre-conditions:

- The long run relationship among our variables under consideration requires ECT to be negative and not less than -2.
- For the consistency condition of Autoregressive Distributed Lag model to be met, the resulting residuals of our EC model must not be correlated serially and the exogenous variables treated as being exogenous. This can only be fulfilled by setting the ARDL lags for both the dependent (say p) and the independent (say q) in EC form.
- Both our time series (T) and cross-country (N) values must be large enough before employing the dynamic panel approach. This will assist in solving the problem of heterogeneity and biased average estimator.

B. The Mean Group

The condition for validity and consistency here is that our T must be large enough with our number of countries (N) be at least between 20 and 30 (Favara 2003). Thus, if our N is small, the mean group estimator may be pruned to outliers with small model permutations. It is a method that gives room for varying coefficient and also for it to be heterogeneous both in the short and the long runs. No restriction is imposed by this approach.

Finally, the ARDL cointegration approach as championed by Pesaran et al (2001) is conferred with the following benefits unlike the Johansen and Joselius (1990) approach:

- Whatever is the order of integration of variables whether of order one or zero or even if mutually cointegrated or fractionally integrated, it is readily usable Twinoburyo and Odhiambo (2016).
- As rightly observed by Pesaran et al (1999) and Bentzen and Engsted (2001), this method can easily estimate both the short and the long run effects simultaneously without losing the long run information.
- Ghatak and Sidikki (2001) attributed its small sample requirement as another added advantage.

4.7 The Dynamic Panel Analysis

Our equation 4.13 earlier specified is meant to achieve the second objective of the study that is, to examine the impact of monetary policy dynamics on economic growth of SSACs. Our method of approach here is the dynamic panel data as against the static panel data estimation. This dynamic way of model specification does account for possible temporal autocorrelation of residuals. This will avoid us the running of regression that is spurious with its attendant inconsistent estimators. It is expressed as follows:

$$y_{it} = \beta_1 + \rho y_{it-1} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \mu_{it} \dots \dots \dots (4.24)$$

Equation 4.24 is the modified form of the fixed effects model with the addition of the lagged value of the dependent variable.

Taking the first difference of equation 4.24, we obtain equation 4.25 as follows:

$$\Delta y_{it} = \beta_1 + \rho \Delta y_{it-1} + \beta_2 \Delta x_{2it} + \beta_3 \Delta x_{3it} + \Delta \psi_{it} \dots \dots \dots (4.25)$$

In order to avoid a likely correlation among y_{it-1} and ψ_{it} , we employ an uncorrelated instrumental variable to these values. Hence, by transposing the explanatory variables matrix, instrumental variable Z' will be derived such that our equation 4.25 above can be multiplied in vector form by Z' to give:

$$Z' \Delta y_{it} = Z' (\Delta y_{-1}) \rho + Z' (x) \beta_{it} + Z' \Delta \psi_{it} \dots \dots \dots (4.26)$$

In estimating eqn. 4.26 using the Generalised Least Square (GLS) method will give a result that is a one-step consistent Generalised Moment Method estimator. This is the Arellano and Bond (1991) approach. However, a further development evolved from the work of Blundell and Bond (1998) called the system-GMM approach. This is similar to the Arellano and Bond (1991) method except that it is more cautious in its usage of instrumental variables than the first-differenced GMM. Under this approach, the assumption of stringent exogeneity was relaxed. Again, it has been argued that the instruments used by Arellano and Bond (1991) are likely to be weak in that if y is close to random walk then the differenced GMM will perform poorly. In essence, the past levels convey very little information about the future changes leading to weak instruments. To remedy this situation Blundell and Bond (1998) came up with an approach which transforms the instruments through differencing to make them exogenous to the fixed effects. In short, while Arellano and Bond (1991) instruments differences with levels, only Blundell and Bond (1998) instruments are at both differences and levels. With this according to Roodman (2006), a more efficient estimator could be guaranteed.

Consequently, we are going to explore this in the dynamic panel model in this study such that at the end, our estimates will not only be consistent but also efficient.

4.7.1 Diagnostic Test

Many times than often, problems do arise in the residuals of an estimated model meaning that the model is inefficient. In essence, the parameter estimates from a model may be biased. In order to address these seemingly challenges therefore, diagnostic checks are usually prescribed. This study will perform the Sargan-Hasen test, the test for serial correlation and the instrument adequacy test.

4.8 Examining the dynamic interaction among monetary policy variables and the influence of external forces in Sub-Saharan African Countries. (Objectives three and four)

In this section of the study, it is aimed that objectives three and four will be captured. These are the dynamic interactions among monetary policy variables and the influence of the two external factors of oil and commodity price volatilities on economic growth in SSA. To this end, an empirically tested monetary policy transmission mechanism that will result into a better effective monetary policy will be brought to the fore. Not only that, the degree of causation among

our variables of interest will be established through this channel. Therefore, the instrument of our analysis will be to construct a Panel Structural Vector Auto-Regressive (P-SVAR) model based on the monetary transmission mechanism for our sample size in SSA.

4.8.1 Monetary Policy Transmission Mechanism for SSACs

We develop a monetary transmission mechanism (MTM) for the SSACs. This is a medium through which all these sub objectives can be met. The monetary policy transmission mechanism has been identified as a technique through which the dynamics of monetary policy and how it affects growth and other major macroeconomic variables are studied (Ojo and Alege 2010). Generally, monetary policy refers to measures and procedures taken by monetary authorities in the management of interest rates, money supply and exchange rates with the hope of influencing credit conditions so that some economic objectives can be achieved, (Fiador 2015).

The MTM explains various channels through which monetary policy affects growth and also identifies the most potent channel for a particular economy. Traditionally, many channels have been acknowledged as noted in chapter two, the most commonly discussed in SSACs context are the credit channel, the interest channel, the exchange rate channel and the asset price channel (Mishkin 1996). For the purpose of exposition, these channels are discussed briefly as follows.

4.8.1.1 Interest rate channel

The first groups of monetary transmission channels are the key monetary policy instruments (MPIs) which comprise of interest rate and money supply. Monetary authorities do directly control official interest rates, which determine the interest rates on the money market. This control has implications on the volume of money supply in an economy. For instance, any monetary policy expansion that corresponds with a decrease in real interest rates will affect aggregate spending in different ways. Lower interest rates for example can lead to lower costs of capital which is especially important for investment decisions. Consumption expenditures increase, because lower rates favour current consumption over future consumption (saving), called the substitution effect. Interest rates also affect disposable income through interest and dividends receipts and payments, the so-called income effect. The direction and magnitude of the income effect depend on the net asset position of firms and households. This channel according to Hicks (1937) is the main thrust of the orthodox Keynesian IS-LM model.

4.8.1.2 Exchange rate channel

Additional real effects of any policy-induced increase in the short term interest rate pass through this exchange rate channel in an open economy. For instance, a rise in local nominal interest rate that is above the counterpart foreign rate will distort foreign exchange equilibrium. To restore this back to equilibrium level therefore would require a gradual depreciation of the local currency at a rate which equals the risk-adjusted returns on the different debt instruments. This is the uncovered interest rate parity condition. One necessary condition for the expected future depreciation to take place in both the traditional Keynesian models and the New Keynesian models is in the initial appreciation of the local currency. This is based on the premise that when prices are slow to adjust, it makes locally produced commodities to be more expensive than the foreign produced commodities. Consequently, the trio of employment, domestic output and net export will fall. However, it has been identified that oil price volatility as a commodity price and non-oil commodity price movement are very germane under the exchange rate channels.

4.8.1.3 Credit channel

According to Bernanke and Blinder (1988), there exists an additional transmission channel through credit that is known as credit channel. The focus here is on financial market imperfections as an essential factor of propagation and amplification of an initial monetary policy shock. It is an issue that is usually referred to financial accelerator effect. Credit market distortions cause imperfect substitutability among the different sources of finance. External finance premium which is defined as the cost spread between credit and self-financing shows the cost as a result of financial imperfections. In line with the theory of credit channel therefore, any possible shock to the external finance premium will affect the decision of borrowers which will invariably affect their activity.

4.8.1.4 The Asset Price Channel

As noted in chapter two, Kganetsano (2007) identified the Tobin q and the effect on wealth as the main routes through which monetary policy can affect an economy. In an expansionary monetary policy according to the Tobin q postulation, more money will be made available in the hands of the public. This will increase people's ability to invest in stock and consequently cause share prices to increase. Not only that, high stock prices will cause q (a fraction of market value of firm and market value of capital) to increase which will lead to high investment and growth. Similarly, under the wealth effect of transmission mechanism, consumptions are expected to be

smoothed out such that increase in consumption arising from increase in the value of their financial wealth will increase. Therefore, expansionary monetary policy will lead to rise in stock prices through wealth effect channel so that output can be stimulated.

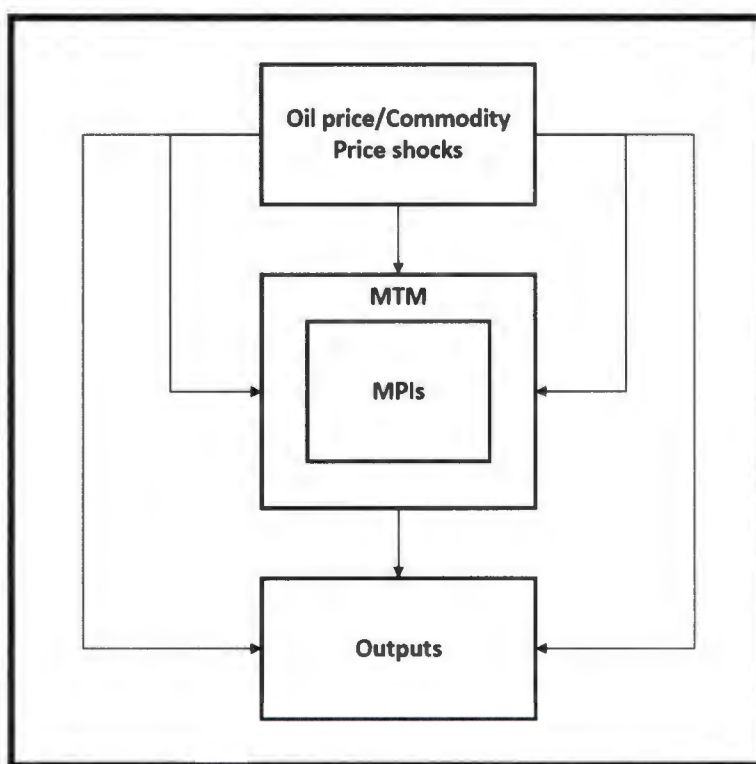
The MTM for the SSACs makes use of the channels explained above and from the explanation; it is obvious that some important variables constitute major external shocks to monetary policy which affects its dynamisms and the resultant effect on growth. Especially in the exchange rate channel, oil price and non-oil commodity price volatilities are identified as exogenous shocks to the MTM.

Furthermore, the monetary policy transmission mechanism is made up of our identified Monetary Policy Instruments (MPIs), output and policy variables. The MPIs include interest rates and growth rate of money supply as identified in the literature. They remain the operating targets as argued by Elborne (2007) and Mahmud (2009). The policy variables are the exchange rate and rate of inflation, (see Mordi and Adebisi 2010, Ngalawa and Viegi 2011 and Ushie, Adeniyi and Akongwalw 2012). MTM comprises of the monetary policy instruments (MPIs), policy and the output variables. The MPIs are interest rates and money supply growth rates. They are the operating targets (see Mahmud 2009 and Elborne 2007) while the policy variables include the exchange rate and the inflation rate (see Mordi and Adebisi 2010, Ndalawa and Viegi 2011 and Ushie, Adeniyi and Akongwale 2012). The policy goals which are the output variables are the GDP growth rates and the net domestic credit in the SSACs. The ordering of the variables follows Pesaran and Shin (1998) in order to overcome arbitrary ordering and likelihood of contemporaneous correlation.

Below is a flow chart showing the transmission mechanism of monetary policy involving the monetary policy instruments and operating targets. The monetary policy instruments comprise of the interest rates and money supply while the policy variables include inflation rate and exchange rate, (Elborne 2007, Mordi and Adebisi 2010, Ngalawa and Viegi 2011 and Ushie, Adeniyi and Akongwale 2012). The flow further shows a schematic diagram of the monetary policy transmission mechanism and other variables that are regarded as exogenous shocks (oil price and commodity price volatilities) According to Demachi (2012), commodity price fluctuations constitute important shock to the MTM especially in the SSA where virtually all the economies are import dependent and their exports are majorly primary products which is their major sources of foreign exchange earnings. Firstly, there are direct effects of the oil price and

commodity price volatilities shocks on the MTM. Secondly, the diagram shows how these exogenous shocks pass through each of the components as they are arranged. Furthermore, the study focuses on the direct impact of shocks in the transmission mechanism on monetary policy goals. Finally, we analyse how shocks in monetary policy mechanism influence our variables of interest in model.

Figure 4.1: Flow chart for variables' roles in the monetary transmission system for SSA



Author's composition

4.9 The panel-structure vector autoregressive (P-SVAR)

In contemporary studies of monetary economics, the S-VAR is the most commonly adopted method when it comes to monetary policy transmission mechanism (Svensson (2013)). As rightly noted by Bjornland and Jacobsen (2010), the S-VAR serves as a good means through which the effect of any shock in monetary policy on other macroeconomic variables can be traced. In this study therefore, the structure of the S-VAR is premised basically on the major sub divisions according to the variables in the model. The first variables are oil price volatility and commodity price volatility. This is a clear departure from what is common in the past empirical studies where prices are used instead of their behaviours (fluctuations) which has been identified as very germane to monetary policy dynamics relationship with growth, (Ojo and Alege, 2010). The next sets of variables are the monetary policy instruments (MPIs) and other policy variables of exchange and inflation rates. Output variables are the last sets of variables in the S-VAR and it comprises of net domestic credit which explains the credit channel in the MTM and GDP growth rate.

We are using the vector auto regression models for this study which had been adjudged the most widely used approach to monetary policy transmission mechanism, Davoodi et al (2013) and Svensson (2013). It follows the conventional method where the structural model takes the following specification:

$$Y_t = A_1Y_{t-1} + \dots + A_2Y_{t-2} + \dots + A_pY_{t-p} + \mu_t \dots \dots \dots (4.27)$$

Here, Y_t represents an $(m \times 1)$ vector of endogenous time series variables, $A_i \{t = 1, 2, \dots, p\}$ are $(m \times n)$ matrices coefficients and μ_t shows an $(m \times 1)$ vector that contains error terms. Although, $\mu_t \sim iid N(O, \Omega)$ represents the error, errors do have possibility to correlate contemporaneously in all the equations. Furthermore, there are pn^2 parameters in the matrices. Consequently, equation 4.27 can also be rewritten using the lag operator (L) that is selected via $L^k x_t = x_{t-k}$. where x is a group of exogenous variables and k is the lag length. The equation becomes:

$$A(L)y_t = \mu_t \dots \dots \dots (4.28)$$

With $A(L) = A_0L^0 - A_1L^1 - A_2L^2 - \dots - A_pL^p$

A_0 represents an identity 1matrix and the required condition for stationarity to be achieved, the $A(L)$ must lie outside the unit circle.

4.8.1 The Variance Decomposition and Impulse Response Functions

The Variance Decompositions (VDs) and Impulse Response Functions (IRFs) can be used to carry out the VAR analysis. This can be done by re-specifying the Auto Regressive function through the following processes:

$$A(L)\mu_t = Y_t \dots\dots\dots (4.29)$$

Where Y_t is the stationary stochastic process in the system and the finite order lag polynomial is also the $A(L)$ while μ_t stands for the white noise error term. One other requirement of this theory is that the root $\det(1-A(z)) = 0$ needs a modular that is greater than 1 such that $\det(1-A(z))$ remains invertible. The vector Moving Average (MA) upon which our VAR interpretation is based can therefore be expressed as follows:

$$Y_t = \phi_t + \sigma(L)\mu_t E(\mu_t) = 0 \dots\dots\dots (4.30)$$

$$E(\mu_t \mu_{t-k}) = Q, |k| = 0 \dots\dots\dots (4.31)$$

$$E(\mu_t \mu_{t-k}) = Q, |k| \neq 0 \dots\dots\dots (4.32)$$

Q in the above equations stands for the covariance matrix sample while ϕ_t represents the predictable perfection and the matrix of the coefficient of $\sigma(L)$ using lag 0 in our identity matrix. The impulse response function can be generated by normalising equation 4.31 and also forecast the error decomposition simultaneously. Still, the variance decomposition adopted here is similar to the moving average.

4.9.2 Model Identification

In order to identify the orthogonal structural components of the error terms that are in the shocks, the Structural Vector Auto Regressive needs enough restrictions. Suffice to note here that this is not in line with the standard Cholesky orthogonalisation. Non-recursive orthogonalisation of the error terms generated via this means can be used for the impulse response functions as well as the variance decomposition. For the sake of clarity, let us assume that Y_t comprises of the vector of the endogenous variables. For instance, say k th element of the endogenous variables in our model where $\sum E[v_t \dot{v}_t]$

$$Av_t = B\mu_t \dots\dots\dots (4.33)$$

Where v_t and μ_t represent the vectors with lag length k , v_t is the observed residual while μ_t represents the unobservable structural innovations. The A and B are the $k \times k$ matrices to be estimated while μ_t is expected to be orthogonal in nature and hence the covariance is a matrix with identity $E[\mu_t \mu_t'] = 1$. Here, the orthogonal assumption of μ_t makes the imposition of restrictions on A and B possible and hence we can have:

$$A \Sigma \hat{A} = B \hat{B} \dots \dots \dots (4.34)$$

Consequently, the existing relationship between the reduced form and the structural form of the Vector Auto Regressive model can be presented as:

$$B(L) = B_0 + B^+(L) \dots \dots \dots (4.35)$$

$$A(L) = -B_0^{-1} B^+(L) \dots \dots \dots (4.36)$$

$$\Sigma = B_0^{-1} A B_0^{-1} \dots \dots \dots (4.37)$$

Therefore, what divide the structural form into contemporaneous equation is equation 4.35, i.e. B_0 and $B^+(L)$. The former stands for correlations at lag zero while the later stands correlations at every strictly lags. Furthermore, 4.37 separates each of the reduced form coefficient into its structural counterpart B_0 , identified through the reduced form of $\Sigma = E[\mu_t \mu_t']$, while the diagonal covariance matrix of the structural form of $\Lambda = E[v_t \bar{v}_t]$ as depicted in equation 4.37.

In addition, because of the vulnerability of the long run restrictions to serious misspecification problems, the study uses a contemporaneous restriction on the B_0 matrix to identify the shocks as shown in equation 4.36 below since the interest of the study lies in the short and medium term responses (Leeper, Sims and Zha 1996 and Elbourne 2008).

$$\begin{bmatrix} v_t^{oilpv} \\ v_t^{compv} \\ v_t^{ndc} \\ v_t^{gdpgr} \\ v_t^{inf} \\ v_t^{msgrr} \\ v_t^{exr} \\ v_t^{intr} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ f_{21}^0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ f_{31}^0 & 0 & 1 & 0 & 0 & 0 & 0 & f_{38}^0 \\ f_{41}^0 & 0 & f_{43}^0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & f_{53}^0 & f_{54}^0 & 1 & f_{56}^0 & 0 & 0 \\ f_{61}^0 & f_{62}^0 & 0 & 0 & f_{65}^0 & 1 & f_{67}^0 & 0 \\ f_{71}^0 & f_{72}^0 & f_{73}^0 & f & f_{75}^0 & f_{76}^0 & 1 & 0 \\ 0 & 0 & 0 & 0 & f_{85}^0 & f_{86}^0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{oilpv} \\ \mu_t^{compv} \\ \mu_t^{ndc} \\ \mu_t^{gdpgr} \\ \mu_t^{inf} \\ \mu_t^{msgrr} \\ \mu_t^{exr} \\ \mu_t^{intr} \end{bmatrix} \quad (4.38)$$

The above matrix equation contains the eight variables of interest in our S-VAR model. For ease of exposition, we simplify equation (4.38) thus:

1. Rows 1 and 2 contain our exogenous variables of oil price volatility (*oilpv*) and commodity price volatility (*compv*). These variables are included in order to take care of the open economy nature of the countries under investigation. They both put external pressure on any economy that is predominantly dominated by import dependent and primary goods production countries as is the case in many SSAS countries, (Demachi, 2012). According to Beckermans, (2005) the transmission of the international shock to the domestic economy can be very rapid. Consequently, oil price volatility shock is the one driving itself while commodity price depends on oil price volatility and its fluctuations as captured by commodity price volatility, (See Kutu and Ngalawa, 2015).
2. In rows 3 and 4, we have the VAR residuals which describe the non-policy variables of GDP (*gdpr*) and net domestic credit (*ndc*). However, our assumption is that money supply, rate of interest, inflation rate and exchange rate are under the control of the monetary authorities. μ is a vector of reduced form disturbance to all the variables in the model (foreign and domestic variables). The position of the variables in the model describes the way they influence themselves in the identification scheme. As noted earlier, row 1 which belongs to the oil price volatility shows that it responds to its own lagged values while row 2 which is for commodity price volatility shows that it only responds contemporaneously to oil price fluctuations as indicated by f_{21}^0 . Again, the two rows further describe how both variables respond slowly to monetary policy shocks which are due to information and planning delays or the expected lags faced by policy makers (See Sims and Zha 2006; Bernanke and Mihov 1997 and Berkelmans 2005). In addition, these two rows describe the positions of net domestic credit and gdp growth rate equations. The large number of zeros described the nominal rigidities (Elbourne 2008; Elbourne and de Haan 2006). f_{31}^0 and f_{38}^0 indicate that net domestic credit respond contemporaneously to interest rate and oil price volatilities while f_{41}^0 and f_{43}^0 describe the contemporaneous responses of GDP growth rate to oil price volatility and net domestic credit (See Kutu and Ngalawa, 2015).
3. Rows 5 and 6 are for inflation rate and money supply growth rate in that order. The coefficients f_{53}^0 , f_{54}^0 and f_{56}^0 give room for the contemporaneous relationships among net domestic credit, GDP growth rate and money supply on one hand, and the rate of inflation

on the other hand. Contemporaneous response of inflation to output shocks assumption is in line with Brischetto and Voss (1999), Dungey and Pagan (2000) and Bernanke and Blinder (1992). Money supply occupies row 6 and it responds instantaneously only to oil price volatility, commodity price volatility, inflation and exchange rates. The logic behind the SVAR approach for supply of money is that not all changes in the monetary policy stance show a systematic response to variations in the state of an economy, (Sousa and Zaghini 2008).

- 4. The last row which is 7 implies that exchange rate is set in a competitive market which then responds contemporaneously to all the variables in our model. Interest rate which is a policy variable will only respond to inflation rate and money supply growth rate as indicated by f_{85}^0 , and f_{86}^0 respectively.

However, it should be noted that the volatilities of oil price and commodity price are used and they are developed through an Exponential Generalized Conditional Heteroskedasticity (EGARCH).

4.9.3 Derivation of Oil Price and Commodity Price Volatilities

One of the sub objectives of the study as noted in chapter one is the assessment of the determinants of monetary policy dynamics in SSACs. Literature has confirmed both oil price fluctuations and commodity price movement as important factors affecting monetary policy framework in the SSA. In addition, Demachi (2012), Thinguri (2014) and Ayodeji (2015) among others argued that the nature of the volatility of these two commodities has important implications for monetary policy dynamics in developing economies due to their reliance majorly on primary commodity export and being largely import dependent. The nature of the volatility can either be symmetric or asymmetric. Either of the two cases has its own implications on monetary policy framework for SSA and by extension monetary policy dynamics. Consequently, Exponential Generalised Conditional Heteroskedasticity (EGARCH) is adopted. More specifically all the volatilities of the commodity prices used in the study will be measured using the EGARCH procedure.

Firstly, volatilities for the commodity and oil prices used in the study are developed via the exponential generalize autoregressive conditional heteroeskedasticity EGARCH. The EGARCH process described as follows:

$$comp_t = \varphi + comp_{t-1} + \mu_t \dots \dots \dots (4.39)$$

$$oilp_t = \varphi + oilp_{t-1} + \mu_t \dots \dots \dots (4.40)$$

The AR[1] approach is followed. The following EGARCH model is estimated for each of the commodities' prices used.

$$\ln\sigma^2 = \omega + \ln\sigma_{t-1}^2 + \alpha \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| + \gamma \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| \dots\dots\dots (4.41)$$

In the equations 4.38, 4.39, 4.30, 4.31 and 4.32 above, μ_t is residual, and σ denotes the conditional variance obtained from the equations. Similarly, if $\gamma < 0$, it indicates the asymmetric character of commodity price and oil price movements on volatility. This means that a negative price shock has a larger influence on volatility than a positive price shock. The estimates of the conditional variance for each of the commodity prices are used as their volatility components as in Demachi (2012). This is capable of allowing us to know which of the prices has asymmetric effects.

The *a priori* expectation is that the commodity and oil price volatilities will impact negatively on growth due to the fact that both are direct consequences of macro-economic mismanagement which will likely have negative feedback effect on the economy. In summary, the *a priori* signs of all the variables to be considered based on experimental and theoretical postulations are given as follows:

Table 4.1: Variables Definition and a priori signs

| Variable | Definition | Expected Signs |
|------------------------------|-----------------------------|-------------------|
| Dependent Variable | | |
| RGDP | Real Gross Domestic Product | |
| Explanatory Variables | | |
| MSGR | Money Supply Growth Rate | Negative |
| INT | Interest Rate | Negative |
| EXR | Exchange Rate | Positive |
| INF | Inflation Rate | Negative |
| K | Capital Formation | Positive |
| GE | Government Expenditure | Positive |
| NDC | Net Domestic Credit | Positive |
| OILPVOL | Oil Price Volatility | Positive/Negative |
| COMPVOL | Commodity Price Volatility | Positive/Negative |

The degree and possibility of how these variables will influence growth will be determined by the results of various models.

4.10 Source of Data and Measurement of Variables

Since the study relies solely on secondary data; textbooks, downloaded journals and periodicals, World Development Indicators online database published by World Bank Organization, IMF's International Financial Statistics and Penn World Indicator were the major consulting references. The major variables of interest are Real GDP growth rate from each of the selected countries, Money Supply Growth Rate (MSGR), Inflation Rate (INF), Interest Rate (INT), Exchange Rate (EXR), Government Expenditure (GE) with Commodity and Oil Price Volatilities serving as external factors.

The scope of the study as earlier noted is to cover the period 1980-2015. This scope represents over three decades (36 years) and this is minimally sufficient to evaluate the issues of interest in this work, Calamitsis *et al* (1999) and Svensson (2013). The scope is also partly informed by data inadequacies. Not only that, sufficient data for the variables of interest prior to 1980 were generally not available for the sampled countries.

Furthermore, the tools used for monetary policy and economic growth proxy by GDP are the concern of this study. In this study, thirty six (36) out of forty eight (48) sub-Sahara African countries are employed and this accounted for about seventy-nine percent (77%) of the countries in sub-Saharan Africa. The choice of this sample size was also informed by the extent of data availability, notwithstanding information from more than three quarter of the population as sample is assumed to be sufficient to generalize for the population Svensson (2013). Also, the choice was carefully made to maximize the available observations. The frequency will therefore be yearly with cross sectional value of 36 and time series of 36 making up 1296 observations. It is a balanced panel data.

Suffice to note that the analyses will be sub regionalised. Therefore, the research questions will be analysed based on the regional blocs in SSA namely the Central Africa Community (CEMAC), the East Africa Communities (ECA), Economic Community of West Africa States (ECOWAS) and the Southern African Development Community (SADC). The blocs and the number of countries therein are repeated here in the table below:

Table 4.2: Sub-Saharan Africa Regional Blocs

| | Sub-Saharan Africa | Countries |
|------|--|---|
| S/NO | Sub-Regions | |
| 1 | Economic Community of West Africa (ECOWAS) | Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, (14 Countries). |
| 2 | Central Africa Monetary and Economic Community (CEMAC) | Cameroon, Chad, Congo Republic, Central Africa Republic, Equatorial Guinea, Gabon. (6 Countries). |
| 3 | East Africa Community (EAC) | Burundi, Kenya, Rwanda, Tanzania, Uganda. (5 Countries). |
| 4 | Southern Africa Development Community (SADC) | Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe. (11 Countries). |

Table 4.3 below presents the comprehensive information on the description, measurement and sources of data for the variables for this study.

Table 4.3: Description and Measurement of Variables

| Variable | Description | Measurement | Sources of Data |
|----------------------|--|---|------------------------------|
| Real GDP growth rate | This is the growth rate of value of total annual output of goods and services produced in the economy in a | It is measured in percentage and as the value of all productive resources that nations used for in a year after | World Development Indicator. |

| | | | |
|----------------|--|---|-----------------------------|
| | particular period of time usually a year. It is used as proxy for Economic Growth (see Nogueira 2009) | correcting for inflation. This implies that real GDP is the value of nominal GDP that has been corrected for inflation in the SSA countries to be used in this study. | |
| Interest rate | The amount charged, expressed as a percentage of principal by a lender to a borrower for the use of assets. (see Christiano <i>et al</i> 1999 and Ivrendi and Yildirim 2013) | The lending rate is used as interest rate can be measured in terms of nominal and real interest rate. Nominal interest rates are the rates quoted in loan and deposit agreement. It can be measured as Real interest rate plus Inflation. Real interest rate can be measured by deflating the nominal interest rates i.e. Nominal interest rates less inflation. | World Development Indicator |
| Inflation rate | The inflation rate is the percentage rate of change in consumer prices. It is the rate at | It is measured by the annual percentage change in consumer prices. There are two | World Development Indicator |

| | | | |
|-------------------------------------|--|--|------------------------------------|
| | <p>which the general price level of goods and services is rising and, consequently the purchasing power on currency is falling (see Yilmazkuday 2013 and Pollins and Zhu 2006).</p> | <p>measures, the Retail Price Index (RPI) and the Consumer Price Index (CPI). Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a fixed basket of goods and services that may be fixed or changed at specified intervals, such as yearly. For this study, CPI measure will be used.</p> | |
| <p>The money supply growth rate</p> | <p>The money supply is the total quantity of money in the economy at any given time in SSA countries. The quantity of money in the economy is set by the monetary authority of a country which is usually the central bank or the federal reserve banks as the</p> | <p>This is measured by the growth rate of M2 also known as broad money or money plus quasi money. The M2 measure includes the money in circulation as well as bank deposits. The M2 is being divided by GDP to get the rate of money supply and</p> | <p>World Development Indicator</p> |

| | | | |
|------------------------|--|--|-------------------------------------|
| | case may be (see Clarida <i>et al</i> 1999). | converted to percentage. | |
| Government Expenditure | This includes all government consumption, investment and transfer payments. The level of government expenditure in any country depends on the amount of revenue available in that country. | It is measured as the total value of government's fiscal spending in each of the SSA countries over a particular period of time which is usually a year. It includes both capital and recurrent expenditures in a country. | World Development Indicator |
| Monetary Policy | The Central/Reserve Bank policy rate of individual country is the proxy for monetary policy (see Christiano <i>et al</i> 1999, Ivrendi and Yudirim 2013) | It is measured as the growth rates of monetary aggregates or growth in credit. | World Development Indicator. |
| Oil Prices | This is the oil revenue accruable to the oil producing Sub Saharan Africa Countries. It comprises of the Premium Motor Spirit (PMS), Dual Purpose | It is measured by the value of fuel exports (% of merchandise exports) | International Financial Statistics. |

| | | | |
|---------------|---|--|------------------------------------|
| | Kerosene (DPK) and the Automotive Gas Oil (AGO). | | |
| Exchange Rate | It is the official exchange rate i.e. local currency unit (LCU) per US\$ period average (see Haddad and Pancaro 2010) | It is calculated based on an annual average based monthly average-Local Currency Unit per US\$ | International Financial Statistics |
| Capital Stock | This is the total capital stock within a year. It is usually proxy by real gross fixed capital formation (see Kohpaiboon 2004 and Havi and Enu 2014). | It is measured by Gross Capital Formation of each country (in nominal terms). | World Development Indicator. |

4.11 Conclusion

In conclusion, this chapter has taken a deep look into the various models and approaches to be adopted in this study. The sequential orders of carrying out tests to ensure the stationarity of our variables, cointegration of variables and how to run the regression were discussed in full under this chapter. In the succeeding chapter, we shall run the panel models discussed in this chapter using STATA packages and complemented with E-Views 9.

CHAPTER FIVE

FINDINGS AND DISCUSSIONS

5.1 Introduction

This particular segment of the research work presents and discusses the results from all the analyses explained in the methodology. According to the methodology, three models were to be estimated with different estimating techniques to achieve all the objectives stated in introduction. Principally, the primary motivation of the study has been to examine the nexus between monetary policy dynamics and growth in the SSACs for the period 1980-2015. The first model specification has to do with analysing the determinants of monetary policy dynamics in the SSACs and equation (10) is to be estimated for this purpose. From this equation, both commodity price volatilities and oil price volatilities are part of the identified determinants of the monetary policy dynamics in the SSACs (see Herrera et al 2011, Chisadza et al 2013 and Aye et al 2014). Consequently, the process leading to the generation of both oil price and commodity price volatilities is the starting point of this analysis. From the methodology, Exponential Generalized Auto-regressive Conditional Heteroskedasticity (EGARCH) is being used to generate both commodity price volatility and oil price volatility (see Demachi, 2012). The EGARCH model according to Nelson (1991) does not only react differently to positive and negative shocks but equally allow for asymmetry effects. Therefore, the results and discussions of the EGARCH process are as follows.

5.2 Analysis of the determinants of monetary policy dynamics in the SSACs

The first objective of this study as stated in chapter one is the determinants of monetary policy dynamics in SSACs. Therefore, the model to be estimated here is equation (10) as presented in chapter four under the methodology. For a better analysis, SSA is divided into four regions namely Central Africa, Eastern Africa, Southern Africa and Western Africa. It is also pertinent to note that these sub regions fall into economic groups or blocs which have an influence on an individual country's economy. For example, Central Africa has an economic union called *Communaute Economiquee et Monetaire de l' Afrique Centrale (CEMAC)*, Eastern Africa has the Eastern Africa Community (EAC), Southern Africa has the Southern Africa Development Economic Council (SADC) and Western Africa has the Economic Community of West African

States (ECOWAS). These divisions form the basis of the analyses since countries under these divisions are mostly bound by similar economic ties. The analysis begins with Central Africa.

5.2.1 Derivation of commodity and oil price volatilities

One basic requirement of the EGARCH process is the fulfilment of the series stationarity. Although, variations in oil and commodities prices herein referred to as volatilities have trends, it is worthy to conform to econometric principles by ensuring these variables are stationary. This is as to avoid heterogeneity biasedness, spurious regression and void results. Consequently, the analysis of this study begins with the unit root tests for both commodity and oil price volatilities using the ADF approach. The results of the unit root tests are presented in Table 5.1 below with the numbers in parenthesis being standard deviations and the ** indicating 5% level of significant.

Table 5.1: Unit root tests for commodity and oil price volatilities

| Variable | ADF statistics | Order of integration | P Value |
|-----------------|----------------|----------------------|---------|
| Oil price | -5.452983** | I(1) | 0.0295 |
| Commodity price | -3.954319** | I(1) | 0.0172 |

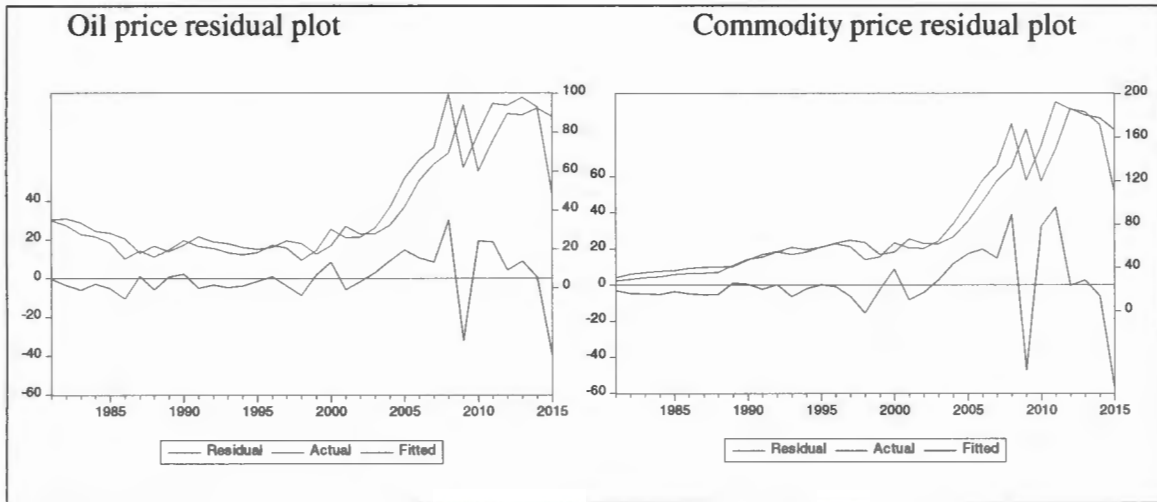
(**) indicates significance at 5%.

The table shows that both commodity and oil price volatilities are stationary at their first differences which suggests that they are integration of order one I(1). By implication, the condition for EGARCH estimation has been fulfilled.

5.2.2 EGARCH process for both commodity and oil price volatilities

The process begins with verification of Auto-regressive Conditional Heteroskedasticity (ARCH) effects. The two series are tested for ARCH effects through residual plot and ARCH tests. The result is presented as follows:

Figure 5.1: Residual plot for both commodity and oil price volatilities



The graphs in Figure 5.1 above show the likelihood of ARCH effect. Both commodity and oil price residual plots indicate undulating shapes that confirm the presence of ARCH effect. Notwithstanding, the ARCH analysis has provided an avenue for double-checking the results presented in Figure 5.1 through the ARCH test. The results of the ARCH test for oil and commodity prices are presented in Table 5.2 below.

Table 5.2: ARCH tests for oil and commodity prices

| Oil prices | | | |
|-------------------------|----------|---------------------|--------|
| F-statistic | 5.192702 | Prob. F(1,32) | 0.0295 |
| Obs*R-squared | 4.746949 | Prob. Chi-Square(1) | 0.0294 |
| Commodity Prices | | | |
| F-statistic | 6.315168 | Prob. F(1,32) | 0.0172 |
| Obs*R-squared | 5.603935 | Prob. Chi-Square(1) | 0.0179 |

The results in Table 5.2 shows that the Null Hypothesis of no ARCH effect is rejected at 5% level for both prices. The implication of this is that the results from the table confirm that there is an ARCH effect. Therefore, we are justified to run any of the ARCH families' analysis. The EGARCH is applied here in order to verify if oil price has an asymmetric effect. The estimated EGARCH equations for both oil and commodity prices are presented as follows:

EGARCH or conditional variance equation for oil price:-

$$\ln\sigma^2 = 1.351934^{***} - 1.169635^{***} \ln\sigma_{t-1}^2 + 0.821859^{***} \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| + 0.882097^{***} \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| \dots \dots \dots (1)$$

(3.94E-06) (0.024807) (0.151661) (1.6E-103)

EGARCH or conditional variance equation for commodity price:-

$$\ln\sigma^2 = 0.319702 - 0.442090 \ln\sigma_{t-1}^2 - 0.034851 \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| + 1.067861^{***} \left| \frac{\mu_{t-1}}{\sigma_{t-1}} \right| \dots \dots \dots (2)$$

(0.221492) (0.323958) (0.394033) (0.002111)

*, **, ***: significance at 10%, 5% and 1% respectively.

Equations 1 and 2 are the estimated EGARCH models for both oil price and commodity price respectively. The results show that both prices do not have an asymmetric effect but rather a significant symmetric effect during the period under review. This is because the coefficient 0.882097 and 1.067861 are greater than zero and they are statistically significant thereby suggesting that a positive price shock will have a more pronounced effect on volatility than a negative price shock. Consequently, the residuals of the conditional variance equations, that is $\ln\sigma^2$ in equations 1 and 2 for both oil and commodity prices are used as oil price volatilities (oilpvol) and commodity price volatilities (compvol) respectively as stated in equation (10) under the methodology. This equation is repeated here thus:

$$R_{i,t} = \beta_0 + \beta_1 Y_{i,t} + \beta_2 MSGR_{i,t} + \beta_3 EXR_{i,t} + \beta_4 INF_{i,t} + \beta_5 GE_{i,t} + \beta_6 NDC_{i,t} + \beta_7 COMPVOL_{i,t} + \beta_8 OILPVOL_{i,t} + \beta_9 D_{i,t} + \mu_t$$

The betas are the parameters to be estimated which show their effects on the variables of interest. β_0 represents the intercept while μ_t is the white noise.

5.2.3. Determinants of Monetary Policy Dynamics in the Central Africa Countries (CEMAC)

The CEMAC has a unique economic bloc that operates a unified monetary policy. The monetary policy administration of member countries is controlled by one Central Bank called Bank of Central African States (BCAS). The countries operate a fixed exchange rate and are mainly francophone countries. The membership includes Cameroun, the Central Africa Republic, Chad, Equatorial Guinea, Gabon and the Republic of Congo. The fact that they fall in the same monetary zone distinguishes them from other economic unions within SSA. To analyse the determinants of monetary policy dynamics in the CACs, the first step is the panel unit root test for the variables.

5.2.3.1 Panel Unit root tests for CEMAC

The variables in the equation are subjected to stationarity tests here. This is to enable their order of integration to be ascertained, which will serve as a precursor to the choice of the estimating technique to be adopted. Table 5.3 shows the results of the unit root tests. It is clear from the table that all the series are combination of integrations of order one and zero, i.e. I(1) and I(0). In essence, both the IPS unit root test and the ADF-Fisher test show similar results throughout the tests for stationarity.

Table 5.3: IPS and ADF - Fisher Chi-square unit root tests for CEMAC

| Variable | IPS unit root test | | | ADF-Fisher Chi-square unit root test | | |
|----------------|--------------------|----------|----------------------|--------------------------------------|----------|----------------------|
| | t* Statistics | P Value | Order of Integration | t* Statistics | P Value | Order of Integration |
| <i>Mpr</i> | -5.9188 | 0.000*** | I(1) | 246.0289 | 0.000*** | I(1) |
| <i>Gdpgr</i> | -4.3266 | 0.000*** | I(0) | 143.2281 | 0.000*** | I(0) |
| <i>Exr</i> | -4.5302 | 0.000*** | I(1) | 142.3679 | 0.000*** | I(1) |
| <i>Inf</i> | -4.3807 | 0.006*** | I(0) | 130.1516 | 0.000*** | I(0) |
| <i>Ge</i> | -4.8905 | 0.000*** | I(1) | 169.4340 | 0.000*** | I(1) |
| <i>K</i> | -5.7102 | 0.000*** | I(1) | 237.1776 | 0.000*** | I(1) |
| <i>Mmgr</i> | -4.5133 | 0.000*** | I(0) | 158.3744 | 0.000*** | I(0) |
| <i>Ndc</i> | -4.8641 | 0.000*** | I(1) | 194.0180 | 0.000*** | I(1) |
| <i>Dum</i> | -5.8310 | 0.000*** | I(1) | 294.7543 | 0.000*** | I(1) |
| <i>Oilpvol</i> | -3.9879 | 0.000*** | I(0) | 104.3020 | 0.000*** | I(0) |
| <i>Compvol</i> | -3.6001 | 0.000*** | I(0) | 82.5095 | 0.000*** | I(0) |

“***” “**” and “*” represent statistical significance at 1%, 5%, and 10%, respectively. Each model includes trend and constant terms.

Note: Mpr is the Monetary policy rate, Gdpgr is the GDP growth rate, Exr is the exchange rate, Infl is inflation rate, Ge is Government expenditure, K is capital formation, Msgr is money supply growth rate, Ndc is Net Domestic Credit, Oilpvol is Oil price volatility and Compvol is Commodity price volatility.

This study tested for the presence of unit roots (stationarity) using the robust versions of Im, Pesaran and Shin (IPS) and the Augmented Standard Dickey-Fuller Test (ADF) as suggested by Pesaran *et al.* (2003) in order to pave the way for the removal of the influence of cross-sectional dependence. The testing using different approaches are to compare and validate the results and further ensure consistency (See Moon and Perron 2004; Demetriades and Fielding 2010; Ishibashi 2012; Frimpong, 2012). Based on the results obtained, *Ndc, Exr, Mpr, K and Ge* are not stationary in levels but are converted and made stationary after their first differencing, that is I(1) and none is I(2). As shown in the table, the dependent variable is I(1) which thus satisfies the Pesaran *et al.* (2003) condition for testing and running an ARDL model in order to achieve a better estimate. The P-Values are shown at the 1%, 5% and 10% significance levels which show that all the variables are statistically significant and stable or stationary.

Having ascertained the nature of the panel data regarding all the series used in the study, all the variables are treated as I(1) and I(0). This result paves the way for panel cointegration test using ARDL approach. The Westerlund (2007) approach, which was discussed under the methodology, requires I(1) series throughout, therefore it cannot be applied here. The ARDL panel cointegration approach further requires that the dependent variable should be non-stationary in levels, hence *Mpr*, which is the dependent variable, is non-stationary but made to be stationary after the first difference. It is clear that the results of the unit root tests indicate that the P-ARDL approach is more suitable than any other method such as the Engel-Granger two-step (1987) and Johansen (1988) not only because it does not requires series to be order of one but also because of its fitness for both large and small sample sizes (Bahmani-Oskoe and Hegerty, 2009).

5.2.3.1 Panel Cross-Sectional Dependency Test for CEMAC

Furthermore, because of the possibility of cross-sectional dependence among the cross-sectional units, we conduct a cross-sectional dependence test is conducted. This is also known as a poolability test. Particularly, CEMAC is the only bloc in SSA that has an economic union that practices a unified monetary policy; hence there is a tendency for similarities among the cross-

sectional units, which may lead to cross-members correlation. The correlation matrix of the residuals for the Breusch-Pagan LM test of independence will be generated (see Persyn and Westerlund, 2008; Westerlund, 2007). The results of the cross-sectional dependence test are presented in Table 5.4 below.

Table 5.4: Correlation matrix of residuals

| | --e1 | --e2 | --e3 | --e4 | --e5 | --e6 | --e7 | --e8 |
|------|---------|---------|---------|---------|--------|---------|---------|--------|
| --e1 | 1.0000 | | | | | | | |
| --e2 | 0.1742 | 1.0000 | | | | | | |
| --e3 | 0.1509 | 0.6775 | 1.0000 | | | | | |
| --e4 | 0.1218 | 0.6615 | 0.9808 | 1.0000 | | | | |
| --e5 | 0.1219 | 0.2235 | 0.6617 | 0.6895 | 1.0000 | | | |
| --e6 | -0.0047 | 0.4395 | 0.7197 | 0.7777 | 0.6795 | 1.0000 | | |
| --e7 | 0.1728 | 0.6548 | 0.9798 | 0.9797 | 0.6661 | 0.7369 | 1.0000 | |
| --e8 | 0.1226 | -0.3653 | -0.2172 | -0.2210 | 0.0383 | -0.0569 | -0.1812 | 1.0000 |

Breusch-Pagan LM test of independence: $\chi^2(28) = 74.870$, $Pr = 0.0582$ H_0 : There is no Cross-sectional dependence

The results show that the null hypothesis of no cross-sectional dependence is accepted at 5% the level of significance. This indicates that there are unobserved common factors affecting all the countries, hence the need to pool the countries together regardless of any possible heterogeneity. By implication, all the countries are relatively homogenous.

5.2.3.2 Panel ARDL cointegration results for CEMAC

The Panel Auto Regressive Distributed Lag comprises the dynamic regression results for both long and short run relationships between monetary policy dynamics as proxy by Mpr and the identified determinants.

Table 5.5: The Panel ARDL Dynamic Regression for Short run and Long run Estimates for CEMAC

| |
|---|
| Dependent Variable: DMPR |
| Method: ARDL |
| Sample: 1980-2015 |
| Model selection method: Akaike Info Criterion (AIC) |
| Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2, 2) |

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---------------------------|-------------|------------|-------------|--------|
| Long Run Equation | | | | |
| GDPGR | 0.062433 | 0.018483 | 3.377818 | 0.0009 |
| EXR | 0.006932 | 0.002074 | 3.341740 | 0.0011 |
| MSGR | 0.009243 | 0.022647 | 0.408151 | 0.0438 |
| COMPVOL | 0.056647 | 0.047620 | 1.189552 | 0.2361 |
| OILPVOL | 0.117125 | 0.066384 | 1.764357 | 0.0497 |
| DUM | -0.015046 | 0.005553 | -2.709457 | 0.0076 |
| Short Run Equation | | | | |
| COINTEQ01 | -0.229335 | 0.084409 | -2.716962 | 0.0074 |
| D(MPR(-1)) | 0.040331 | 0.115738 | 0.348469 | 0.7280 |
| D(GDPGR) | -0.025729 | 0.013368 | -1.924608 | 0.0562 |
| D(GDPGR(-1)) | -0.016008 | 0.016813 | -0.952110 | 0.3426 |
| D(EXR) | 0.005408 | 0.002647 | 2.043327 | 0.0428 |

| | | | | |
|----------------|-----------|----------|-----------|--------|
| D(EXR(-1)) | -0.000790 | 0.003091 | -0.255435 | 0.7987 |
| D(MSGR) | 0.212445 | 0.144027 | 1.475032 | 0.1423 |
| D(MSGR(-1)) | 0.111829 | 0.086992 | 1.285515 | 0.2006 |
| D(COMPVOL) | -0.001412 | 0.009019 | -0.156557 | 0.8758 |
| D(COMPVOL(-1)) | 0.017810 | 0.009335 | 1.907795 | 0.0584 |
| D(OILPVOL) | -0.008586 | 0.017887 | -0.480021 | 0.6319 |
| D(OILPVOL(-1)) | -0.027544 | 0.015364 | -1.792738 | 0.0751 |
| K | 0.315287 | 0.675951 | 0.466434 | 0.6416 |
| GE | 0.884937 | 2.423264 | 0.365184 | 0.7155 |
| NDC | -5.98E-13 | 1.22E-12 | -0.490247 | 0.6247 |
| INF | -0.007620 | 0.027546 | -0.276629 | 0.7825 |
| DUM | -0.015046 | 0.005553 | -2.709457 | 0.0076 |
| C | 3.076532 | 1.428749 | 2.153305 | 0.0329 |

The results in Table 5.5 show the long run and the short run impacts of the determinants of monetary policy dynamics on the monetary policy rates of CEMAC. The results identified GDP growth rate, exchange rate, financial crisis and oil price volatility as major determinants of monetary policy dynamics in the CEMAC. Specifically the results indicate that all these variables have a significant long-run impact on monetary policy dynamics in the CEMAC except COMPVOL with a value of 0.2361. Other variables that were missing out in the table were considered not significant and therefore do not form part of the determinants of monetary policy in all the blocs. Furthermore, the default parameter estimate of the short run value (COINTEQ01) which is negative and statistically significant is another pointer that this model is appropriate and cointegrated.

However, exchange rate and GDP growth rate have only significant short-run impacts on monetary policy dynamics in the sub-region. The implication of these results is that the impacts of exchange rate and GDP growth rate on the monetary policy dynamics is sustained from the short-run through the long-run period. Consequently, findings from this analysis have underscored the importance of exchange rate, output, money supply, oil price and financial crisis as important variables that can determine monetary policy dynamics in CEMAC.

To further confirm the long-run relationship between monetary policy dynamics and the identified determinants, the result in Table 5.5 were also subjected to Wald test. Apart from the fact that the Wald test is necessary to support the existence of cointegration among the variables, it also investigates the validity of the Panel-ARDL Dynamic regression. The result of the Wald test is presented in Table 5.6 below.

Table 5.6: Wald test for the dynamic panel cointegration for CEMAC

Wald Test:

| Test Statistics | Value | Df | Probability |
|-----------------|----------|----------|-------------|
| F-statistics | 10.24504 | (2, 147) | 0.0001 |
| Chi-square | 20.49007 | 2 | 0.0000 |

Null Hypothesis: $C(1)=0, C(3)=2 * C(4)$

Null Hypothesis Summary:

| Normalised Restriction (=0) | Value | Std. Err. |
|-----------------------------|----------|-----------|
| C(1) | 0.062433 | 0.018483 |
| $C(3) - 2 * C(4)$ | 0.122536 | 0.101231 |

The Wald test result has confirmed the existence of cointegration among the variables in the estimated regression model. Since the p-value is less than 0.05, the null hypothesis of no cointegration can be rejected and the alternative of the existence of long run relationship can be accepted. In addition, the value of the F-Statistics (10.24) is not only positive but larger than the Pesaran upper band critical value of 4.09 even at less than the required 5% level. Consequently it can be concluded that there is a long run relationship between monetary policy rate and its determinants.

5.2.3.3 Measuring the Strength of the Panel-ARDL Regression Model for CEMAC

To further lend credence to the strength of the Akaike Information Criterion (AIC) model over others such as the Schwarz Information Criterion (SIC) and Hannan-Quinn Criterion HQC) in the regression and also determine the long run and short run relationships in this study, the criteria table was employed to determine the top Panel-ARDL models.

Table 5.7: Model summary (lag length selection using AIC) for CEMAC

| Model | LogL | AIC* | BIC | HQ | Specification |
|-------|-------------|----------|----------|----------|------------------------|
| 4 | -287.213834 | 3.148631 | 5.017815 | 3.899044 | ARDL(2, 2, 2, 2, 2, 2) |
| 2 | -299.448799 | 3.179771 | 4.942902 | 3.887606 | ARDL(1, 2, 2, 2, 2, 2) |
| 1 | -353.984488 | 3.286651 | 4.519517 | 3.781604 | ARDL(1, 1, 1, 1, 1, 1) |
| 3 | -346.176512 | 3.288063 | 4.626982 | 3.825592 | ARDL(2, 1, 1, 1, 1, 1) |

Based on the benchmark analysis for the models that says the lower the value, the better the model, the fourth one is the most suitable for the estimation since it has the least AIC value of 3.148631.

5.2.3.4 The Panel-ARDL Error Correction Model for CEMAC

Using the Error Correction Model (ECM), the study investigates the short run and long-run dynamics of the present model. The ECM coefficient shows the speed of adjustment of the variables return to equilibrium.

Table 5.8: Error Correction Coefficient for CEMAC

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|----------|-------------|------------|-------------|--------|
| ECT(-1) | -0.229335 | 0.084409 | -2.716962 | 0.0074 |

A further test to confirm the cointegration among the variables is the ECT value (Engle and Granger, 1987). As shown in Table 5.8, the negative coefficient sign of the ECT shows that there was disequilibrium in the past and the adjustment is in the right direction. Not only that, the ECT value of -0.229335 suggests the relatively low speed of adjustment from the short run

deviation to the long run equilibrium of monetary policy rate. More precisely, it indicates that about 23% deviation from the long run monetary policy rate in CEMAC is corrected in the dynamic model annually or that the system is getting adjusted towards long run equilibrium at the speed of about 23% per year. In addition, the ECT is statistically significant at the 5% level, indicating that long run equilibrium can be attained. These results are consistent with Rabbi and Wuliulah (2011) and Bannerjee *et al.* (1998) where it was argued that a well signed and significant error correction term is a further proof of the existence of a stable long-run relationship. This result further confirms that there will be convergence (steady-state) of the system and the attainment of stable monetary policy rates in CEMAC in the long run.

5.2.3 Analysis of the Determinants of Monetary Policy Dynamics in the Southern Africa Development Community (SADC)

The Southern African Countries are an important sub-region of SSA. It includes members of economic unions called South Africa Development Community (SADC). Eleven countries within the sub-region were taken into consideration in this study. These countries are Botswana, the Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe. Consequently, the starting point is the investigation of the unit root of the variables of interest.

5.2.3.1 Panel Unit root test for SADC

The results of stationarity test for the SADC are presented in Table 5.9 below. As usual both the Panel IPS and ADF unit root tests are employed.

Table 5.9: IPS and ADF - Fisher Chi-square unit root tests for SADC

| Variable | IPS unit root test | | | ADF-Fisher Chi ² unit root test | | |
|--------------|--------------------|----------|----------------------|--|----------|----------------------|
| | t*Statistics | P Value | Order of Integration | t*Statistics | P Value | Order of Integration |
| <i>Mpr</i> | -5.7010 | 0.000*** | I(1) | 290.9724 | 0.000*** | I(1) |
| <i>Gdpgr</i> | -4.6565 | 0.000*** | I(0) | 192.9464 | 0.000*** | I(0) |
| <i>Exr</i> | 0.4066 | 0.000*** | I(1) | 114.4701 | 0.000*** | I(1) |

| | | | | | | |
|----------------|---------|----------|------|----------|----------|------|
| <i>Inf</i> | -3.3079 | 0.006*** | I(0) | 107.1688 | 0.000*** | I(0) |
| <i>Ge</i> | -4.7493 | 0.000*** | I(1) | 212.2624 | 0.000*** | I(1) |
| <i>K</i> | -4.7119 | 0.000*** | I(1) | 196.3591 | 0.000*** | I(1) |
| <i>Mmgr</i> | -2.4259 | 0.000** | I(0) | 79.5410 | 0.000*** | I(0) |
| <i>Ndc</i> | -4.0562 | 0.000*** | I(1) | 163.7939 | 0.000*** | I(1) |
| <i>Dum</i> | -5.8310 | 0.000*** | I(1) | 294.7543 | 0.000*** | I(1) |
| <i>Oilpvol</i> | -3.9879 | 0.000*** | I(0) | 104.3020 | 0.000*** | I(0) |
| <i>Compvol</i> | -3.6001 | 0.000*** | I(0) | 82.5095 | 0.000*** | I(0) |

“***” “**” and “*” represent statistical significance at 1%, 5%, and 10%, respectively. Each model includes trend and constant terms.

Note: Mpr is the monetary policy rate, Gdpgr is the GDP growth rate, Exr is the exchange rate, Inf is inflation rate, Ge is government expenditure, K is Capital formation, Mmgr is money supply growth rate, Ndc is Net domestic credit, Oilpvol is oil price volatility and Compvol is commodity price volatility.

The results of the unit root test also contain the mixture of order zero and order one variables. That is, the variables are integrations of I(0) and I(1). More importantly, the dependent variable is non-stationary at a level which is one of the important criteria for the application of P-ARDL as explained under CEMAC. Here, exchange rate, government expenditures, capital formation, net domestic credit and financial crisis are not stationary in levels but made so after their first differences. As done under CEMAC, all the variables are treated as combination of I(0) and I(1). Accordingly, the cross-sectional dependency test is next.

5.2.3.2 Panel Cross-sectional Dependency Test for SADC

The result of the cross-sectional dependence test is necessary to confirm the poolability of the countries in SADC. The result of the panel cross-sectional dependence test is presented in Table 5.10 as follows.

Table 5.10: Correlation matrix of residuals for SADC

| | --e1 | --e2 | --e3 | --e4 | --e5 | --e6 | --e7 | --e8 | --e9 |
|------|---------|---------|---------|---------|---------|---------|---------|---------|--------|
| --e1 | 1.0000 | | | | | | | | |
| --e2 | 0.1277 | 1.0000 | | | | | | | |
| --e3 | 0.1224 | 0.1209 | 1.0000 | | | | | | |
| --e4 | -0.1705 | 0.2547 | -0.1354 | 1.0000 | | | | | |
| --e5 | 0.0738 | 0.1343 | 0.2113 | -0.1422 | 1.0000 | | | | |
| --e6 | -0.0196 | 0.0138 | -0.4235 | 0.3516 | -0.0227 | 1.0000 | | | |
| --e7 | -0.0417 | 0.6576 | 0.0382 | 0.1144 | 0.4026 | 0.1679 | 1.0000 | | |
| --e8 | -0.1678 | 0.5364 | -0.2011 | 0.2084 | 0.2848 | 0.3937 | 0.7918 | 1.0000 | |
| --e9 | 0.1063 | -0.1830 | 0.0495 | -0.2794 | -0.1487 | -0.0518 | -0.2931 | -0.1834 | 1.0000 |

Breusch-Pagan LM test of independence: $\chi^2(28) = 84.870$, $Pr = 0.0000$ H_0 : There is no cross-sectional dependence.

The results in Table 5.10 show that there is the presence of a common factor and hence cross-sectional correlation is established. The implication is that some countries in the SADC exhibit some salient characteristics that distinguish them from others. In the same reasoning, Chudik and Pesaran (2013) accounts for cross-sectional dependence and with the Augmented DF test suggested by Pesaran *et al.*, (2003) which is employed in this study, the influence of cross-sectional dependence on the results has been removed (see Moon and Perron, 2004; Bai and Ng 2004a; Breitung and Das, 2008).

5.2.3.3 Panel ARDL Cointegration Results for SADC

The dynamic panel regression for the SADC is presented in Table 5.11. It shows both the short run and long run dynamic relationships between monetary policy rates and its determinants in SADC. In the long run, GDP growth rates, exchange rates, inflation rate, oil price volatility, money supply growth rate, commodity price volatility all have a significant impact on monetary

policy dynamics in SADC. The dummy variable for financial crisis is significant but at the 10% level.

The results further indicate that when oil price volatility faces the downward trend it leads to a significant increase in the monetary policy rates in the long run. The same trend is replicated for the relationship between exchange rate and monetary policy rate as well as the financial crisis dummy variable.

However, the short run dynamic model for the SADC is not as good as the long run model because virtually all the variables in the short run fail to have significant impact on the monetary policy rates in the SADC, except the financial crisis at 10%. The implication of this result is that in SADC the identified determinants of monetary policy dynamics appear to have more permanent effects on monetary policy than transitory effects.

Table 5.11: The Panel ARDL Dynamic Regression for Short run and Long run Estimates for SADC

| |
|---|
| Dependent Variable: DMPR |
| Method: ARDL |
| Sample: 1980-2015 |
| Model selection method: Akaike Info Criterion (AIC) |
| Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2, 2) |

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|--------------------------|-------------|------------|-------------|--------|
| Long Run Equation | | | | |
| GDPGR | 0.132832 | 0.038710 | 3.431493 | 0.0008 |
| EXR | -0.000770 | 0.000326 | -2.362692 | 0.0193 |
| MSGR | 0.939721 | 0.013993 | 67.15742 | 0.0000 |
| INF | 0.014118 | 0.003380 | 4.177031 | 0.0000 |

| | | | | |
|---------------------------|-----------|----------|-----------|--------|
| COMPVOL | 0.051408 | 0.021126 | 2.433389 | 0.0160 |
| OILPVOL | -0.065800 | 0.029944 | -2.197472 | 0.0293 |
| DUM | -0.652007 | 0.347188 | -1.877964 | 0.0621 |
| Short Run Equation | | | | |
| COINTEQ01 | -0.171486 | 0.988273 | -1.734426 | 0.0846 |
| D(MPR(-1)) | 0.844235 | 0.745913 | 1.131815 | 0.2593 |
| D(GDPGR) | -0.025821 | 0.038591 | -0.669099 | 0.5043 |
| D(GDPGR(-1)) | -0.013392 | 0.049837 | -0.268722 | 0.7885 |
| D(EXR) | -0.068549 | 1.025282 | -0.066858 | 0.9468 |
| D(EXR(-1)) | 9.635168 | 8.423445 | 1.143851 | 0.2543 |
| D(MSGR) | -0.801601 | 0.748029 | -1.071617 | 0.2854 |
| D(MSGR(-1)) | -0.015865 | 0.058483 | -0.271273 | 0.7865 |
| D(INF) | -0.040624 | 0.042676 | -0.951917 | 0.3425 |
| D(COMPVOL) | -0.084879 | 0.058058 | -1.461965 | 0.1456 |
| D(COMPVOL(-1)) | -0.055200 | 0.031245 | -1.766683 | 0.0791 |
| D(OILPVOL) | 0.094297 | 0.067652 | 1.393848 | 0.1652 |
| D(OILPVOL(-1)) | 0.047797 | 0.038238 | 1.249988 | 0.2130 |
| D(DUM) | -1.949662 | 1.020893 | -1.909761 | 0.0578 |
| D(DUM(-1)) | -41.65305 | 42.58375 | -0.978144 | 0.3294 |
| K | 1.352195 | 1.896081 | 0.713152 | 0.4767 |
| GE | -1.262882 | 1.617582 | -0.780722 | 0.4360 |
| C | 2.189330 | 1.315384 | 1.664404 | 0.0979 |

The results in Table 5.11 further speak volumes of the policy response of the variables to monetary policy dynamics in SADC. All the identified determinants, except the control variables of capital stock and government expenditures, have been shown to be core determinants of the dynamics in monetary policy in SADC during the period under review. To further support the existence of long run relationship among the variables, the Wald test is conducted and the result is presented as follows:

Table 5.12: Wald test for the Dynamic Panel Cointegration for SADC

Wald Test

Summary Equation:

| Test Statistics | Value | Df | Probability |
|-----------------|----------|----------|-------------|
| F-statistics | 1651.985 | (2, 172) | 0.0000 |
| Chi-square | 3303.969 | 2 | 0.0000 |

Null Hypothesis: $C(1)=2 * C(4)$

Null Hypothesis Summary:

| Normalised Restriction (=0) | Value | Std. Err. |
|-----------------------------|----------|-----------|
| C(1) | 0.132832 | 0.038710 |
| C(3) – 2 * C(4) | 0.911486 | 0.016335 |

Table 5.12 further confirms the existence of cointegration between monetary policy rate and its determinants. The null hypothesis of no cointegration is rejected at 1% level. This is an indication that a long-run relationship exists between monetary policy rates and the determinants.

5.2.3.4 Measuring the Strength of the Panel-ARDL Regression Model for SADC

As done under CEMAC, the estimated model is also subjected to strength measurement here. The model summary using table criteria is presented below.

Table 5.13: Model summary (lag length selection using AIC) for SADC

| Model | LogL | AIC* | BIC | HQ | Specification |
|-------|-------------|----------|----------|----------|------------------------------|
| 4 | -552.478280 | 4.388595 | 6.508344 | 5.233496 | ARDL(2, 2, 2, 2, 2, 2, 2, 2) |
| 2 | -570.344581 | 4.435279 | 6.441673 | 5.234999 | ARDL(1, 2, 2, 2, 2, 2, 2, 2) |
| 3 | -707.441918 | 4.952178 | 6.391793 | 5.525987 | ARDL(2, 1, 1, 1, 1, 1, 1, 1) |
| 1 | -731.693759 | 5.036758 | 6.363018 | 5.565386 | ARDL(1, 1, 1, 1, 1, 1, 1, 1) |

Following the selection guiding principle which says that the lower the value, the better; the model with the lowest value of AIC is selected for this analysis with a value of 4.388595. It is obvious from the table that model 4 offers the least AIC and hence it is picked for the estimation. The result further confirms the validity of the dynamic regression panel model for the SADC.

5.2.3.5 The Panel-ARDL Error Correction Model for SADC

The result of the Error Correction Model ECM is necessary to investigate the short run dynamics among the variables in the model. The result is presented in Table 5.14 below.

Table 5.14: Error Correction Coefficient for SADC

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|----------|-------------|------------|-------------|--------|
| ECT(-1) | -0.171486 | 0.988273 | -1.734426 | 0.0846 |

The error correction term is positively signed and it is statistically significant at 5%. The short run model for the SADC can be adjusted to equilibrium whenever there is disequilibrium. The speed of the adjustment is about 17%, though it appears to be slow but equilibrium will surely be achieved whenever there is disequilibrium.

5.2.4 Analysis of Determinants of Monetary Policy Dynamics in the East Africa Community (EAC)

In this community zone, a total number of only five countries are taken into consideration due to the lack of data availability. This sub-region has a vibrant economic union called the East Africa Union (EAU). Countries of interest in this study are Burundi, Kenya, Rwanda, Tanzania

and Uganda. Analysis for this economic bloc also begins with the exploration of time series property of the variables through the unit root tests.

5.2.4.1 Panel Unit root tests for EAC

The results of stationarity test for EAC are presented in Table 5.15 below. As usual both the Panel IPS and ADF unit root tests were employed.

Table 5.15: IPS and ADF - Fisher Chi-square unit root tests for EAC

| Variable | IPS Unit Root Test | | | ADF-Fisher Chi ² Unit Root Test | | |
|----------------|--------------------|----------|----------------------|--|----------|----------------------|
| | t*Statistics | P Value | Order of Integration | t*Statistics | P Value | Order of Integration |
| <i>Mpr</i> | -4.6844 | 0.000*** | I(1) | 57.6671 | 0.000*** | I(1) |
| <i>Gdpgr</i> | -3.1492 | 0.000*** | I(0) | 23.4964 | 0.000*** | I(0) |
| <i>Exr</i> | -3.9023 | 0.000*** | I(1) | 40.4313 | 0.000*** | I(1) |
| <i>Inf</i> | -6.1259 | 0.006*** | I(0) | 98.7155 | 0.000*** | I(0) |
| <i>Ge</i> | -5.3581 | 0.000*** | I(1) | 81.7620 | 0.000*** | I(1) |
| <i>K</i> | -4.3367 | 0.000*** | I(1) | 52.5768 | 0.000*** | I(1) |
| <i>Msg</i> | -3.1744 | 0.000** | I(0) | 25.4526 | 0.000*** | I(0) |
| <i>Ndc</i> | -5.1601 | 0.000*** | I(1) | 69.5453 | 0.000*** | I(1) |
| <i>Dum</i> | -5.8310 | 0.000*** | I(1) | 294.7543 | 0.000*** | I(1) |
| <i>Oilpvol</i> | -3.9879 | 0.000*** | I(0) | 104.3020 | 0.000*** | I(0) |
| <i>Compvol</i> | -3.6001 | 0.000*** | I(0) | 82.5095 | 0.000*** | I(0) |

“***” “**” and “*” represent statistical significance at 1%, 5%, and 10%, respectively. Each model includes trend and constant terms.

Note: *Mpr* is the monetary policy rate, *Gdpgr* is the GDP growth rate, *Exr* is the exchange rate, *Inf* is inflation rate, *Ge* is government expenditure, *K* is Capital formation, *Msg* is money supply

growth rate, *Ndc* is Net domestic credit, *Oilpvol* is oil price volatility and *Compvol* is commodity price volatility.

Following the same pattern as the earlier discussed, the results in Table 5.15 show a combination of I(1) and I(0) series. The *Exr*, *Ge*, *K*, *Ndc* and Financial crisis dummy are all I(1). The implication is that the P-ARDL is also more suitable to be used for the analysis. Notwithstanding, the cross-sectional dependence test is again performed to justify the pool ability of the cross sectional units together.

5.2.4.2 Panel Cross-sectional Dependency Test for EAC

The result of the panel cross-sectional dependence test for EAC is presented in Table 5.16 below.

Table 5.16: Correlation matrix of residuals for EAC

| | --e1 | --e2 | --e3 |
|------|--------|--------|--------|
| --e1 | 1.0000 | | |
| --e2 | 0.1277 | 1.0000 | |
| --e3 | 0.1224 | 0.1209 | 1.0000 |

Breusch-Pagan LM test of independence: chi2 (28) = 5.570, Pr =0.1345 H₀: There is no cross-sectional dependence.

The results in Table 5.16 show that there is no presence of a common factor and hence the null hypothesis of no cross sectional-dependence is accepted and the alternative of the presence of cross-sectional dependence is rejected. The implication is that all countries in the EAC have similar characteristics that can enable them to be pooled together in the panel. Apart from this, Chudik and Pesaran (2013) accounts for cross-sectional dependence and with the Augmented DF test suggested by Pesaran *et al.*, (2003) which is employed in this study, the influence of cross-sectional dependence on our results has been removed (see Moon and Perron, 2004; Bai and Ng, 2004a; Breitung and Das, 2008).

5.2.4.3 Panel ARDL cointegration results for EAC

Since the issue of cross-sectional dependence is cleared, the dynamic panel regression can now be estimated. The result is presented in Table 5.17 below.

Table 5.17: The Panel-ARDL Dynamic Regression for Short run and Long run Estimates for EAC

| |
|---|
| Dependent Variable: DMPR |
| Method: ARDL |
| Sample: 1980-2015 |
| Model selection method: Akaike Info Criterion (AIC) |
| Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2) |

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---------------------------|-------------|------------|-------------|--------|
| Long Run Equation | | | | |
| GDPGR | -0.165427 | 0.453292 | -0.364946 | 0.7167 |
| EXR | 0.004849 | 0.006481 | 0.748232 | 0.4578 |
| MSGR | -0.863008 | 0.091861 | 9.394747 | 0.0000 |
| INF | 0.036601 | 0.042869 | 0.853774 | 0.3972 |
| OILPVOL | 0.700412 | 0.331922 | 2.110173 | 0.0398 |
| COMPVOL | 0.310353 | 0.257276 | 1.206305 | 0.0333 |
| DUM | 0.406987 | 0.956704 | 0.786941 | 0.4562 |
| Short Run Equation | | | | |
| COINTEQ01 | -0.208653 | 0.144932 | -1.439656 | 0.0461 |
| D(MPR(-1)) | -0.158729 | 0.264989 | -0.599003 | 0.5518 |
| D(GDPGR) | 0.070867 | 0.082059 | 0.863605 | 0.3918 |
| D(GDPGR(-1)) | -0.173072 | 0.064737 | -2.673475 | 0.0101 |

| | | | | |
|----------------|-----------|----------|-----------|--------|
| D(EXR) | 0.027428 | 0.022143 | 1.238712 | 0.2211 |
| D(EXR(-1)) | 0.087276 | 0.092209 | 0.946509 | 0.3484 |
| D(MSGR) | 0.243799 | 0.387346 | 0.629409 | 0.5319 |
| D(MSGR(-1)) | 0.125009 | 0.209358 | 0.597107 | 0.5531 |
| D(INF) | 0.048262 | 0.035415 | 1.362724 | 0.1790 |
| D(OILPVOL) | -0.099135 | 0.093198 | -1.063702 | 0.2925 |
| D(OILPVOL(-1)) | -0.070162 | 0.071326 | -0.983686 | 0.3299 |
| D(COMPVOL) | 0.052316 | 0.049996 | 1.046403 | 0.3003 |
| D(COMPVOL(-1)) | 0.049796 | 0.037769 | 1.318424 | 0.1933 |
| GE | -1.429290 | 1.897557 | -0.753226 | 0.4548 |
| K | 0.418859 | 0.785440 | 0.533279 | 0.5962 |
| NDC | 2.94E-12 | 2.54E-12 | 1.160740 | 0.2512 |
| C | 1.915965 | 2.048613 | 0.935250 | 0.3541 |

The dynamic regression results for the EAC are an indication that the long run model appears to be more significant than the short run model. Out of the variables used as the determinants of monetary policy dynamics in the region, three variables appear to be very important in dictating the pace of monetary policy dynamics. These variables are money supply growth rate, oil price volatility and commodity price volatility. All other variables fail to have a significant impact on monetary policy dynamics in the region. While the fall in oil price may have a downward effect on the monetary policy dynamism, commodity price volatility tends to have a contrary effect on monetary policy dynamics. However, the expected inverse relationship between money supply and MPR is achieved and it is significant. In the short run model, none of the variables except the GDP growth rate has a significant impact on the monetary policy dynamics in

the EAC. All other variables fail to have immediate or instant impact on the monetary policy dynamics.

On the whole in the EAC, the dominant variables in the determination of the monetary policy dynamics are the GDP growth rate, money supply growth rate, and oil and commodity price volatilities. The existence of co-movement (long-run relationship) between monetary policy and its determinants is further subjected to confirmation using the Wald test. The result is presented in Table 5.18 below.

Table 5.18: Wald test for the Dynamic Panel cointegration for EAC

Wald Test:

Summary Equation:

| Test Statistics | Value | Df | Probability |
|-----------------|----------|---------|-------------|
| F-statistics | 15.23220 | (2, 51) | 0.0000 |
| Chi-square | 30.46439 | 2 | 0.0000 |

Null Hypothesis: $C(1)=0, C(3)=2*C(4)$

Null Hypothesis Summary:

| Normalised Restriction (=0) | Value | Std. Err. |
|-----------------------------|----------|-----------|
| C(1) | 0.165427 | 0.453292 |
| $C(3) - 2*C(4)$ | 0.789807 | 0.143614 |

Both the F-Statistics and Chi square tests in the above table show that the hypothesis of no cointegration is rejected. Hence, the Wald test has confirmed the existence of a long run relationship between monetary policy dynamics and its determinants in the EAC.

5.2.4.4 Measuring the Strength of the Panel-ARDL Regression Model for EAC

The estimated model is also subjected to strength measurement and the result is presented in the table below. It should be note that AIC is also the preferred choice.

Table 5.19: Model summary (lag length selection using AIC) for EAC

| Model | LogL | AIC* | BIC | HQ | Specification |
|-------|-------------|----------|----------|----------|---------------------------|
| 4 | -137.522189 | 3.814161 | 5.281057 | 4.408157 | ARDL(2, 2, 2, 2, 2, 2, 2) |

| | | | | | |
|---|-------------|----------|----------|----------|---------------------------|
| 3 | -158.170791 | 3.924917 | 5.005789 | 4.362599 | ARDL(2, 1, 1, 1, 1, 1, 1) |
| 2 | -149.923948 | 3.998509 | 5.388200 | 4.561242 | ARDL(1, 2, 2, 2, 2, 2, 2) |
| 1 | -165.800006 | 4.015686 | 5.019352 | 4.422105 | ARDL(1, 1, 1, 1, 1, 1, 1) |

The model summary for the EAC shows that model 4 gives the lowest AIC value of 3.8141. Therefore, running the dynamics regression model with the AIC specification as shown in model 4 is actually the best.

5.2.4.5 The Panel-ARDL Error Correction Model for EAC

The result of the Error Correction Model (ECM) is necessary to investigate the short run dynamics among the variables in the model. The result is presented thus.

Table 5.20: Error Correction Coefficient for EAC

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|----------|-------------|------------|-------------|--------|
| ECT(-1) | -0.208653 | 0.144932 | -1.439656 | 0.0461 |

The panel error correction model for EAC in Table 5.20 above is a confirmation that the ECT is in right direction of bringing about equilibrium whenever there is disequilibrium. The speed of adjustment is about 21%.

5.2.5 Analysis of the Determinants of Monetary Policy Dynamics in the Economic Community of West African States (ECOWAS).

ECOWAS is one of the important economic blocs in SSA. The sub region of West Africa constitutes a very large proportion of SSA's total GDP. As noted in chapter four, the countries selected as a result of data constraints are Benin Republic, Burkina Faso, Cape Verde, Ivory Coast, The Gambia, Ghana, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The analysis begins with unit root tests to ascertain the levels of stationarity of the variables.

5.2.5.1 Panel Unit root tests for ECOWAS

The results of stationarity tests for ECOWAS are presented in Table 5.21 by undertaking the IPS and ADF unit root tests.

Table 5.21: IPS and ADF - Fisher Chi-square unit root tests for ECOWAS

| Variable | IPS unit root test | | | ADF-Fisher Chi-square unit root test | | |
|----------------|--------------------|----------|----------------------|--------------------------------------|----------|----------------------|
| | t* Statistics | P Value | Order of Integration | t* Statistics | P Value | Order of Integration |
| <i>Mpr</i> | -6.3033 | 0.000*** | I(1) | 486.3563 | 0.000*** | I(1) |
| <i>Gdpgr</i> | -5.4769 | 0.000*** | I(0) | 385.7930 | 0.000*** | I(0) |
| <i>Exr</i> | -4.5175 | 0.000*** | I(1) | 251.1183 | 0.000*** | I(1) |
| <i>Inf</i> | -3.7920 | 0.006*** | I(0) | 172.5686 | 0.000*** | I(0) |
| <i>Ge</i> | -5.0805 | 0.000*** | I(1) | 322.8295 | 0.000*** | I(1) |
| <i>K</i> | -5.6764 | 0.000*** | I(1) | 409.8717 | 0.000*** | I(1) |
| <i>Msgr</i> | -5.1115 | 0.000*** | I(0) | 338.8278 | 0.000*** | I(0) |
| <i>Ndc</i> | -3.9274 | 0.000*** | I(1) | 239.8733 | 0.000*** | I(1) |
| <i>Dum</i> | -5.8310 | 0.000*** | I(1) | 294.7543 | 0.000*** | I(1) |
| <i>Oilpvol</i> | -3.9879 | 0.000*** | I(0) | 104.3020 | 0.000*** | I(0) |
| <i>Compvol</i> | -3.6001 | 0.000*** | I(0) | 82.5095 | 0.000*** | I(0) |

“***” “**” and “*” represent statistical significance at 1%, 5%, and 10%, respectively. Each model includes trend and constant terms.

Note: Mpr is the monetary policy rate, Gdpgr is the GDP growth rate, Exr is the exchange rate, Inf is inflation rate, Ge is government expenditure, K is Capital formation, Msgr is money supply growth rate, Ndc is Net domestic credit, Oilpvol is oil price volatility and Compvol is commodity price volatility.

The above unit root test results show a combination of I(1) and I(0) series. The variables that are stationary in levels are *Mpr*, *Exr*, *Ge*, *K*, *Ndc* and the dummy for financial crisis. By implication, the Panel-ARDL is also more suitable to be used for the analysis. Notwithstanding, the cross-sectional dependence test is first carried out to investigate the poolability of the cross-sectional unit.

5.2.5.2 Panel Cross-sectional Dependency Test for ECOWAS

The result of the panel cross-sectional dependence test for ECOWAS is presented in Table 5.22 below.

Table 5.22: Correlation matrix of residuals for ECOWAS

| | --e1 | --e2 | --e3 | --e4 | --e5 | --e6 | --e7 | --e8 | --e9 |
|------|---------|---------|---------|---------|---------|---------|---------|--------|--------|
| --e1 | 1.0000 | | | | | | | | |
| --e2 | 0.8111 | 1.0000 | | | | | | | |
| --e3 | 0.0921 | 0.0586 | 1.0000 | | | | | | |
| --e4 | 0.8415 | 0.8655 | 0.0579 | 1.0000 | | | | | |
| --e5 | -0.1101 | -0.3452 | -0.2368 | -0.2195 | 1.0000 | | | | |
| --e6 | -0.1151 | -0.1209 | 0.1086 | -0.1541 | -0.1579 | 1.0000 | | | |
| --e7 | -0.0972 | -0.0184 | 0.0072 | -0.1562 | 0.1208 | 0.1364 | 1.0000 | | |
| --e8 | 0.1379 | 0.1337 | 0.0623 | 0.0968 | -0.1003 | 0.0943 | 0.0527 | 1.0000 | |
| --e9 | 0.8504 | 0.8866 | -0.0361 | 0.9102 | -0.2602 | -0.0527 | -0.2201 | 0.1564 | 1.0000 |

Breusch-Pagan LM test of independence: $\chi^2(36) = 167.510$, $Pr = 0.0000$ H_0 : There is no cross-sectional dependence.

The presence of a common factor is confirmed from the cross-sectional dependence test. The implication is that individual countries in ECOWAS possess some characteristics that distinguish them from one another. However, the ADF test has been shown to be capable of removing the effect of cross sectional dependence so the dynamic panel model regression (see Moon and Perron, 2004; Bai and Ng, 2004a; Breitung and Das, 2008)

5.2.5.3 Panel ARDL cointegration results for ECOWAS

The Panel ARDL cointegration tests the existence of cointegration as well as estimate the dynamic regression model for the ECOWAS. The result as presented in Table 5.23 shows that all

the variables in the long run have significant impact on the monetary policy rates except money supply and dummy variable for financial crisis.

The dominance of oil price volatility, commodity price volatility, GDP growth rate, exchange rate and inflation rate in determining the monetary policy rate in the ECOWAS region is confirmed from the estimated dynamic regression model. The coefficient of the GDP growth rate in the estimated model is negative and it is significant. This simply indicates that GDP growth rate shows an inverse significant relationship with the MPR in the ECOWAS sub-region.

Exchange rate coefficient in the estimated model is positive and significant. The implication is that a direct relationship exists between EXR and MPR in the ECOWAS region. In essence, an upward movement in the exchange rate is capable of exerting upward pressure on the MPR as well.

Oil price movement shows a significant positive relationship with MPR in the ECOWAS region. This also indicates that a downward movement in the oil price is capable of exerting downward pressure on the monetary policy rate (MPR). However, oil price volatility has been shown as an important determinant of monetary policy dynamics in the ECOWAS sub region.

Table 5.23: The Panel ARDL Dynamic Regression for Short run and Long run Estimates for ECOWAS

| |
|---|
| Dependent Variable:DMPR |
| Method: ARDL |
| Sample: 1980-2015 |
| Model selection method: Akaike Info Criterion (AIC) |
| Selected Model: ARDL(1, 2, 2, 2, 2, 2, 2, 2) |

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|--------------------------|-------------|------------|-------------|--------|
| Long Run Equation | | | | |
| GDPGR | -0.101560 | 0.036259 | -2.803703 | 0.0055 |
| EXR | 0.010795 | 0.000637 | 16.93373 | 0.0000 |

| | | | | |
|---------------------------|-----------|----------|-----------|--------|
| INF | 0.048241 | 0.013916 | 3.466658 | 0.0006 |
| MSGR | 0.002929 | 0.009482 | 0.308941 | 0.7576 |
| OILPVOL | 0.055371 | 0.032688 | 1.693962 | 0.0415 |
| COMPVOL | 0.068392 | 0.022462 | 3.044801 | 0.0026 |
| DUM | 0.356198 | 0.495360 | 0.719068 | 0.4728 |
| Short Run Equation | | | | |
| COINTEQ01 | -0.319365 | 0.083488 | -3.825277 | 0.0002 |
| D(GDPGR) | -0.033363 | 0.030941 | -1.078278 | 0.2820 |
| D(GDPGR(-1)) | -0.022560 | 0.029304 | -0.769848 | 0.4421 |
| D(EXR) | -2.633932 | 2.601400 | -1.012506 | 0.3123 |
| D(EXR(-1)) | -0.086197 | 0.133327 | -0.646506 | 0.5186 |
| D(INF) | 0.007016 | 0.009925 | 0.706881 | 0.4803 |
| D(MSGR) | 0.100617 | 0.075656 | 1.329935 | 0.1848 |
| D(MSGR(-1)) | -0.011411 | 0.014412 | -0.791798 | 0.4292 |
| D(OILPVOL) | 0.018720 | 0.014065 | 1.330971 | 0.1844 |
| D(OILPVOL(-1)) | 0.070849 | 0.053293 | 1.329413 | 0.1850 |
| D(COMPVOL) | -0.010010 | 0.007950 | -1.259131 | 0.2092 |
| D(COMPVOL(-1)) | -0.042093 | 0.029679 | -1.418272 | 0.1574 |
| D(DUM) | 0.170606 | 0.653588 | 0.261030 | 0.7943 |
| D(DUM(-1)) | -0.077205 | 0.786269 | -0.098191 | 0.9219 |
| K | -7.260720 | 6.063524 | -1.197442 | 0.2323 |
| GE | -1.591511 | 4.353377 | -0.365581 | 0.7150 |

| | | | | |
|-----|----------|----------|----------|--------|
| NDC | 1.31E-10 | 9.49E-11 | 1.384319 | 0.1675 |
| C | 5.590883 | 2.099238 | 2.663292 | 0.0083 |

Commodity price volatility has a positive and significant coefficient from the estimated model, thus implying that an upward commodity price movement is capable of also bringing about upward pressure on the MPR. Therefore commodity price movement has also been shown as an important determinant of monetary policy dynamics.

Inflation rate coefficient is positive and significant. This also indicates that upward inflation rate will put upward pressure on the MPR. The implication is that whenever the inflation rate is rising, monetary policy rates are also adjusted upward. Inflation rate is also identified as an important determinant of monetary policy dynamics in the ECOWAS sub-region.

Net domestic credit, capital formation and government expenditure appear not to have a significant impact on the movement of MPR. This is because their coefficients are not significant in the estimated dynamic model. Moreover in the short run, none of the explanatory variables used have an individual significant impact on MPR. This implies that the long run dynamic model of the ECOWAS is more important in the determination of MPR. The Wald test is conducted to further confirm the existence of a long run relationship between MPR and the identified determinants. The result is presented in the table below.

Table 5.24: Wald test for the Dynamic Panel cointegration for ECOWAS

Wald Test

Summary Equation:

| Test Statistics | Value | Df | Probability |
|-----------------|----------|----------|-------------|
| F-statistics | 7.255151 | (2, 244) | 0.0009 |
| Chi-square | 14.51030 | 2 | 0.0007 |

Null Hypothesis: $C(1)=0, C(3)=2 \cdot C(4)$

Null Hypothesis Summary:

| Normalised Restriction (=0) | Value | Std. Err. |
|-----------------------------|-----------|-----------|
| C(1) | -0.101660 | 0.036259 |
| $C(3) - 2 \cdot C(4)$ | 0.042382 | 0.024298 |

The F-Statistic and Chi-square tests in Table 5.24 show that the hypothesis of no cointegration is rejected. Hence, the Wald test has confirmed the existence of a long run relationship between monetary policy dynamics and its determinants in the ECOWAS sub region.

5.2.5.4 Measuring the Strength of the P-ARDL Regression Model for ECOWAS

The estimated model is also subjected to strength measurement using table criteria and the summary for ECOWAS shows that model 4 gives the lowest AIC value. Therefore, running the dynamic regression model with the AIC specification as shown in model 2 is actually the best.

Table 5.25: Model summary (lag length selection using AIC) for ECOWAS

| Model | LogL | AIC* | BIC | HQ | Specification |
|-------|-------------|----------|----------|----------|------------------------------|
| 2 | -536.815000 | 3.357869 | 5.631609 | 4.252100 | ARDL(1, 2, 2, 2, 2, 2, 2, 2) |
| 4 | -526.765242 | 3.374537 | 5.771182 | 4.317104 | ARDL(2, 2, 2, 2, 2, 2, 2, 2) |
| 1 | -638.761431 | 3.433593 | 4.969903 | 4.037802 | ARDL(1, 1, 1, 1, 1, 1, 1, 1) |
| 3 | -628.997826 | 3.451468 | 5.110683 | 4.104014 | ARDL(2, 1, 1, 1, 1, 1, 1, 1) |

5.2.5.5 The Panel-ARDL Error Correction Model for ECOWAS

The result of the Error Correction Model (ECM) is necessary to investigate the short run dynamics among the variables in the model. The result is presented in Table 5.26.

Table 5.26: Error Correction Coefficient for ECOWAS

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|----------|-------------|------------|-------------|--------|
| ECT(-1) | -0.319365 | 0.083488 | -3.825277 | 0.0002 |

The panel error correction model for ECOWAS in Table 5.26 shows that the error correction term is negative and significant. This means that the disequilibrium in the past is adequately corrected in the present and the speed of adjustment is about 31%. However, the error correction model has indicated that adjustment to equilibrium is convergent in nature. Hence a stable equilibrium is possible.

5.2.4 Discussion of Results on Determinants of Monetary Policy Dynamics in SSA

Findings from the results on the analysis of the determinants of monetary policy dynamics in the SSA have shown that there are various degrees of relationship between MPR and its determinants depending on the economic bloc. This has justified the need to break SSA into economic blocs or sub-regions. Notwithstanding, there exist some similarities as well but this is not as common as the differences.

As noted in chapter four, that both oil price and commodity price volatilities are among the factors affecting monetary policy dynamics in the SSA, analysis therefore begins with the examination of volatilities of both oil and commodity prices. It has been discovered that the two prices are actually volatile during the period under review and the nature of their volatility is symmetric and not asymmetric. The implication is that positive news is capable of causing more volatility in the prices than negative news. This finding is similar to that of Demachi (2012) who posited that in the oil producing countries and in many SSA countries, commodity and oil prices have more of a symmetric effect than asymmetric effect. The residuals of the conditional variance of the two prices are then used as their volatilities.

Again, the results across the economic blocs have shown that MPR is integration of order one $I(1)$. Virtually all other variables also exhibit the same level of integration across the four economic blocs. Based on the results from the unit root tests, the Panel-ARDL is found to be suitable for the analysis of the determinants of monetary policy dynamics in SSA.

However, on the cross-sectional dependence test, CEMAC and EAC displayed unique common factors affecting the result. The implication is that these two economic blocs comprise countries that demonstrate the same pattern of behaviour in terms of studying the determinants of monetary policy dynamics. The reason behind this result might not be unconnected with the unique characteristics which the two economic blocs possess in terms of monetary policy administration. For instance, CEMAC comprises six countries with the same monetary structure. The six countries operate under a single monetary system with the same currency and exchange rate policies. The monetary policy is controlled by one Central Bank (BEAC) located in Cameroon. For the EAC, the arrangement to operate a unified monetary policy has been finalized by each member country and each country has started reshaping its monetary policy framework to reflect a unified monetary policy administration across the member countries. Therefore, the absence of cross-sectional dependence is strongly linked with the unified monetary system in operation in the two economic

blocs. This finding is empirically supporting the views of Omolade and Ngalawa (2014) where the responses of the monetary policy to some external shocks were found to be similar across the individual countries that make up CEMAC. The results of the dynamic panel regression can be summarized as follows.

Firstly, GDP growth rate has been identified as an important determinant of monetary policy dynamics in SSA. The results across the four economic blocs indicate that GDP growth rate impacts significantly on the monetary policy rates except in the EAC. For SADC and CEMAC, the GDP growth rate exhibits a significant positive relationship with MPR while in ECOWAS it exhibits a negative and significant relationship with MPR. The implication of the result is that in both SADC and CEMAC, whenever the dynamics of MPR are upward, the growth rate also rises and vice versa. But in ECOWAS there exists a significant inverse relationship between MPR and GDP growth rate. The implication is that as the GDP growth rate rises, MPR dynamics falls. According to Obamuyi and Demachi (2012), this result speaks volume about the financial deepening in the economies; the rise in MPR might not discourage growth as the financial deepening has positive and significant impact on the output growth. It appears that the effect of money supply on the output is more significant positively in the CEMAC and SADC than ECOWAS and that is why GDP growth rate increase also attracts increased MPR. According to Obamuyi and Demehin (2012), an economy with weak financial deepening may need to lower MPR considerably before the impact can be felt on the economy. This is because the money released for the purpose of output growth would not have the immediate expected positive impact on growth and hence the need to continue to lower the MPR. This appears to be the case with ECOWAS.

Secondly, the money supply growth rate used in this study is measured as a percentage of the GDP and therefore can be used as a proxy for the financial deepening. In the four economic blocs, money supply growth rate shows significant relationship with MPR in SADC, EAC and CEMAC but not in ECOWAS. This is an indication that the two key instruments of monetary policy, namely money supply and interest rate, are significantly related in SADC, EAC and CEMAC. In addition, it shows that dynamics in monetary policy can be significantly influenced by money supply availability for growth purpose in the economy. However, this situation is not so in ECOWAS where the money supply growth rate fails to influence MPR significantly. The

finding here further corroborates the position stated earlier that there appears to be a weak financial deepening in the ECOWAS sub-region compared to other economic blocs in SSA.

Thirdly, exchange rate has been shown to have significant relationship with the MPR in all the four blocs except EAC. While the exchange rate exhibits a positive relationship with MPR in ECOWAS and CEMAC, it shows a negative relationship in SADC. The implication of this result is that any fall in the value of domestic currencies in both CEMAC and ECOWAS will cause upward movement of the MPR. The situation is very evident in the Nigerian economy which is the largest economy in ECOWAS where the MPR has been on an upward movement since the devaluation of the currency (naira) in 2015. The same thing is noticed in the unified currency CFA of the CEMAC. The reason behind this might not be unconnected with the efforts of the monetary authorities in these countries to always minimize the inflationary effect of the depreciation with the increase in the interest rate (see Sanchez, 2005). However, the reverse is the case for SADC where currency appreciation is capable of causing upward movement in the MPR. The implication of this is that in SADC, savings are likely to bring a high return which invariably allows investors to move their funds to countries with high interest rate (see Petinger, 2012). In summary, exchange rate has been largely identified as an important factor that influences monetary policy dynamics across the economic blocs in SSA.

Again, findings from the study have shown that ECOWAS and SADC are the only economic blocs in SSA where inflation plays an important role in determining monetary policy dynamics. To a large extent, it speaks volumes about the influence of consumer price on the two economic blocs. This result supports the view of Cochrane (2016) that the consumer price index affects ECOWAS and SADC in SSA more than any sub-region in SSA because they both account for more than 76% of imported commodities in the whole of SSA. This singular reason is capable of exposing the economies in these two economic blocs to external cyclical changes in prices which exert inflation pressure on the domestic economies (see Petinger, 2012; Cochrane, 2016). In addition, the monetary authorities of these countries appear to be fond of using MPR to regulate inflation rate significantly. This action among others culminates in the significant relationship which exists between MPR and inflation rate.

The influences of oil price and commodity price volatilities on MPR appear to be mostly pronounced across the four economic blocs of the SSA. The recent dynamics in the oil price has been shown to have a significant influence on monetary policy dynamics in all the four economic

blocs. The reason behind this might not be unconnected with the fact that oil accounts for a high percentage of the GDP in SSA. Therefore, the result about the significant influence of oil price volatility on the MPR is expected. More importantly, the relationship with MPR is positive in CEMAC and ECOWAS while it is negative for EAC and SADC. The result appears to give a clear distinction between oil dominant economies and the economies where oil is less dominant. All the economies in the CEMAC are net oil exporters while the largest net oil exporter in SSA, Nigeria, belongs to ECOWAS. The implication is that downward movement in oil price volatility is capable of causing downward movement in the MPR in economies where oil sectors are dominant. This is because oil is the major foreign exchange earner in most of the economies in these economic blocs, therefore in order to promote domestic investment, MPR will need to be reviewed downward (see Kutu and Ngalawa, 2015). However, the reverse is the case for countries in the EAC and SADC which are more oil importers than exporters. The inverse relationship exhibited by oil price volatility shows that a reduction in oil price is expected to reduce the cost of industrial inputs and therefore boost economic activities within the SADC region. This has not been the case especially in recent time where increasing cost of doing business has been a major contending issue especially in South Africa which is the dominating economy within the sub-region. In line with economic theory, a reduction in oil price may not necessarily promote growth in Less Developing economies as observed by Mork (1989); Hamilton (1988); Herrera *et al.*, (2011); Aye *et al.*, (2014).

For commodity price volatility, the relationship is also significant for all the four economic blocs. This is an indication that commodity price volatility is an important determinant of monetary policy dynamics in the SSA. The implication is that a downward movement in the commodity price volatility is capable of putting downward pressure on MPR. The argument behind this can be traced to the fall in commodity prices in recent times that has led to a drastic fall in income of many SSACs. Therefore monetary policy is relied on to improve domestic output and this causes a downward review of the MPR to boost domestic output. This argument is further supported due to the fact that SSA comprises countries that are largely primary commodity exporters (see Deaton 1999).

Net domestic credit, government expenditure and capital formation appear not to have significant impact on monetary policy rate in the four economic blocs of SSA. The implication is that these three variables might not have an important role to play in determining monetary policy

dynamics in SSA. However, the financial crisis appears to have more dominance in the CEMAC than the remaining three economic blocs.

Finally, this study has confirmed money supply growth rate, exchange rate, GDP growth rate, inflation, commodity price volatility and oil price volatility as important determinants of monetary policy dynamics in SSA. Net domestic credit, government expenditure and capital formations are not important determinants of monetary policy dynamics in SSA.

5.3 Examining the Impact of Monetary Policy Dynamics on the Growth of SSA

The growth model used in chapter four to derive the model specification for this objective necessitated the use of production function since the study is concerned with output growth and consequently the variable appears in log form. The estimating technique adopted here is panel data. This is because all the variables have been made stationary as shown in Table 5.27. But yet panel ARDL cannot be used since the dependent variable (which is the GDP growth rate) is stationary in levels for all SSA (see Pedroni 2000). The study uses both the fixed and random effects and the Hausman test is conducted to ascertain the model that gives a better result (see Pedroni, 2000). In addition, the dynamic panel model is estimated as a robust check as well as to check consistency in the results. Furthermore, the fixed effects least square dummy variable was also adopted to test for the cross-sectional dependence. The analysis of the panel unit root test is conducted first and discussed as follows.

5.3.1 Panel Unit root test for SSA

As noted earlier, one important criterion for panel analysis is that all the variables must be made stationary. This is the reason why it is important to begin the analysis with the unit root test (Pedroni, 2000). The result is presented in Table 5.27 below.

Table 5.27: Panel Unit root tests for the whole SSA

| Variables | IPS unit root test | | ADF-Fisher Chi ² unit root test | | LLC unit root test | |
|------------|--------------------|----------------------|--|----------------------|--------------------|----------------------|
| | t* Statistics | Order of Integration | t* Statistics | Order of Integration | t* Statistics | Order of Integration |
| <i>Mpr</i> | -1.8165*** | I(0) | 1111.4330** | I(1) | -9.6675*** | I(0) |

| | | | | | | |
|--------------|------------|------|-------------|------|-------------|------|
| <i>Gdpgr</i> | -4.8033*** | I(0) | 772.7790*** | I(0) | -19.7990*** | I(0) |
| <i>Exr</i> | -3.1168** | I(1) | 570.5235** | I(1) | -32.2307** | I(2) |
| <i>Inf</i> | -3.7179*** | I(0) | 453.4714*** | I(0) | -16.3528*** | I(0) |
| <i>Ge</i> | -5.0185** | I(1) | 825.2299** | I(1) | -21.5292** | I(1) |
| <i>K</i> | -5.2683** | I(1) | 912.0424** | I(1) | -20.5313** | I(1) |
| <i>Mmgr</i> | -4.0604*** | I(0) | 621.1645*** | I(0) | -20.4252** | I(0) |
| <i>Ndc</i> | -3.9345** | I(1) | 631.3320** | I(1) | -34.9641** | I(2) |

Note: *Mpr* is the monetary policy rate, *Gdpgr* is the GDP growth rate, *Exr* is the exchange rate, *Inf* is inflation rate, *Ge* is government expenditure, *K* is Capital formation, *Mmgr* is money supply growth rate, *Ndc* is Net domestic credit.

The result from the unit root tests is an indication that all the variables are stationary and are between order one and zero. In other words they are all integration of order 1 and 0 [I(1) and I(0)]. Three methods of panel unit root tests are used namely the IPS, ADF and LLC. Though a few are I(2) under the LLC. they are all I(1) and I(0) under the IPS and ADF, which is enough to accept them as integration of order one and zero, that is I(1) and I(0). Notwithstanding, the aim here is that all of them must be made stationary and this has been achieved thus paving the way for panel analysis.

5.3.2 Fixed and Random Effects Estimation for GDP growth in SSA

The results of both the fixed and random effects for the whole of SSA are presented in Table 5.28. Notwithstanding, the Hausman test is also conducted to determine which of the estimated results is more reliable. Both the results of the random and the fixed effects appear to be similar considering the coefficients of the variables and the level of significance. But then as earlier said, the result of the Hausman test is necessary to determine which of the two results to continue with. According to the Hausman test, the probability of the Chi Square is significant; this simply indicates that fixed effect results are more preferable in this case.

From the coefficients relationship estimated in the fixed effect result for the whole of SSA, it is clear that monetary policy rate exhibits an inverse relationship with the economic growth of SSA.

Table 5.28: Fixed and Random Effects results for GDPGR in SSA

| Variables | Coefficients | |
|-----------|---------------------------|--------------------------|
| | FE | RE |
| LMPR | -.2095717** (.0999297) | -.1826521** (.084522) |
| LEXR | .0680286** (.035413) | .028349 (.0200705) |
| LINF | -.0095697 (.030468) | -.02683 (.0288695) |
| LGE | .0076767 (.0704102) | -.0867585 (.0589125) |
| LK | -.0002544 (.0599627) | .073681 (.0546484) |
| LMSGR | .0308708** (.0458685) | .0882944** (.0445484) |
| LNDC | .0146354 (.0282426) | .0075224 (.0210254) |
| CONS | 1.360292 (.7149213) | 1.461172** (.5220391) |

| | | |
|---------------------------|---------|---------|
| F(7,813)/ Wald chi2(7) | 3.06*** | 17.26** |
|---------------------------|---------|---------|

* Statistical significance at 10%, ** Statistical significance at 5%, *** Statistical significance at 1%

Table 5.29: Hausman test for SSA

| | |
|-----------|---------|
| chi2(5) | 35.28 |
| Prob>chi2 | 0.00000 |

However, apart from the fact that this relationship is correct theoretically, it is also statistically significant. This is an indication that monetary policy rates play an important role in determining the level of economic growth in SSA. The consistency in the result is also very important. This is because both the random and the fixed effects models show that monetary policy rate coefficients are statistically significant.

Again, the fixed effect results have established a significant relationship between exchange rate and the economic growth of SSA. The relationship is positive thus indicating that currency appreciation might not be good for the economic growth of the region. Furthermore, exchange rate as a variable has been confirmed by the estimated model as an important variable impacting on the economic growth of SSA.

Money supply growth rate coefficient in the estimated model also shows a significant positive relationship with the SSA economic growth. Since the ratio of the money supply to the GDP is used here, this simply indicates the impact of financial deepening on the growth potentials of SSA economy.

In addition, the fixed effects result has also shown that apart from the three variables discussed above, (that is, monetary policy rate, exchange rate and money supply growth rate) none of the remaining explanatory variables in the model show a significant relationship with the economic growth of SSA. This singular reason further underscores the importance of the monetary policy dynamics and exchange rate in SSA.

The test of overall significance, that is the F test, indicates that the fixed effects model is statistically significant. Therefore, all the variables used in the model will jointly influence

economic growth of SSA significantly. The fixed effects model is also subjected to a cross-sectional dependence test to ascertain the level of cross-sectional specific effects in our model.

5.3.3 Cross sectional dependence test for the SSA

This test as explained under the methodology is to confirm the level at which the results can be generalized among all the 36 countries used in the fixed effects panel model. The fixed effects least square dummy variable is used to achieve this objective. The result is presented in Table 5.30 below:

Table 5.30: Fixed Effects Least Square Dummy Variable (LSDV) for the SSA

| Country dummy | Intercepts |
|---------------|-------------|
| 2 | .0707063 |
| 3 | .1957185 |
| 4 | -.7839589** |
| 5 | .2929215 |
| 6 | .785196** |
| 7 | .0859034 |
| 8 | .911814** |
| 9 | .0940698 |
| 10 | -.2577378 |
| 11 | .1741557 |
| 12 | -.1266116 |
| 13 | .0979586 |
| 14 | .1048276 |
| 15 | 1.048027** |

| | |
|------|------------|
| 16 | .2611925 |
| 17 | .3150916 |
| 18 | -.4729797 |
| 19 | .7526501** |
| 20 | .0354425 |
| 21 | -.3130271 |
| 22 | .1170043 |
| 23 | .6300045 |
| 24 | .9517142** |
| 25 | .178884 |
| 26 | .0369253 |
| 27 | -.2531024 |
| 28 | .0380183 |
| 29 | 1.613087** |
| 30 | -.1652548 |
| 31 | .0316287 |
| 32 | -.2070548 |
| 33 | -.0758627 |
| 34 | .3522878 |
| 35 | .5514922** |
| 36 | -.2951361 |
| Cons | .5220391 |

The result of the fixed effect LSDV is an indication that the individual intercepts generated for each of the countries are largely not significant. Out of the 36 countries, only 8 countries demonstrate specific cross-sectional effects. This means that the results generated by the fixed effect can be generalized to a large extent among the 36 countries. Notwithstanding, since there is a slight country-specific effect, breaking the analysis down to major economic blocs in SSA might throw more light on countries which are going to be outliers among the 36 countries used in the study.

In addition for a further robust check on the panel results, the dynamic panel model is explored to further examine the impacts of the monetary policy dynamics on the economic growth of SSA.

5.3.4 Dynamic panel estimation of the effects of monetary policy dynamics on the economic growth of SSA

Apart from standing as an appropriate robust check for the results discussed under the fixed effects, the dynamic panel estimation will further examine the consistency in the results and it is capable of generating more efficient parameter estimates than the fixed effect results.

Table 5.31: Dynamic panel model for the SSA

| Variable | Coefficients | Robust S.E |
|-----------------|---------------------|-------------------|
| LGDPGRL1. | -.021463 | .0609975 |
| LMPR | -.4430628*** | .1366033 |
| LEXR | .0217517** | .0154208 |
| LINF | -.0343585 | .0360663 |
| LGE | .003321 | .1124073 |
| LK | -.0397457 | .1054859 |

| | | |
|--|-----------|--------------------------|
| LMSGR | -.0498376 | .0560344 |
| LNDC | -.0270155 | .0397994 |
| <i>A-B test for Auto Regressive (1), Z=-3.03</i> | | <i>Pr > Z = 0.002</i> |
| <i>A-B test for Auto Regressive (2), Z= -1.66</i> | | <i>Pr > Z = 0.096</i> |
| <i>Sargan test of over-identification restrictions: $\chi^2(496) = 578.96$, Prob > $\chi^2 = 0.006$</i> | | |
| <i>Hansen test of over-identification restrictions: $\chi^2(496) = 28.36$, Prob > $\chi^2 = 1.000$</i> | | |

A-B is the Arellano-Bond test.

The dynamic panel results as shown in Table 5.31 further affirm the importance of monetary policy rate in the determination of the economic growth of the SSA. The coefficient is negative and significant, just as that obtained under the fixed effects estimation. The exchange rate is another variable that maintains its relationship with economic growth. The coefficient of the exchange rate remains positive and significant in the estimated dynamic panel model. However, money supply growth rate or the financial deepening indicator fails to maintain the significant relationship it possesses in the fixed effect model. The implication is that the results from the dynamic model are more reliable than those of the fixed effect model. Notwithstanding, we have been able to ascertain some levels of consistencies in the results.

5.3.5 Dynamic panel model diagnostics

Customarily, the dynamic panel models are subjected to some diagnostic tests to ascertain the reliability of the results. Both the serial correlation (autocorrelation) test and Sargan/Hasen test for over-identification are carried out. The results are also contained at the bottom of Table 5.31. Both the AR1 and AR2 results indicate that there is no presence of serial correlation in the dynamic panel results. Again, the over-identification test also confirmed that the instruments used in the dynamic panel estimation are in order and are appropriate to a large extent.

5.3.6 Economic bloc-by-bloc analysis of the effects of monetary policy dynamics on the economic growth of SSA

Due to the results of the cross-sectional dependence test and for a more robust analysis, SSA is broken into notable economic blocs in order to be able to conduct deeper investigation into

the impact of monetary policy dynamics on the economic growth of the sub region. As was done under objective one, SSA is broken into four economic blocs namely: CEMAC EAC, ECOWAS and SADC. The results of the panel data analysis are presented in Table 5.32.

Both the results of the fixed and random effects are reported. This will enable a study of the consistency of the result. Notwithstanding, the Hausman test is conducted to determine which of the two to interpret and discuss. Therefore, Table 5.32 below presents the results of the Hausman test. The results of the Hausman test shows that all the results across the four economic blocs will better be discussed using the fixed effects results. The probabilities of the chi square statistics are all statistically significant at the 5% level. Therefore the hypothesis of random effect is rejected and the alternative hypothesis of fixed effect is accepted. Consequently, the results of the fixed effect will be relied upon in this analysis. It should be noted that the results are also almost similar in most cases across the four economic blocs.

Table 5.32: Fixed and Random Effects results for GDPGR of Blocs

| Variables | CEMAC | | EAC | | ECOWAS | | SADC | |
|-----------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------------------|--------------------|
| | FE | RE | FE | RE | FE | RE | FE | RE |
| LMPR | -.1696** (.2589) | -.4509** (.2476) | -.6596** (.2922) | -.4375* (.2257) | -.3550** (.1992) | -.3292** (.1524) | -.1159 (.1660) | .0581 (.1391) |
| LEXR | .2808 (.5273) | -.0621 (.5187) | .2882** (.0998) | .3045*** (.0589) | -.1021** (.0617) | -.0911** (.0518) | .2016** (.0568) | .0303 (.0251) |
| LINF | .0221 (.0668) | .0401 (.0661) | -.0627 (.0774) | -.1272 (.07232) | .0068 (.0488) | -.0146 (.0449) | -.0541 (.0651) | -.0763 (.0605) |
| LGE | .1059 (.2639) | .2631 (.2240) | .0624 (.2248) | .1124 (.2000) | .1812 (.1017)* | .0836 (.0868) | .2985** (.1278) | .2051** (.1190) |
| LK | .1588** (.1883) | .3903 (.1447) | .0245 (.1739) | .1179 (.1662) | -.1150 (.0898) | -.1284 (.0803) | .0624** (.0029) | .1592 (.1215) |
| LMS/GDP | -.1495 | -.1069 | .2169** | .1476 | .1708** | .1882** | .2232** | -.0732 |

| | | | | | | | | |
|-------|----------|----------|----------|----------|----------|----------|----------|---------|
| | (.1460) | (.1465) | (.0936) | (.0953) | (.0642) | (.0622) | (.1232) | (.1167) |
| LNDC | .5537** | .4038** | .1059** | .1962*** | .1209** | .1019** | -.0256 | .0071 |
| | (.1781) | (.1431) | (.0602) | (.0540) | (.0643) | (.0523) | (.0373) | (.0262) |
| CONS | 14.091 | 11.295 | 5.2032 | 6.703 | -.4344 | -.197 | 2.699 | 1.369 |
| | (4.6061) | (3.959) | (1.5977) | (1.5300) | (1.5597) | (1.2190) | (1.0317) | (.6516) |
| F/CHI | 3.88** | 42.83*** | 4.23*** | 39.69*** | 2.74*** | 18.71*** | 4.09*** | 9.44 |

***, ** and * represent statistical significance at 10%, 5% and 1% respectively.

Table 5.33: Bloc-by-Bloc Hausman test

| | CEMAC | EAC | ECOWAS | SADC |
|-----------------------|--------|--------|--------|--------|
| Chi ² (5) | 11.98 | 17.31 | 11.21 | 29.66 |
| Prob>Chi ² | 0.0351 | 0.0017 | 0.0467 | 0.0001 |

Having concluded to stick with the results of the fixed effects, the interpretation of the results of the effects across the four economic blocs can begin. Firstly, it should be noted from the results that monetary policy rate is significant and negative across the four economic blocs except SADC. The implication of this result is that there exists a significant inverse relationship between monetary policy rates and economic growth of SSA. The result is in the right direction according to theoretical postulation which suggests using an expansionary monetary policy (i.e. lower monetary policy rates) to increase GDP growth rate (see Ahmed and Wadud, 2011; Sepe, 2012).

Secondly, exchange rate also shows a significant relationship with economic growth of the four economic blocs except CEMAC. However, the coefficient is positive in ECOWAS while it is negative in EAC and SADC. The implication of the results is that when the exchange rate rises (that is currency depreciation) the GDP growth rate of both the SADC and EAC rises significantly. The reverse is the case for ECOWAS as currency appreciation (which is a fall in exchange rate) brings about increase in the growth rate of the GDP significantly.

Inflation rate and government expenditure fail to have significant impact on the economic growth of SSA except in SADC where government expenditure is shown to have a significant positive impact on GDP growth rate. The implication is that expansionary fiscal policy in the SADC contributes positively and significantly to the economic growth of the sub region. This

shows the dominance of the fiscal policy that has been the anchor framework of South Africa for years back.

Capital formation which is used as a proxy for capital in the estimated growth model, shows significant coefficients in CEMAC and SADC. The result shows that there is a significant positive relationship between capital and GDP growth rate in both CEMAC and SADC. The implication is that a rise in capital formation will significantly increase the economic growth of the two economic blocs. However, this is not the case with both ECOWAS and EAC where capital fails to have a significant positive impact on their GDP growth rates. This is a clear indication that the necessary infrastructural facilities needed for growth in these blocs are still missing to a greater extent. To compound this problem is the challenges posed by the Boko Haram insurgency and Niger-Delta militancy in Nigeria, the Ebola saga coupled with democratic instability in some of the countries within ECOWAS to the Al-Shabab attacks in the East.

The coefficient of financial deepening is positive and significant across the four economic blocs except in CEMAC. The financial deepening (which measures the ratio of money supply to the GDP) is an indication of the economic impact of money supply in an economy. A positive coefficient indicates a greater economic impact of money supply. Consequently, the results have shown that an increase in the financial deepening will contribute positively and significantly to the economic growth of ECOWAS, SADC and EAC.

Net domestic credit has been shown to have significant impacts on the growth of the GDP across the four economic blocs except SADC. The implication of the result is that there exists a positive and significant relationship between net domestic credit and the GDP growth rates of the other three economic blocs. This implies that a rise in the net domestic credit will lead to a rise in the GDP growth rates of these countries. It should be noted that there appears to be a linkage between the monetary policy rates and the net domestic credit because the same economic blocs where monetary policy rates are significant are also the economic blocs where net domestic credits are also significant.

The test of overall significance of the estimated model indicates that all the models are statistically significant. The F statistics and the probability show that the estimated panel models for each of the four economic blocs pass the overall test of statistical significance at 5% level. This implies that the combination of all the explanatory variables will jointly have significant impacts on the economic growth of the economic blocs. Moreover, it is necessary to investigate the cross

sectional dependence of the model. This is to justify the poolability of the estimated panel results. The approach adopted in this study is the fixed effects least square dummy variable (Fixed effects LSDV).

5.4.7 Cross-sectional dependence test (Fixed effects LSDV)

The least square dummy variable version of the fixed effect is estimated to ascertain the cross sectional dependence of the estimated fixed effect models. The result is presented in Table 5.34. The results show that there is an absence of cross-sectional dependence in most of the economic blocs fixed effect estimated models. However, CEMAC is the only economic bloc where intercept dummy for many of the countries remains significant. This is an indication that about five out of the six countries that form CEMAC exhibit specific characteristics that distinguish them from one another. But the effect of the cross-sectional dependence has been reduced due to the ADF unit root test conducted to determine the stationarity of the variables. Another economic bloc that exhibits almost similar characteristics is SADC. But the number of countries which show specific characteristics is five while six do not show specific characteristics. Hence the results can largely be generalized.

Table 5.34: Cross-sectional dependence test using fixed effect LSDV

| COUNTRY DUMMY | CEMAC | EAC | ECOWAS | SADC |
|---------------|-------------|-----------|-------------|--------------|
| 2 | -1.278092** | -.0363827 | .1014751 | -1.195724** |
| 3 | -.7724671** | .2314555 | -.0355343 | -.8526343 |
| 4 | -.4667693 | .1747334 | -1.066743** | -1.953302*** |
| 5 | -.5893269** | -.7871903 | .3715631 | -.0438604 |
| 6 | -.9635414** | | -.0648503 | -.7783996** |
| 7 | | | .20453 | -.2003944 |
| 8 | | | .499067 | -1.240745*** |
| 9 | | | .0898767 | .1862918 |

| | | | | |
|------|------------|------------|-----------|------------|
| 10 | | | -.209246 | 1.210803 |
| 11 | | | -.5428646 | -.8632328 |
| 12 | | | -.2604643 | |
| 13 | | | .2629898 | |
| 14 | | | .1399921 | |
| Cons | 14.69287** | 5.255687** | -.383072 | 3.279778** |

However, ECOWAS and EAC do not show any sign of cross-sectional dependence as virtually none of the intercept dummy for the countries is significant. This implies that the result for these economic blocs can be generalized among all the countries that form the economic bloc. On the whole the total number of countries that show evidence of cross-sectional dependence is small compared to the ones that do not show cross-sectional dependence. This is attesting to the poolability of the countries in a panel data analysis.

5.3.8 Dynamic Panel analysis for the economic blocs

The dynamic panel analysis serves as a robust check for the previous panel results. It also serves as a means of confirming the consistency of all the results obtained in the previous analysis. The current and improved Arellano and Bond systemic GMM which uses xtabond2 in STATA is applied. The results are presented as follows:

Table 5.35: Dynamic panel results for economic growth in SSA

| Variable | CEMAC | | EAC | | ECOWAS | | SADC | |
|-------------|--------|------------|----------|------------|---------|-----------|---------|------------|
| | Coeff. | Robust S.E | Coeff. | Robust S.E | Coeff. | Robust SE | Coeff. | Robust S.E |
| LGDPR L1 | -.096 | .172 | -.039 | .102 | -.124 | .111 | .053 | .084 |
| LMPR | -.438 | 0.636 | -.430*** | .088 | -.327** | .162 | -.468** | .194 |
| LEXR | .677 | .922 | .057 | .133 | -.214** | .122 | .077 | .090 |

| | | | | | | | | |
|-------|--------------------------------|---------------------------------|----------------------------------|--------------------------------------|----------------------------------|--------------------------------------|----------------------------|--------------------------------------|
| LINF | .0140 | .039 | -.157** | .063 | .0230 | .076 | .017 | .048 |
| LGE | 1.204** | .351 | -.244 | .310 | .1770 | .170 | .274** | .133 |
| LK | .538** | .262 | -.217 | .209 | -.309 | .478 | .149** | .029 |
| LMSGR | -.169 | .162 | -.219** | .110 | .1215** | .066 | .205** | .058 |
| LNDC | .006 | .220 | -.228*** | .032 | -.145 | .139 | -.024 | .064 |
| AR(1) | z= 0.75** | Pr > 0.031 | z= -1.45** | Pr > z = 0.048 | z=-1.71** | Pr > z = 0.037 | z=-.36** | Pr > z = 0.018 |
| AR(2) | z = -1.51 | Pr > 0.131 | z= 0.03 | Pr > z = 0.974 | z = -1.41 | Pr > z = 0.160 | z = 0.24 | Pr > z = 0.810 |
| STOR | Chi2(46) = 64.29** | Prob> Chi2 0.039 | Chi2(119)= 149.7** | Prob > Chi2 = 0.030 | Chi2(176) = 252.1** | Prob > Chi2 = 0.000 | Chi2(197) = 212.63** | Prob > Chi2 = 0.012 |
| HTOR | Chi ² (46)=0. 00 | Prob>Chi ² =1.000 | Chi ² (119) = 0.00 | Prob> Chi ² = 1.000 | Chi ² (176) = 5.92 | Prob> Chi ² = 1.000 | Chi2(197) = 1.73 | Prob> Chi ² = 1.000 |

The dynamic panel results for the economic blocs show some results which simply affirm consistency in the various techniques used so far to estimate the impact of monetary policy dynamics on the growth of SSA. Firstly in CEMAC, the MPR coefficient remains negative but not significant in the dynamic panel model which is the same as that obtained under the static effect model result. The same thing with capital formation (K); the only difference is the Net Domestic Credit (NDC) which is significant in the fixed effect but not in the dynamic panel model. On the other hand, government expenditure (GE) is significant in the dynamic panel but not in the fixed effect model. Basically some levels of consistency can be observed in the results. Notwithstanding, since the result of the dynamic panel model is adjudged to be able to produce a more consistent and efficient estimates than the fixed effect result, the dynamic panel result was continued with. Therefore, we conclude for CEMAC that MPR, K and Ge are the most important variables affecting economic growth in this economic bloc.

Secondly, an almost similar trend is noticed in the EAC dynamic panel results; while there are some similarities in the results of the fixed effects and dynamic panel result, there is still a slight difference as well. For instance MPR, MSGR/GDP, NDC all remain significant in both

models. But while exchange rate (EXR) is significant in the fixed effect model, INF is significant in the dynamic panel model for the EAC. As earlier stated, since the results in the dynamic panel model yield better parameter estimates than the fixed effect, it can be concluded that MPR, MSGR/GDP, NDC and INF are variables that have the greatest impacts on the economic growth of the EAC.

For the ECOWAS, MPR, EXR and MSGR/GDP repeat the same significant impact they produced on growth in the fixed effect model. However, the only slight difference in the two results is that K is significant in the fixed effects model but not in dynamic panel model while NDC is significant in the dynamic panel model but not in the fixed effect model. As usual, the dynamic panel results continue to be used and it is concluded that in the ECOWAS economic bloc, MPR, EXR, MSGR/GDP and NDC are very germane in influencing the growth of the ECOWAS countries in the SSA.

Finally, SADC is the only economic bloc where there is a perfect similarity between the results of the fixed effect and that of the dynamic panel model. The result shows that MPR, GE, MSGR/GDP and K have a significant impact on economic growth in both estimated panel models. The result has confirmed that these variables appear to be the most important variables that drive the economic growth of SADC.

5.3.9 Dynamic panel diagnostics for the economic blocs

The dynamic panel model selected for this analysis passed the required tests of validity. For instance for all the economic blocs, the AR1 are significant and the AR2 are not. This is an indication of absence of serial correlation in the results. Similarly, Sargan and Hasen tests results are also in the right directions as they both indicate that there is no problem of over-identification in case of instrument selection for the dynamic panel model.

5.3.10 Inferences from results and comparison with previous empirical findings

The result from this section of the research work can be divided into two. One is based on the SSA as a whole, while the other is based on major economic blocs within SSA. The reason for this has been justified going by the nature of results obtained from the two different approaches adopted. However, the major aim of using this approach is to be able to find out the extent to which the results from SSA panel analysis can be generalized among all the countries in the SSA, and

also to do a comparative analysis of the results based on the major economic blocs within SSA. Major findings from the two approaches of analyses are highlighted as follows.

Firstly, in studying the dynamic effects of monetary policy on the economic growth of the SSA, the dynamic panel data has shown that monetary policy rate is significant in determining the economic growth of SSA. This finding is supporting the conclusions of various empirical studies like Kutu and Ngalawa (2014) and Olomola (2007), among others, where it was confirmed that many of the SSA countries find monetary policy tools useful in controlling key macroeconomic variables in their domain and consequently giving monetary policy an important pride of place in dictating the pace of the economic activities in most of the SSA countries. Therefore this finding is contributing to the existing literature that found monetary policy dynamics to be an important influence on the economic growth of SSA.

Secondly, the dynamic panel results for SSA have shown that exchange rate is an important factor that affects the economic growth of SSA. The coefficient of exchange rate is positive and significant. The implication is that the situation in SSA favours currency devaluation as against currency appreciation to promote economic growth. This is also supporting the views of Olomola (2007) and Omolade and Ngalawa (2014), among others, that over-valuation of currencies is capable of squeezing out the tradable sector and the real sector of an economy. This process is found to be inimical to the economic growth of many developing countries.

Thirdly, money supply growth rate which doubles as a key monetary policy instrument and also a proxy for financial deepening does not exert significant pressure on the economic growth of SSA. Since the ratio of money supply to the GDP is used, it is capable of measuring the financial deepening in SSA. The results from the analysis indicates that money supply growth rate is only significant in the static panel model but not in the dynamic panel model which is the basis for this discussion. The implication of this result is that the rate at which money supply influences the economic activities in SSA appears to be very low. However, corruption, credit diversions, money laundering, capital flight, and porous borders among others, have been attributed to the cause of ineffectiveness of money supply on the domestic economy. This is because much of the money that supposed to go into -the economy fails to achieve the purpose for which they are intended (Maturu, 2014; Ngalawa and Viegi, 2011).

All other variables used in the model, such as capital formation, net domestic credit and inflation rate fail to have any significant impact on the economic growth of SSA. The dearth of

socio-economic infrastructure in virtually all SSACs has been revealed as a cause of the non-significance of capital formation on the lack of economic growth of SSA. Some empirical studies have attributed the slow pace of economic growth in SSA and general backwardness in terms of economic development to the deficient socio-economic infrastructures (Omolade and Ngalawa, 2014). Again, the net domestic credit which fails to have significant impact on the economic growth of SSA is supporting the finding in the previous paragraph, where money supply fails to exert a significant impact on the economic growth of SSA. Levels of inflation in SSA might not exert much impact on the economic growth of SSA during the period under review. This is because many SSA countries are much more aware of the danger inflation rate poses to their economies and many of them have put in place measures to curtail these inflation pressures (Maturu 2014).

However as earlier stated, these findings discussed are subjected to further analysis based on major economic blocs in the SSA. From there, it will be easier to conclude about the extent to which these findings can be generalized among the whole of SSA.

Firstly, considering the impact of monetary policy dynamics on the economic growth of the various economic blocs used in this analysis, it is important to note that all the economic blocs show that monetary policy rate which is used as proxy for monetary policy dynamics) exhibit significant impact on the economic growth, except in CEMAC. But in EAC, ECOWAS and SADC, monetary policy rate remains a significant factor that influences the growth of these economic blocs. However, it should be noted that CEMAC is the only economic bloc among the four where unified monetary policy is practiced in full among member countries. The reason for the lack of significance of the MPR can be traced to the position of the Africa Development Bank (AfDB) that individual countries in the CEMAC are subjected to the MPR given by the Sub-Regional Central Bank (BEAC) even if the economic realities in the member countries are different. This, to a great extent might limit the effectiveness of monetary policy dynamics on the economic growth of the CEMAC. Notwithstanding, since three out of the four economic blocs show that MPR is significant, this supports the findings obtained under the first approach where the whole of SSA is used as the case study.

For the exchange rate, the results appear to be more diverse across the economic blocs. ECOWAS is the only economic bloc where exchange rate is significant. It should be noted that exchange rate is also significant in the SSA model. This is an indication that ECOWAS as an economic bloc in the SSA is likely to be exhibiting a great influence on SSA as a whole. Because

of the position of the IMF in the SSA economy in 2015 and also that Nigeria is the largest economy in Africa; the result of this may be that the country's policy direction at times might affect some key macroeconomic indicators of the whole of SSA (IMF, 2015; IMF, 2016). Exchange rate has been a major macroeconomic variable affecting the Nigerian economy especially since the oil price began to fluctuate. The situation became more severe in the last three years which saw the Naira devalued by about 100%. This alone has affected outputs of the country significantly and empirical studies have shown that many of the countries in the ECOWAS are severely affected by the recent economic downturn in Nigeria (Mordi and Adebisi, 2010).

Inflation rate as one of the variables used in the model has significant impact only on the growth of EAC economy. It fails to show any significant impact on ECOWAS, CEMAC and SADC economic growths. It will be recalled that the result for the whole of SSA indicates that inflation rate does not have significant impact on the economic growth of SSA. Unlike ECOWAS, the EAC result fails to have significant influence on SSA as a whole.

Again, government expenditure is used as proxy for fiscal policy in the model and the result across the economic blocs shows that it has significant impacts on the economic growth of both the SADC and CEMAC. The implication is that these two economic blocs use fiscal policy to a large extent to influence their economic growth. This supports the conclusion about the impact of the AfDB on CEMAC economy, that due to the rigidity posed by monetary policy which is sub-regionally controlled, individual countries in the CEMAC rely on fiscal policy to stimulate their economic growth. This assertion made by the AfDB goes a long way to support the findings in this study. In addition, economic statistics have shown that major countries in the SADC witness higher economic growth rates whenever fiscal policy is used with monetary policy (Olomola, 2007; Mordi and Adebisi, 2010). It should also be noted that for the whole of SSA, government expenditure is not significant. This means that the results of these two economic blocs might not affect the result for the whole SSA.

Just as has seen in the previous paragraph, the results across the economic blocs have also shown that capital formation is significant in CEMAC and SADC only. For ECOWAS and EAC capital formation is not significant. The implication is that SADC and CEMAC can be excluded from the economic blocs in SSA where capital formation is not contributing significantly to the economic growth. This shows that SADC and CEMAC have socio-economic infrastructures that can contribute significantly to their economic growth. Notwithstanding, this might not reflect on

SSA as a whole. For instance, South Africa being the largest country in the SADC has been adjudged to be the only country in SSA with the most adequate socio-economic infrastructures that can promote growth by the Global economic indicators for the past three decades.

Money supply growth rate is the other monetary policy instrument used in the model. It was measured as a ratio of the GDP to enable it to capture the financial deepening in SSA. The results across the economic blocs show that it is significant in ECOWAS, EAC and SADC; it is not significant in the dynamic model of SSA but it is significant in the fixed effect. This result is an indication that financial deepening is very germane to the economic growth of these countries. According to Ngalawa and Vegi (2011), aggregate money supply might not be enough to measure the effect of monetary policy since the effect of economic activities is not captured. Consequently the ratio of money supply to GDP is adjudged to be better in measuring the effect of money supply on an economy. Therefore, the implication of this result is that individual economic bloc exhibits a result that is significantly different from has been obtained in SSA result as a whole.

Finally, for the net domestic credit, the results from the economic blocs support the findings from SSA. The implication is that the net domestic credit has not been a significant factor driving growth in SSA. This might not be unconnected with the lack of total commitments by the financial intermediaries to directives of the monetary authorities on implementation of credit policies, especially to the preferred sectors of their economies (AfDB, 2015). Coupled with this is the relative high interest rate being charged by most of the deposit money banks in SSA.

5.4 Summary

In this chapter, the findings of objectives one and two were captured. The results show varying degrees of the impact of monetary policy dynamics on growth in each of the four blocs under investigation. The summary of the findings clearly revealed that GDPGR, MSGR, EXR, INF, OILPVOL and COMPVOL are the major determining factors of monetary policy dynamics in SSA as a whole. Other variables of NDC, GE and K did not exhibit much influence on growth and therefore do not determine monetary policy dynamics in SSA. Of the variables considered under the impact of monetary policy dynamics, NDC remains the same with no influence in all the four major blocs under consideration. While government expenditure and capital formation show almost the same result, they however have impact in CEMAC and SADC. This further justifies the rationale behind the bloc-by-bloc analysis of the findings in this study.

CHAPTER SIX

FINDINGS AND DISCUSSIONS

6.1 Introduction

This chapter is the continuation of findings from the results of the analysis. The chapter is devoted to the last two objectives of the study which touches on the dynamic interactions among the variables of interests and also the influence of the external factors of oil price and commodity price volatilities. As discussed under the methodology, the Structural-VAR model was developed to generate the Impulse Response Functions (IRFs) and the Variance Decomposition (VDCs) to capture these objectives. Hence there is a need to discuss the findings under the same headings.

6.2 Examining the dynamic interaction among monetary policy variables, external factors and economic growth in Sub-Saharan African Countries.

Based on the third and fourth sub-objectives of this study, the Panel S-VAR was used to examine the short run dynamic interaction between the selected variables of GDPGR, NDC, MPR, INF, EXR, MSGR, OILP and COMP and macroeconomic variables in SSA. The structural vector auto-regression, as explained under the methodology, described the linkages among the selected variables as well as the key exogenous variables of oil price and commodity price volatilities. As done in the previous models, the analysis under this section is based on different economic blocs. With this, it will be easier to know the importance of each economic bloc in SSA as regards monetary policy transmission mechanism and its dynamics.

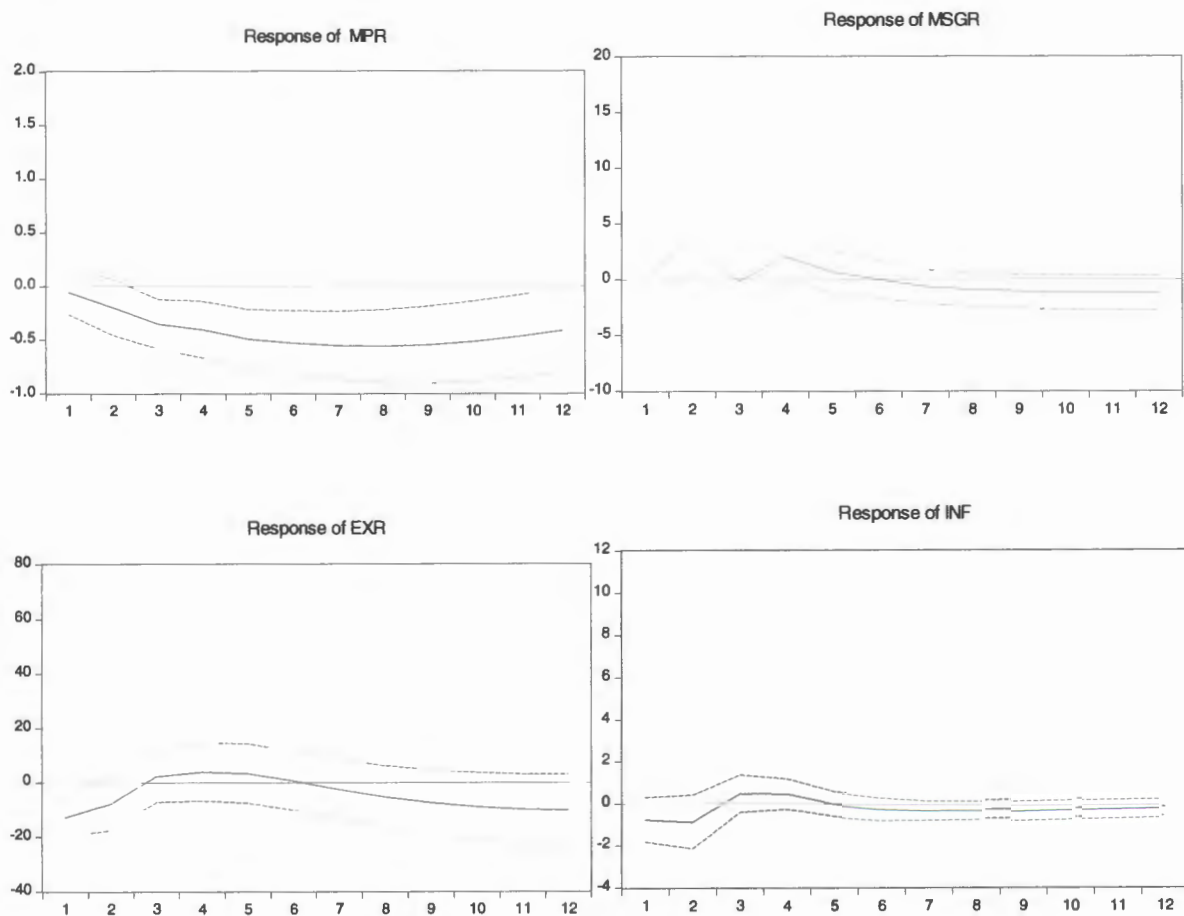
6.2.1 Impulse response analysis for CEMAC

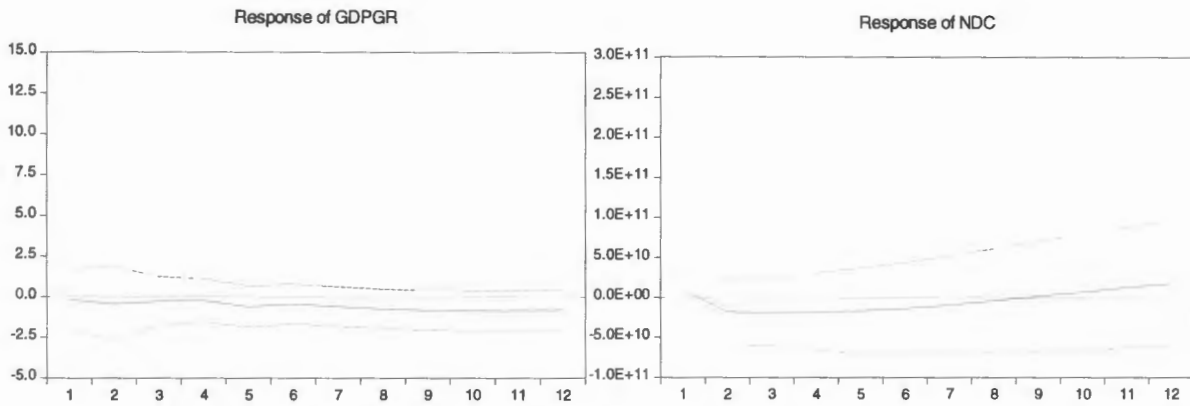
The impulse response function describes the short run interaction among the macroeconomic variables and MPR as well as the exogenous variables. It shows the behaviour of the variables to 1% standard deviation in oil price. The analysis is purely based on short run since many of the previous conclusions were mostly on the long run basis. The horizontal axis represents the time scale in twelve months while the vertical axis shows the degree of responsiveness of the variable to possible shocks. The dotted lines stand for the analytical confidence intervals derived from the variance-covariance matrices as discussed in chapter four after the final iteration.

The results from Figure 6.1 indicate that all the variables behave differently to the shocks. For instance, the response of MPR is significant and contemporaneous. Shock in oil prices caused it to fall initially and later it started rising significantly after the eighth period. The results further corroborate what was obtained under the determinants of monetary policy dynamics where it was shown that oil price plays an important role in determining monetary policy dynamics in the CEMAC. The impact of money supply was only significant towards the end of the period with an undulating response between the first and, the sixth period and, for exchange rate, the effect was not all that significant after the earliest period until the ninth month.

However, other variables such as NDC, GDPGR and INF failed to show noticeable significant responses to oil price shock in the short run. Their responses were sluggish especially in the early periods with inflation showing no response up to the twelve month. Notwithstanding, the long run effect has been shown to be significant especially for the GDPGR in the previous analysis.

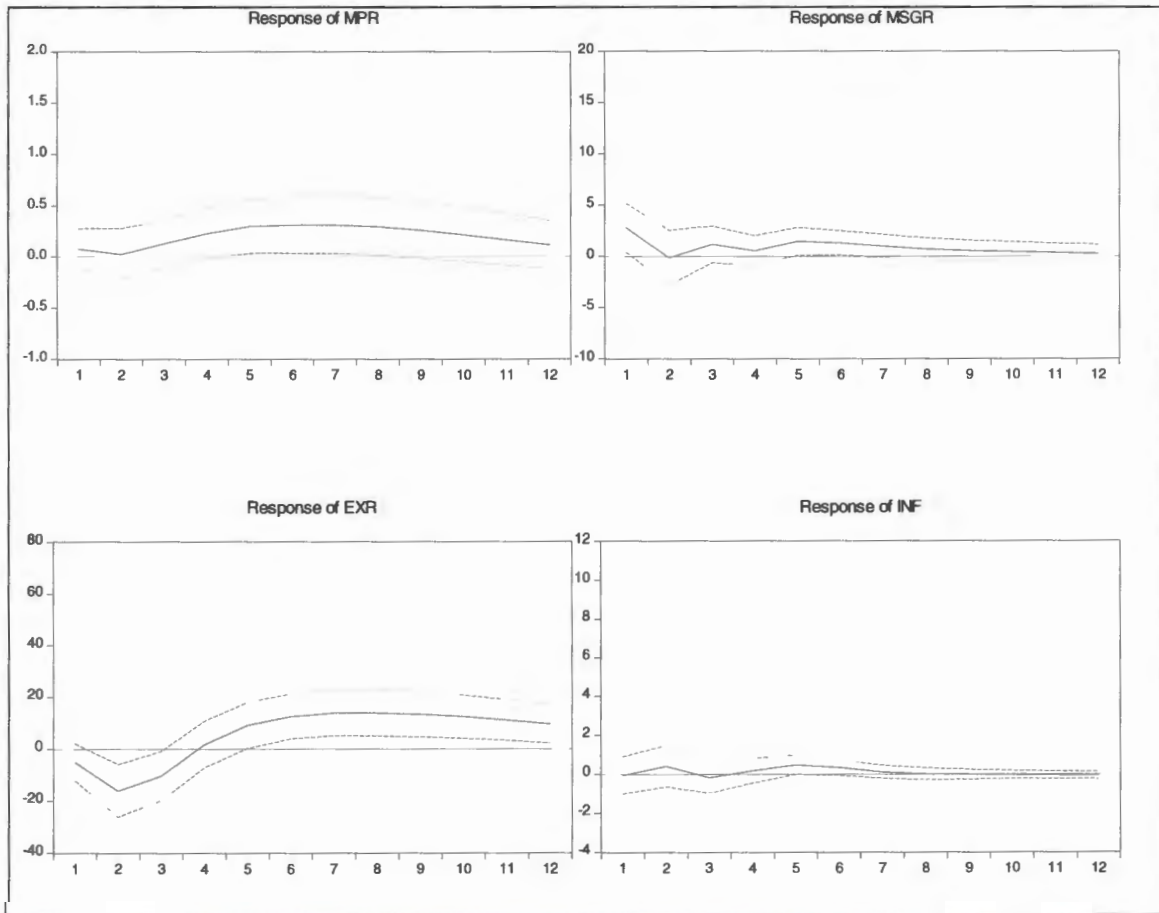
Figure 6.1: Response to oil price shock in CEMA

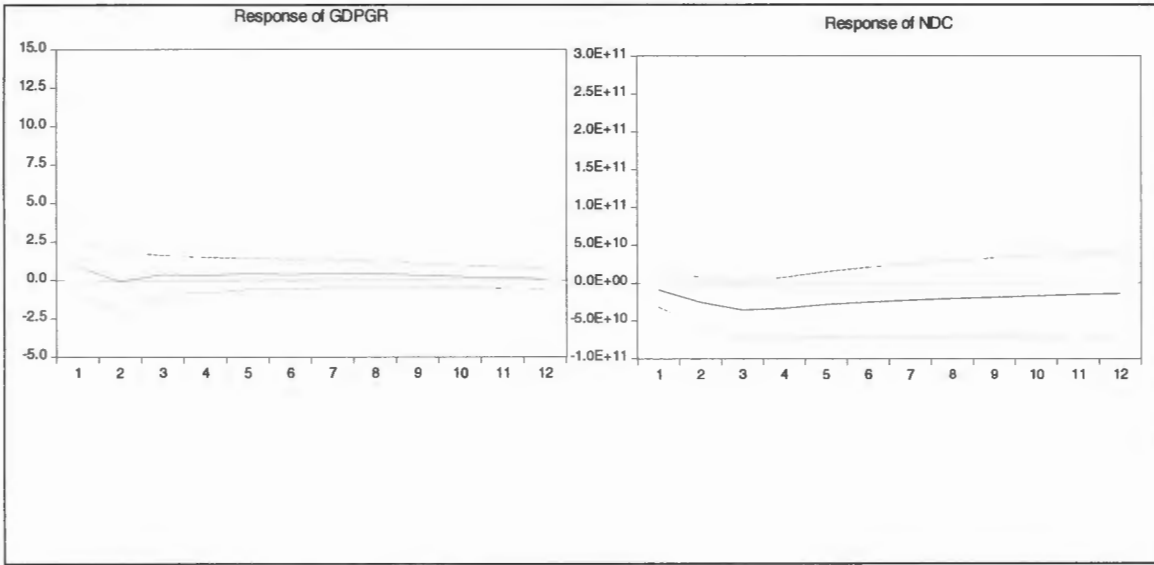




Again, the results have further given priority to oil price as an important factor that can affect the shape of monetary policy dynamics in the short run in CEMAC.

Figure 6.2: Response to commodity price shock in CEMAC

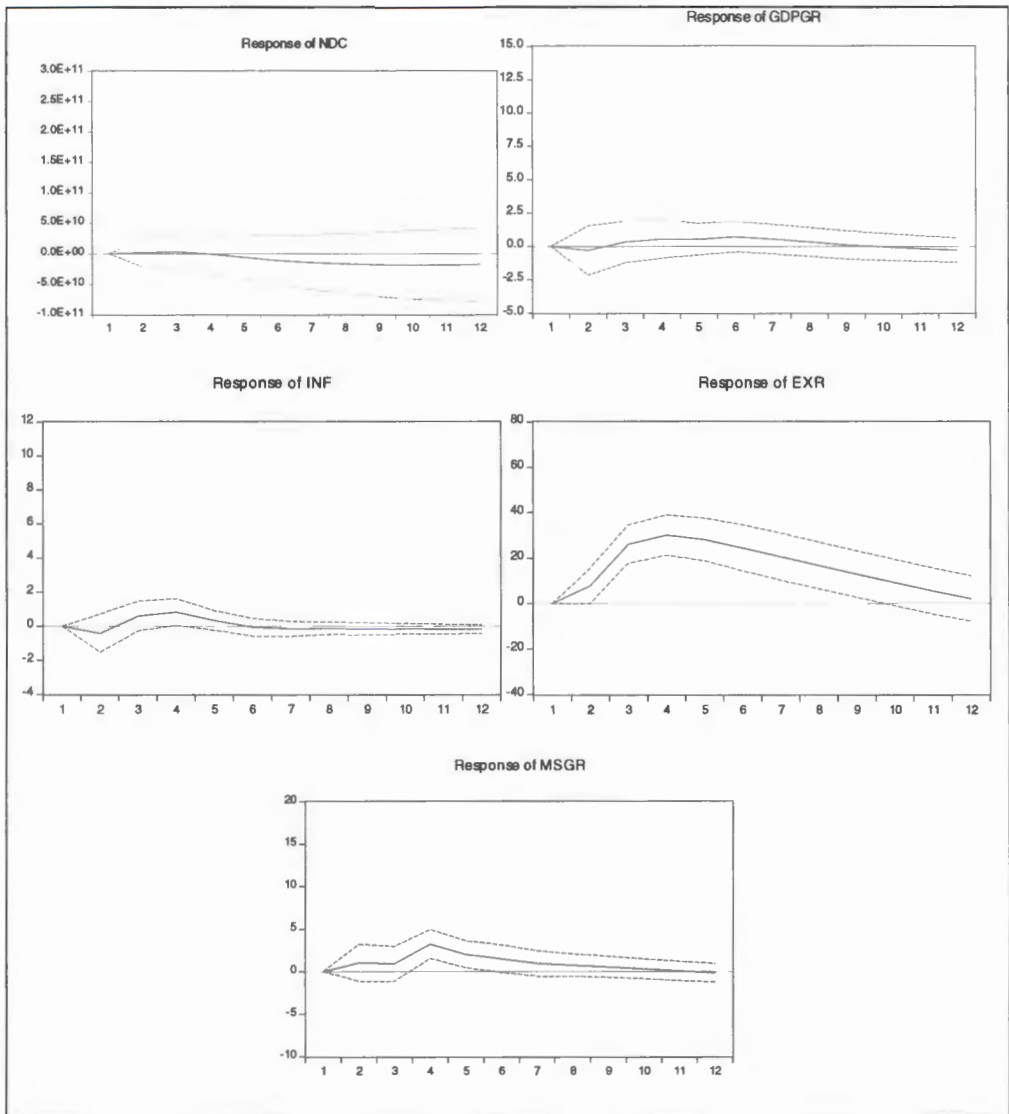




The next exogenous variable used in the model is commodity price. Consequently, Figure 6.3 explains the responses of the variables to its shock. That is, it explains the responses of the variables to 1% standard deviation in commodity price. The result is almost similar to what was obtained for the oil price shock. The response of MPR to the shock is the most pronounced, followed by exchange rate and money supply. The responses of GDPGR and INF were also sluggish for the larger part of the period. The response of NDC was on the downward trend during the first three months before it started rising almost unnoticeably in the fifth month. The shock caused the MPR and exchange rate to rise significantly. This result again underscores the importance of commodity price changes in the determination of monetary policy dynamics in the CEMAC.

Figure 6.3: Response to Monetary policy rate shock in CEMAC

Monetary policy rate is the key variable in this analysis and the responses of other variables to its shock is also very germane to studying the interactions between the exogenous and the endogenous variables.



The behaviours of the variables to 1% standard deviation in MPR show that exchange rate demonstrates the most significant response, followed by money supply growth rate and inflation rate. The implication is that monetary policy plays a significant role in the exchange rate policy of the CEMAC. The exchange rate responds significantly to shock from MPR more than any other variable in the model. The response shows that the positive shock caused the exchange rate to first depreciate and later appreciate significantly. However, the shock caused money supply to fall significantly; the interaction shows that the fall in the money supply as a result of the positive shock to MPR leads to the currency appreciation. The result has shown that exchange rate and money supply are significantly affected whenever there is a shock to the MPR in the CEMAC.

Figure 6.4: Response to exchange rate shock in CEMAC

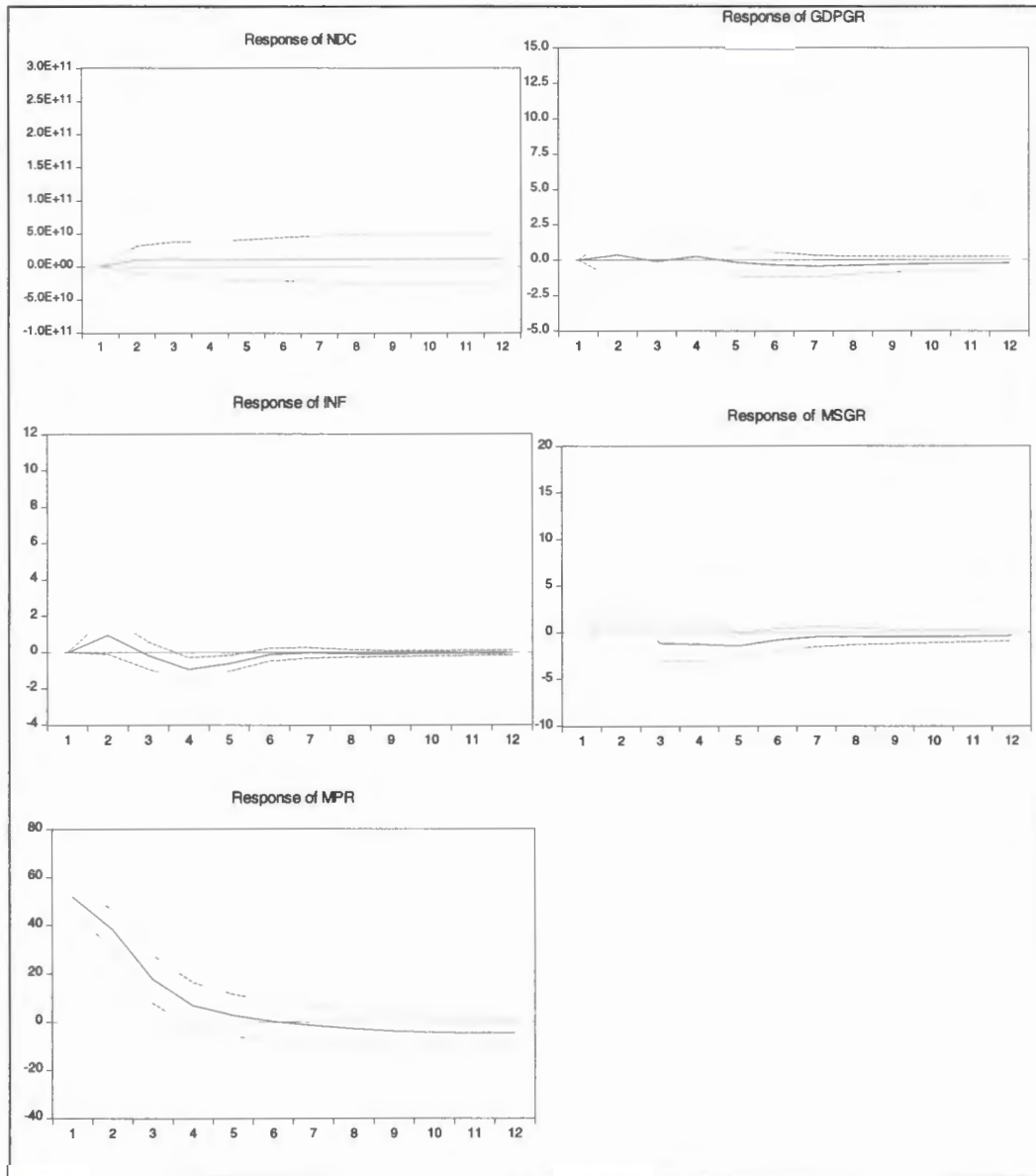


Figure 6.4 describes the responses of the variables to 1% standard deviation in exchange rate. The result replicated what was obtained under the MPR shock. The response of MPR to exchange rate shock is the most pronounced and the most significant. Money supply and inflation rate also follow in that order. The situation in the impulse response function is that a sharp currency depreciation is a result of a significant fall in the MPR. Money supply and inflation also rise. However, the GDPGR appears to fall as a result of this trend but not significantly.

6.2.2 Variance decomposition for CEMAC

Variance decomposition explains the contributions of each shock to the behaviour of a particular variable in the SVAR model. Since the interest is in the behaviour of monetary policy, the variance decomposition of MPR is analysed first.

Table 6.1: Variance decomposition of MPR for CEMAC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 2.051322 | 3.921662 | 0.562226 | 0.090548 | 2.244474 | 0.235722 | 5.122908 | 1.229890 | 86.59257 |
| 6 | 2.567185 | 12.89685 | 3.959389 | 0.975066 | 2.988635 | 1.034591 | 3.382283 | 0.948110 | 73.81508 |
| 9 | 2.855632 | 21.66313 | 6.277719 | 2.351454 | 3.098184 | 1.126406 | 3.382109 | 0.874960 | 61.22604 |
| 12 | 3.029279 | 26.43405 | 6.539292 | 3.450214 | 2.792105 | 1.048995 | 3.529960 | 0.786696 | 55.41868 |

Table 6.1 is an affirmation of the influence of oil price volatility on the behaviour of monetary policy in the CEMAC. From the table, apart from the own shock, oil price has the largest influence on the dynamics of monetary policy in the CEMAC as earlier said; the reason for this might not be unconnected with the fact that five of the six countries that belong to this economic bloc are net oil exporters in SSA. In the first quarter of the period, oil accounted for 3.92% fluctuation in monetary policy and increased to 12.89% after half of the year. By the end of the period however, the fluctuation was more than double its mid-period response. This result is supporting the findings under the impulse response function where a sharp and significant response is shown by MPR to oil price shock. Other noticeable responses are those from exchange rate, GDPGR and commodity prices. Within the first three months, there was a quick response from exchange rate with 5.12% but later fell to 3.53% at the end of the year. GDPGR accounted for 2.24% in the first three months and maintained that range till the end of the year. Commodity prices had 6.54% response to shock at the end of the year.

Table 6.2: Variance decomposition of EXR for CEMAC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 77.50067 | 3.834241 | 6.528161 | 0.323722 | 0.640405 | 1.096875 | 74.62440 | 0.504091 | 12.43801 |
| 6 | 93.68880 | 2.925293 | 7.218503 | 0.600908 | 1.302432 | 1.077170 | 51.70904 | 0.487237 | 34.67842 |

| | | | | | | | | | |
|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 9 | 102.5553 | 3.284982 | 11.35162 | 0.526985 | 2.415215 | 1.178762 | 43.38883 | 0.594028 | 37.25958 |
| 12 | 107.0244 | 5.452243 | 13.63812 | 0.656824 | 2.761270 | 1.200870 | 40.38040 | 0.655395 | 35.25488 |

Exchange rate is one of the important variables used in the SVAR model and Table 6.2 describes its behaviour. The table shows that apart from the own shock, MPR dictates the behaviour of exchange rate in CEMAC thus supporting the findings under the impulse response function. The result shows that MPR contributes more shock to the behaviour of exchange rate than oil price. The implication of this result if compared with the previous one is that the medium through which oil price affects the economy of CEMAC is MPR and from MPR to exchange rate. Within the first three months, there was a response of 12.44% from MPR and by the end of the year; it was almost tripled with 35.25% fluctuation. Next to MPR is the commodity price with 6.53% response in the first three months but more than double by the end of the year at 13.64%. 4.45% was accounted for by oil price as at the end of the period under consideration. Other variables did account for one percentage or the other but were insignificant.

Table 6.3: Variance decomposition of GDPGR for CEMAC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 14.02095 | 0.153164 | 0.467139 | 0.053101 | 92.22335 | 0.268841 | 6.655496 | 0.074230 | 0.104682 |
| 6 | 14.51175 | 0.445333 | 0.626769 | 0.082237 | 89.68645 | 1.028282 | 7.333962 | 0.168563 | 0.628407 |
| 9 | 14.69305 | 1.191977 | 0.836143 | 0.157987 | 88.16731 | 1.060219 | 7.411092 | 0.366286 | 0.808986 |
| 12 | 14.79845 | 2.151562 | 0.867264 | 0.211376 | 87.04155 | 1.069567 | 7.368642 | 0.444120 | 0.845922 |

Table 6.3 describes the behaviour of economic growth of CEMAC represented by GDPGR. The result shows that apart from the own shock, exchange rate contributes the largest shock to the behaviour of the GDPGR in the short run, with 6.66% in the first three months and 7.37% by the end of the twelfth month. This further shows that the medium through which the exogenous shock affects the CEMAC economies is the MPR and EXR. All other variables did not account for any noticeable fluctuation with oil price accounting for a paltry 0.15% at the beginning of the year and 2.15% by the end of the period. Inflation's contribution was 1.07% as at the end of the twelfth month.

Table 6.4: Variance Decomposition of OILP for CEMAC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 18.01798 | 89.11240 | 7.152259 | 1.376543 | 0.011445 | 0.268542 | 0.610103 | 0.220885 | 1.247824 |
| 6 | 23.17097 | 88.29474 | 7.187707 | 1.803698 | 0.024741 | 0.420070 | 0.372952 | 0.145024 | 1.751066 |
| 9 | 25.67080 | 85.18269 | 7.180699 | 1.818516 | 0.164726 | 0.384141 | 0.309697 | 0.130728 | 4.828804 |
| 12 | 26.88582 | 81.25100 | 7.618365 | 1.694445 | 0.493181 | 0.352969 | 0.284609 | 0.167269 | 8.138159 |

The table shows that apart from own shock, commodity price and MPR are the two variables that show signs of responses to shock from oil price. The response from oil price maintains almost the same degree throughout the period while MPR became pronounced after the third quarter of the period. Other variables' responses are not significant throughout the period.

Table 6.5: Variance Decomposition of COMP for CEMAC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 29.67061 | 76.44478 | 20.82862 | 0.994849 | 0.017669 | 0.132363 | 0.277162 | 0.093928 | 1.210624 |
| 6 | 39.54798 | 76.92697 | 19.59804 | 1.366283 | 0.019488 | 0.314886 | 0.248364 | 0.093413 | 1.432551 |
| 9 | 44.22285 | 75.75652 | 18.75655 | 1.383516 | 0.070906 | 0.315807 | 0.220028 | 0.076520 | 3.420150 |
| 12 | 46.39357 | 73.48367 | 18.68215 | 1.286412 | 0.245599 | 0.290426 | 0.213003 | 0.087044 | 5.711701 |

The same pattern of responses as observed in the response of OILP was displayed in the COMP shock. The response of OILP to shock from COMP is more pronounced than the response to its own shock.

6.3 Impulse response analysis for EAC

The East Africa Community (EAC) is the next economic bloc to be discussed. The impulse response function which describes the responses of the variables to major exogenous and endogenous shocks is presented in the following figure.

Figure 6.5: Response to oil price shock in EAC

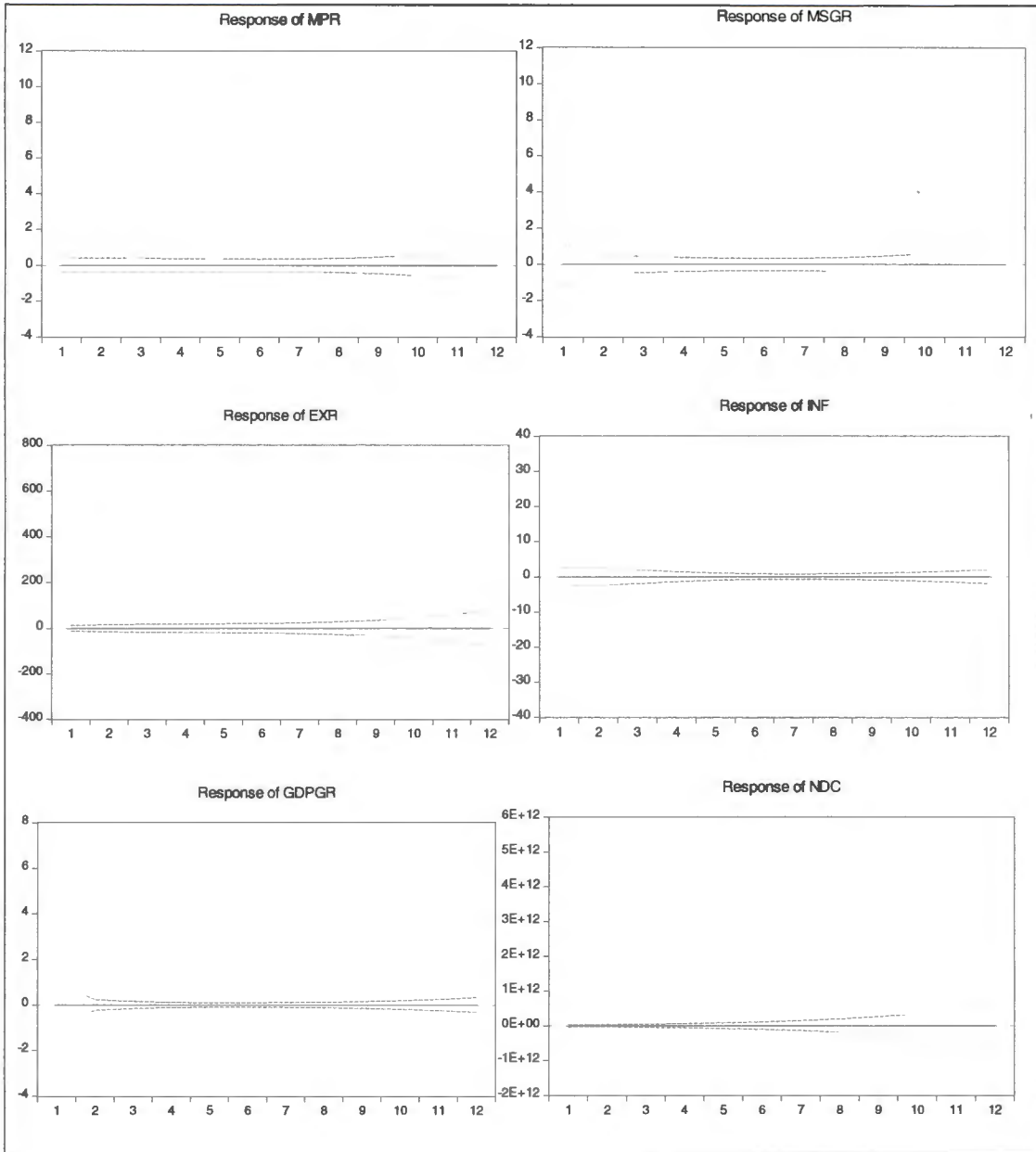
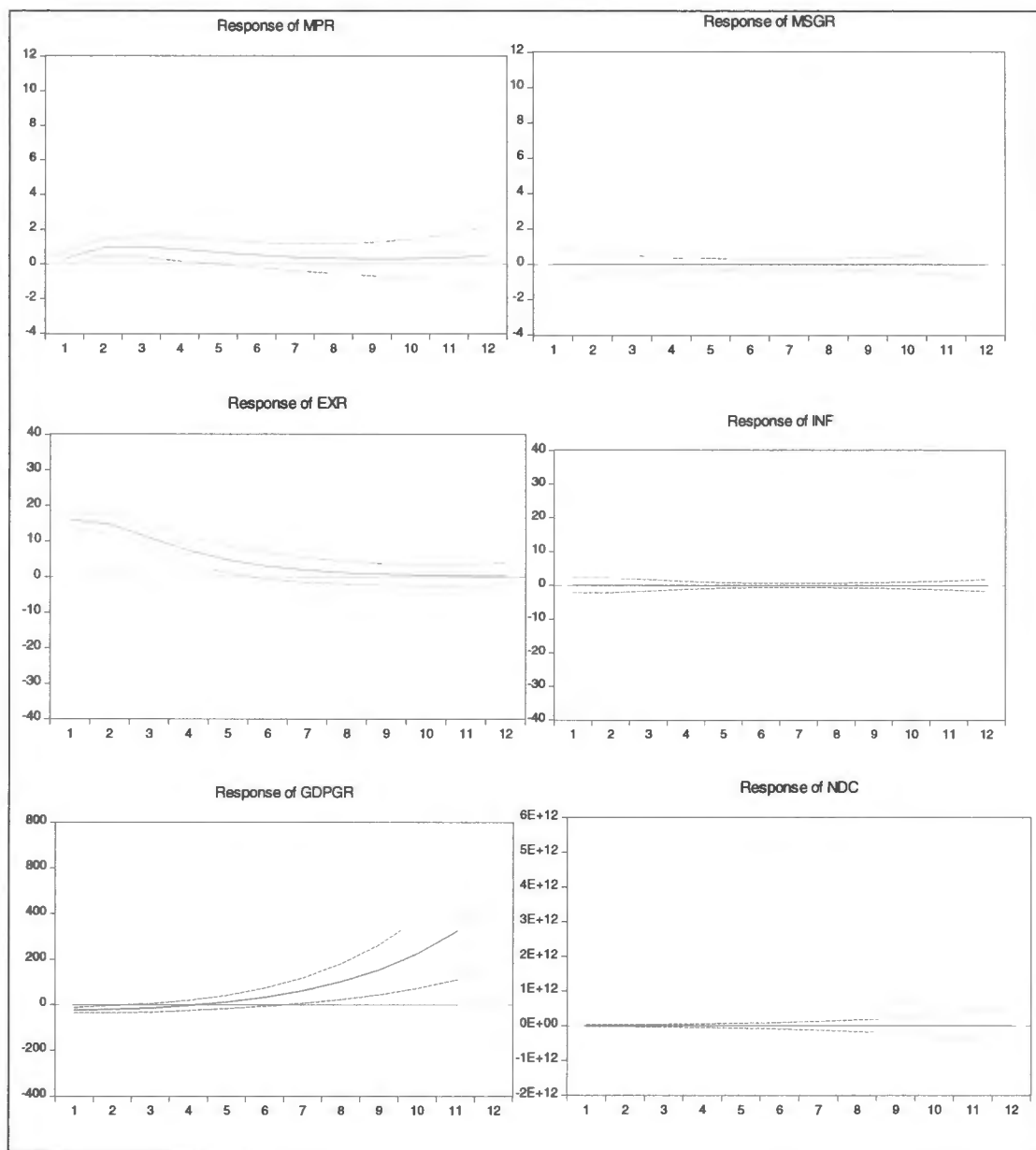


Figure 6.5 explains the responses of the variables to 1% standard deviation oil price. The result shows that none of the variables responded significantly in the short run to the shock from oil price. They all maintain sluggish responses throughout the year. This is an indication that the region might not be prone to oil price volatility effect like the CEMAC. The reason for this might

not be unconnected with the fact that unlike CEMAC that is dominated by net oil exporters, the EAC is not.

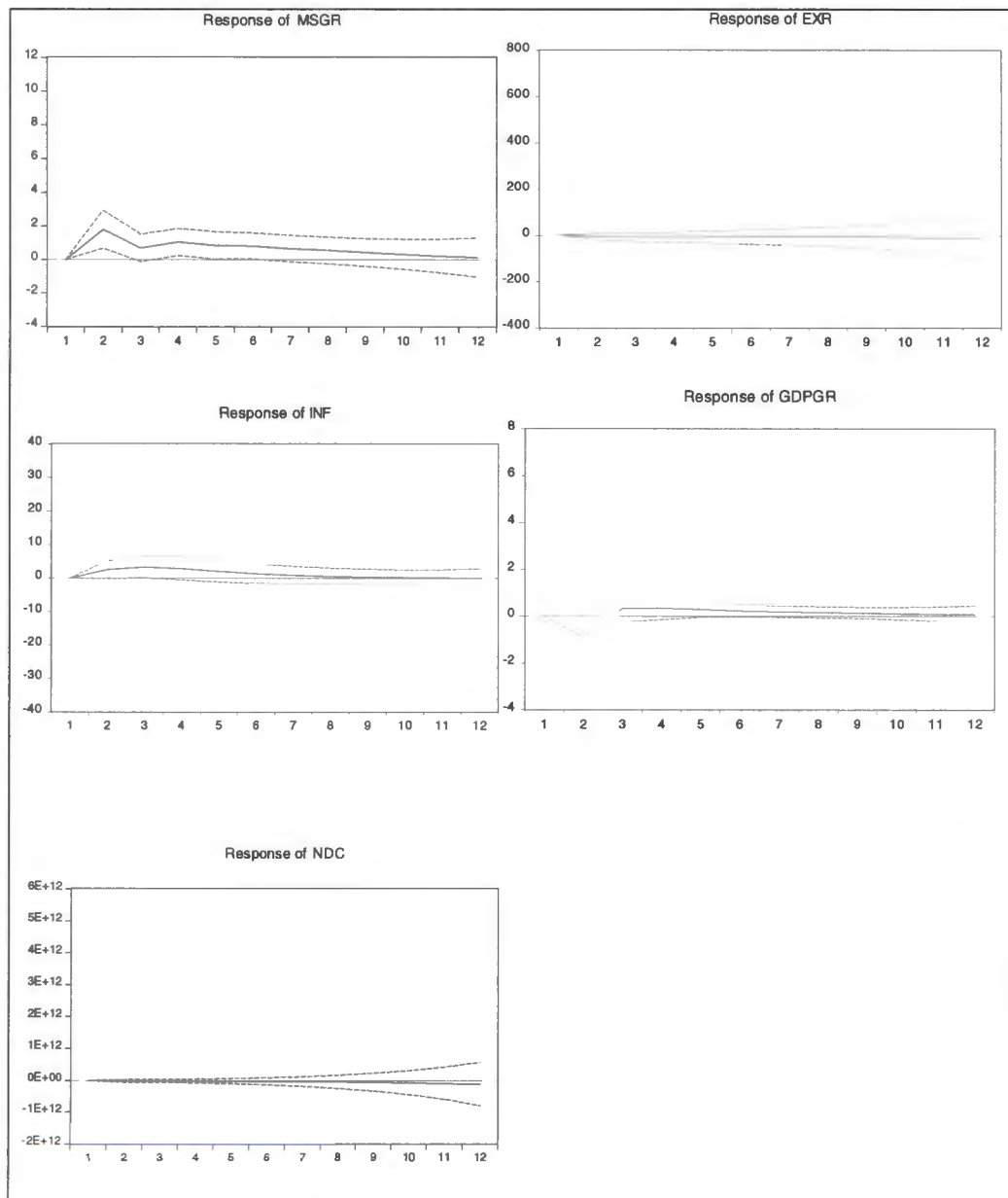
Figure 6.6: Response to commodity price shock in EAC



The responses of the variables to 1% standard deviation in commodity price shows that three variables of monetary policy rate, exchange rate and the gross domestic growth rate respond significantly to the shock. The shock causes monetary policy rate to fall significantly initially but later rise between the second and the fourth period. A slight increase was maintained from this

period till the end of the period. Again, it causes the exchange rate to fall continuously which indicates currency appreciation while the gross domestic growth rate rises significantly from its low level in the fifth period till the end of the period. The results are an indication that commodity price is an important variable that affects monetary policy dynamics in EAC even though the effect on exchange rate is more pronounced than MPR.

Figure 6.7: Response to monetary policy rate shock in EAC



The response of the variables to monetary policy rate shock shows that money supply, inflation rate and gross domestic growth rate are the most active variables that respond to monetary policy rate shock. The shock caused money supply to drop after an undulating movement at the beginning of the year; consequently, inflation rate drops but the effect on the gross domestic product growth rate is a steady rise after an initial fall between the first and the second months. Other variables fail to show significant responses to monetary policy rate shock.

Figure 6.8: Response to exchange rate shock in EAC

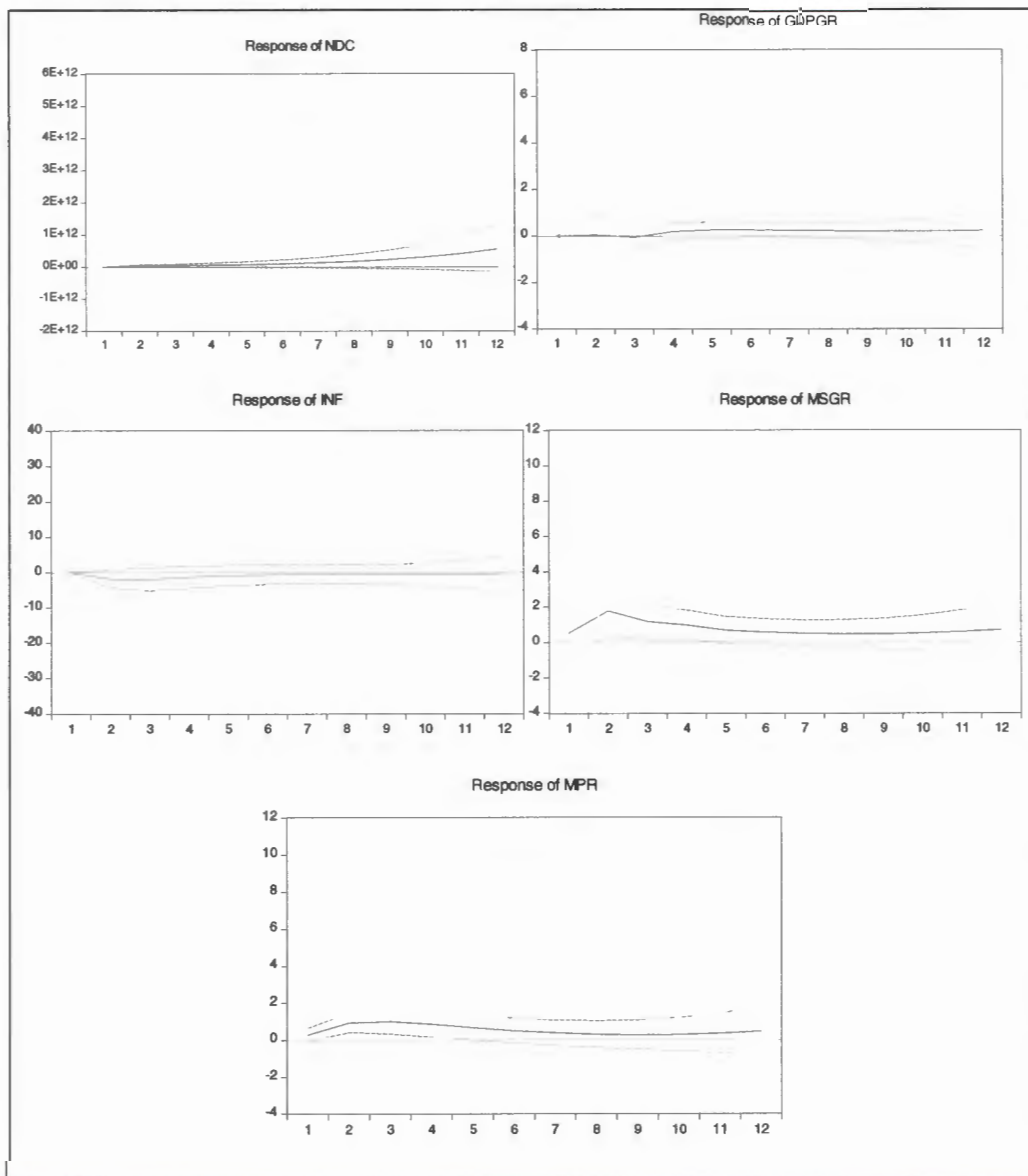


Figure 6.8 show that the two monetary policy variables, namely monetary policy rate and money supply, are the major variables that respond significantly to exchange rate shock. The implication is that exchange rate constitutes a great influence on monetary policy dynamics in the EAC. Money supply growth rate increased between the first and the second month and fell a little bit thereafter. Other variables do not respond significantly to the exchange rate shock.

6.3.1 Variance decomposition analysis for EAC

Three major shocks can be inferred under this economic block. These are the MPR, EXR and GDPGR and the responses of other variables are discussed below starting with that of MPR. The responses and shocks of other variables are however insignificant.

Table 6.6: Variance decomposition of MPR for EAC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 4.475124 | 4.36E-06 | 10.17958 | 5.66E-05 | 0.335233 | 9.996381 | 17.43934 | 0.143394 | 61.90601 |
| 6 | 5.956191 | 3.23E-06 | 9.319766 | 3.71E-05 | 1.280981 | 9.764982 | 30.99097 | 1.827320 | 46.81594 |
| 9 | 7.026602 | 7.73E-06 | 7.669539 | 2.68E-05 | 1.856150 | 7.693765 | 31.86595 | 14.40582 | 36.50874 |
| 12 | 9.596733 | 3.81E-05 | 4.337483 | 1.54E-05 | 1.784839 | 4.611530 | 19.38965 | 49.99995 | 19.87649 |

Table 6.4 describes the contributions of each shock to the behaviour of monetary policy rate in the EAC. The result shows that exchange rate, money supply and commodity price constitute the largest influences on the behaviour of monetary policy changes in the EAC apart from itself. With 17.44% contribution within the first three months, exchange rate increases to 31% on the ninth month and 19.39% by the end of the year. Money supply growth rate accounted for 0.14% at the beginning of the month but increased sharply to 50% by the end of the twelfth month. Inflation rate also exerts some small degree of influence on the behaviour of monetary policy with a 10% fluctuation within the first three months and later falls to 4.61% as at the end of the period. As at the end of the year, the contribution of commodity price has reduced from the 10.18% it recorded in the first three months to 4.38% by the end of the year.

Table 6.7: Variance decomposition of EXR for EAC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 166.1394 | 1.01E-06 | 4.307193 | 0.000538 | 0.658041 | 0.985044 | 93.63537 | 0.013494 | 0.400321 |
| 6 | 275.6775 | 6.95E-06 | 3.240690 | 0.000485 | 1.539355 | 3.140111 | 91.67701 | 0.013452 | 0.388893 |
| 9 | 430.5304 | 3.03E-05 | 21.76515 | 0.000356 | 2.317943 | 4.858448 | 70.82463 | 0.012107 | 0.221338 |
| 12 | 816.8864 | 6.62E-05 | 58.94114 | 0.000177 | 2.208229 | 3.414434 | 35.29079 | 0.024161 | 0.121004 |

The contributions of each shock to the behaviour of exchange rate are explained by Table 6.5. Apart from own shock, commodity price constitutes the largest influence on the exchange rate from a low 4.31% in the first quarter to a very high 58.94% by the end of the period. By implication, commodity price shock affects the behaviour of exchange rate in the EAC more than any other variable in the model. Though small, gross domestic product growth rate fluctuate from 0.66% at the beginning to 2.21% at the end of period. The effect of inflation was equally noticed even though with little percentages. From 0.98% in the first quarters, the fluctuation in inflation increased to 3.86% by the end of the third quarter of the period.

Table 6.8: Variance decomposition of GDPGR for EAC

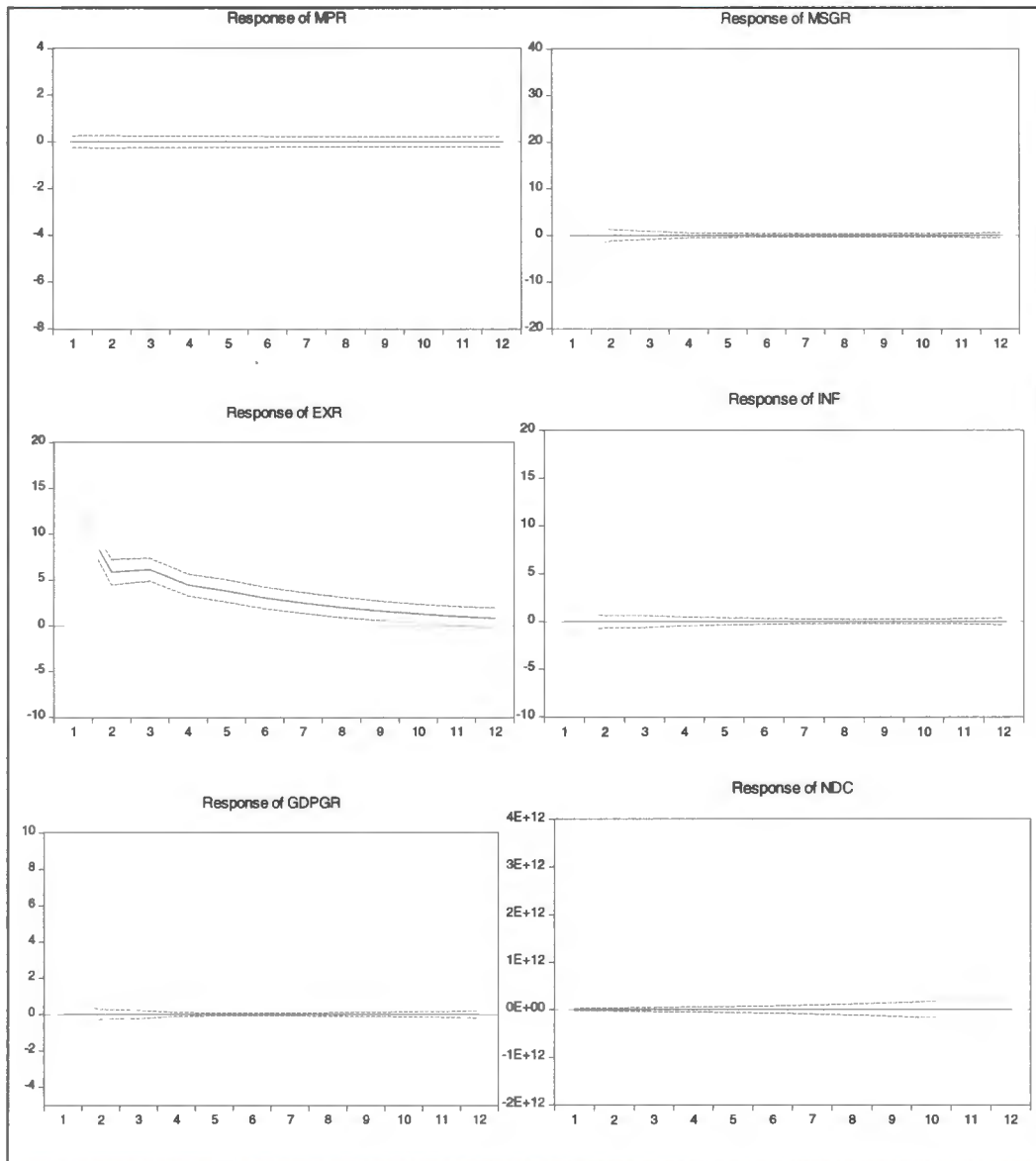
| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 6.228362 | 4.93E-06 | 0.000141 | 0.841456 | 96.49658 | 0.074595 | 0.014869 | 0.118110 | 2.454247 |
| 6 | 6.281070 | 4.88E-06 | 0.000141 | 0.835408 | 94.90033 | 0.488358 | 0.435774 | 0.281881 | 3.058101 |
| 9 | 6.331746 | 4.92E-06 | 0.000140 | 1.118283 | 93.44318 | 1.080032 | 0.799203 | 0.347002 | 3.212151 |
| 12 | 6.445082 | 6.75E-06 | 0.000136 | 3.619285 | 90.28285 | 1.470141 | 1.109168 | 0.364309 | 3.154106 |

The result of variance decomposition of the gross domestic growth rate of EAC is an indication that apart from own shock, monetary policy rate is the only variable with a noticeable influence on changes in monetary policy in this bloc. Although the impact of net domestic credit was not felt until the last quarter of the period, all other variables maintained no relationship with GDP growth rate throughout the period.

6.4. Impulse response analysis for ECOWAS

ECOWAS is the largest economic bloc in the SSA as well as the largest economy in the whole of Africa region. The impulse response functions for the economic bloc are explained as follows:

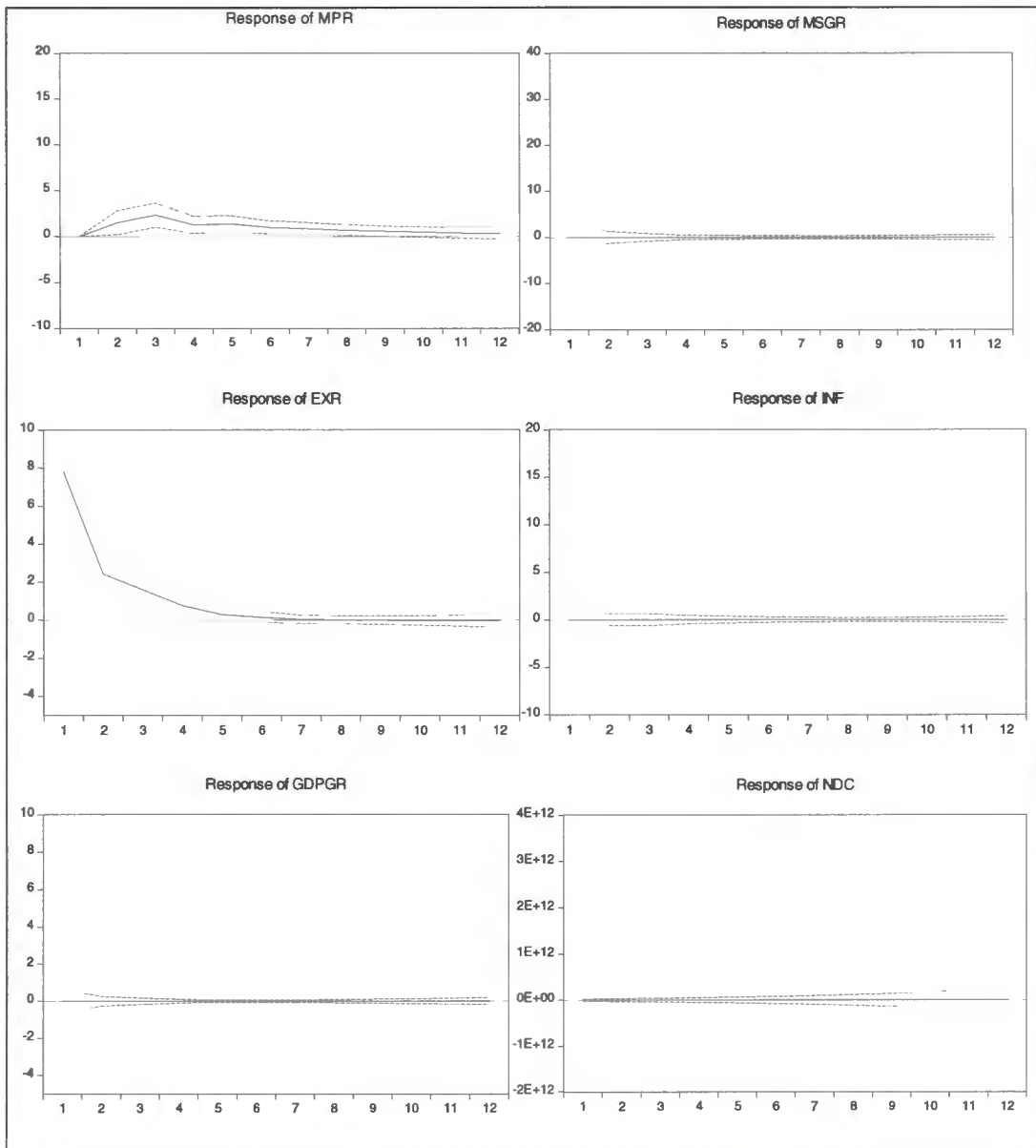
Figure 6.9: Response to oil price shock for ECOWAS



The responses of variables to oil price shock in ECOWAS are explained by Figure 6.9. The figure clearly shows that exchange rate is the only variable that responds significantly to the oil

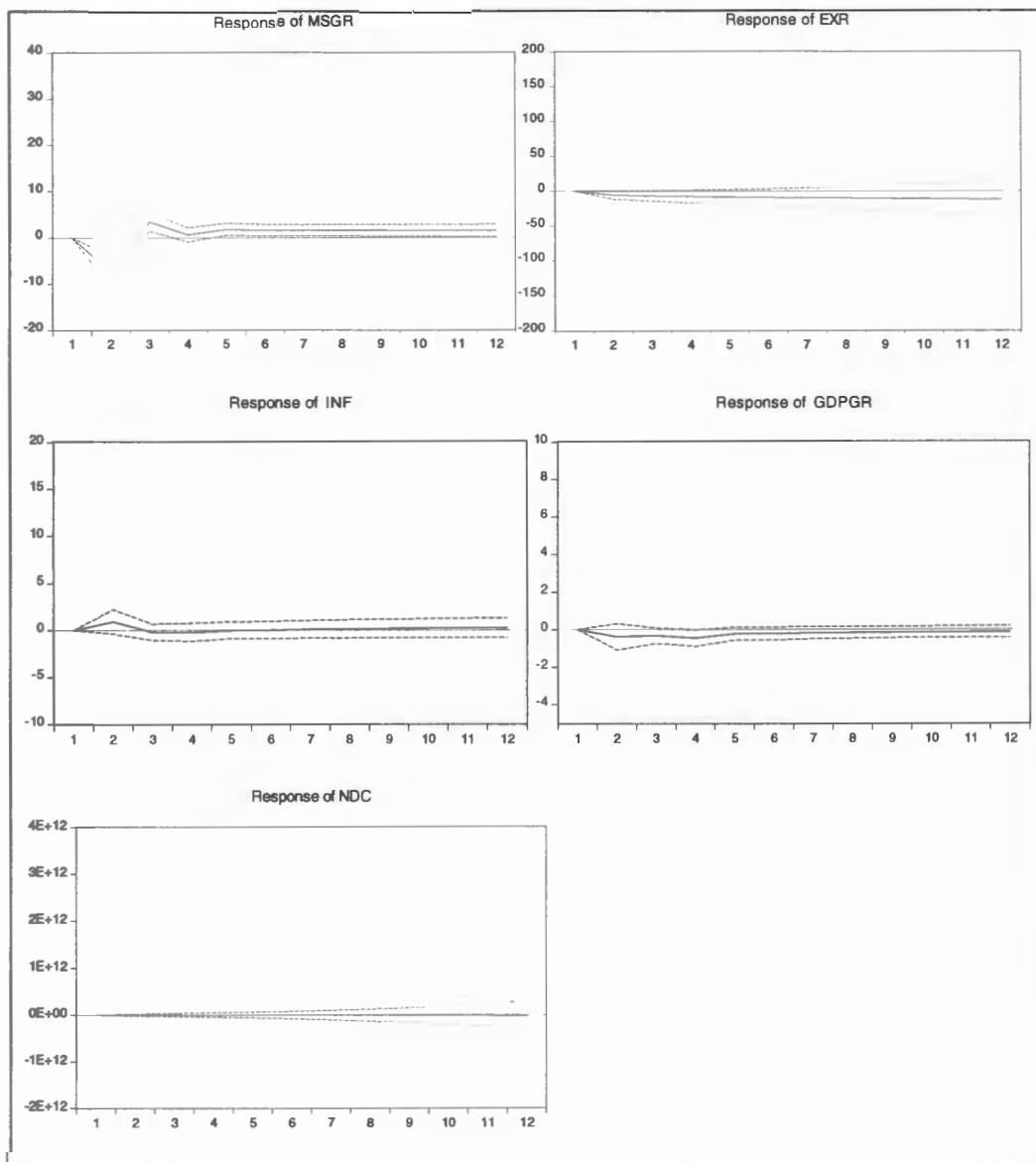
price shock in the region. All other variables' responses to oil price shock are not significant. The effect is currency appreciation. That is a 1% positive shock to oil price is capable of making the currencies in the region appreciate. The reason for this might not be unconnected with the fact that Nigeria (see IMF, 2015; IMF, 2016), which is the largest economy in Africa, also dominates this bloc and the major source of revenue to Nigeria is oil.

Figure 6.10: Response to commodity price shock for ECOWAS



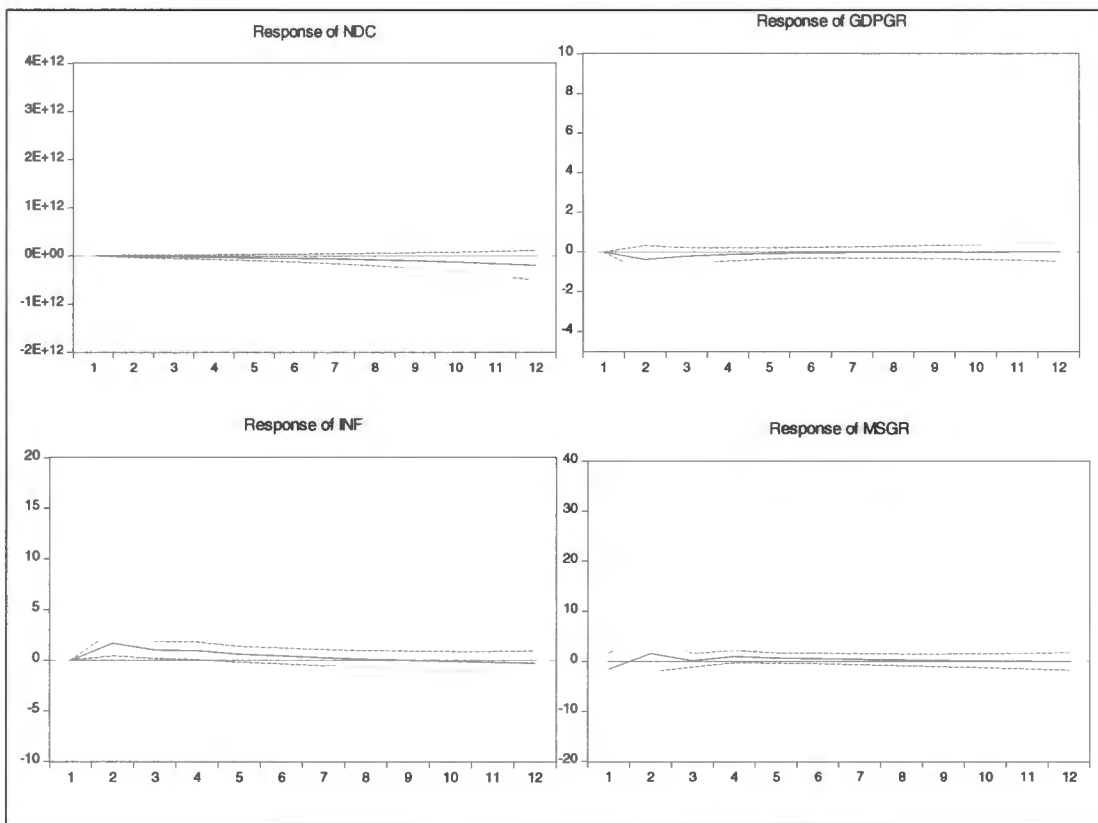
The impulse response function describing the responses of the variables to 1% standard deviation in commodity price is shown in the figure above. The responses of exchange rate and monetary policy rate are the most significant. Commodity price shock caused the exchange rate to fall significantly, especially in the first half of the year, which is currency appreciation. It also caused the monetary policy rate to fall after an initial rise in the first quarters within the ECOWAS bloc.

Figure 6.11: Response to monetary policy rate shock for ECOWAS



Money supply growth rate, exchange rate and gross domestic product growth rate are the variables that show some degree of significant response to monetary policy rate shock. Expectedly, money supply, which is the second instrument of monetary policy used in the model, reacts most significantly to the shock from the monetary policy rate. It caused money supply to fall in the first quarters of the period and later rose gradually. Gross domestic products growth rate does not respond significantly at the beginning but as the period progresses to the middle of the year, the reaction to monetary policy rate becomes more significant. Exchange rate follows the same pattern after the second month of the year.

Figure 6.12: Response to exchange rate shock for ECOWAS



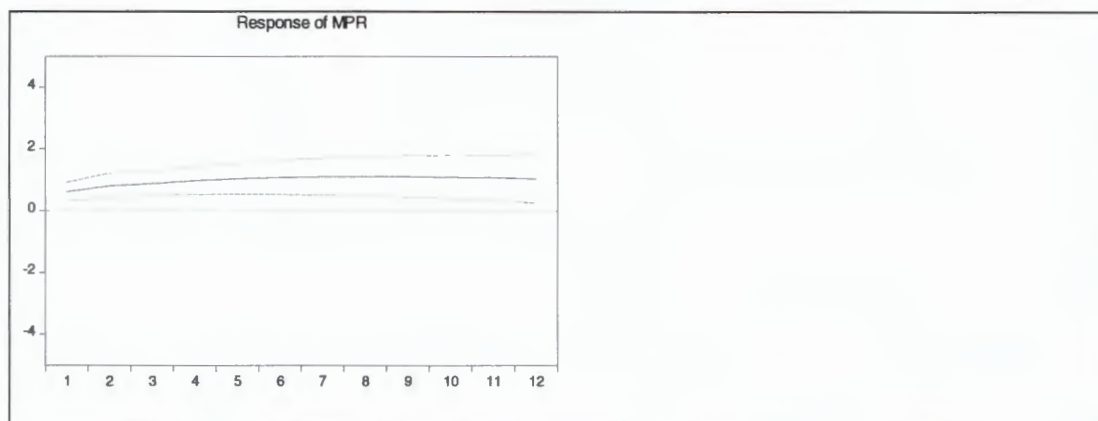


Figure 6.12 indicates that monetary policy rate reacts most significantly to exchange rate shock. An upsurge of 1% deviation in exchange rate means a sudden fall in the value of the currency. This shock generates a significant upward reaction from the monetary policy rate starting from the beginning of the period up to the last quarters of the period. Inflation rate also shows little significant reaction to the exchange rate shock after an initial rise at the beginning of the period.

6.4.1 Variance decomposition analysis for ECOWAS

Following the same trend as observed under the EAC, three variables are of importance under this bloc and these are MPR, EXR and GDPGR. The responses of other variables to their shocks are explained below starting with MPR shock.

Table 6.9: Variance decomposition of MPR for ECOWAS

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 5.266505 | 5.00E-06 | 2.33E-07 | 0.215919 | 0.212574 | 0.409898 | 6.519556 | 4.282159 | 88.35989 |
| 6 | 7.113169 | 4.27E-06 | 5.66E-07 | 0.397548 | 0.190355 | 0.615384 | 9.834816 | 6.321838 | 82.64006 |
| 9 | 8.397249 | 3.69E-06 | 8.91E-07 | 0.793936 | 0.160915 | 0.647912 | 12.28173 | 7.184358 | 78.93114 |
| 12 | 9.378312 | 3.17E-06 | 1.27E-06 | 1.863630 | 0.134888 | 0.604421 | 13.74167 | 7.585385 | 76.07000 |

The contributions of each variable to the behaviour of monetary policy rate are described by Table 6.7. According to the table, exchange rate and money supply contribute the largest shock to monetary policy rate in ECOWAS apart from self. In other words, the behaviour of monetary policy rate is dictated by the exchange rate as well as money supply. In the first three months,

exchange rate accounted for 6.52%, 9.83% by half of the year and increased to 13.74% as at the end of the twelfth month. Money supply growth rate recorded 4.28% during the first three month and increased to 7.59% by the end of the period. All other variables accounted for some paltry effects.

Table 6.10: Variance decomposition of EXR for ECOWAS

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 143.7082 | 1.223420 | 1.620355 | 0.178470 | 5.28E-05 | 2.13E-06 | 96.47429 | 0.091752 | 0.411656 |
| 6 | 236.5915 | 0.545714 | 3.395307 | 0.224035 | 5.13E-05 | 2.37E-06 | 94.90941 | 0.351514 | 0.573965 |
| 9 | 328.1886 | 0.316567 | 4.870405 | 0.142502 | 5.15E-05 | 2.64E-06 | 93.47347 | 0.591457 | 0.605549 |
| 12 | 426.7336 | 0.222002 | 5.918394 | 0.119020 | 5.26E-05 | 2.99E-06 | 92.39484 | 0.755471 | 0.590215 |

Table 6.8 shows that apart from own shock, the behaviour of exchange rate is mostly determined by oil price and commodity prices in ECOWAS. Money supply and monetary policy rate play a paltry role as well. Commodity price accounted for 1.62% in the first quarter of the period and increased to 5.92% by the end of the year. An increase in the exchange rate signifies depreciation in the currencies of the bloc. This is evident in Nigeria where the government had been battling with the continuous and unabated fall in the exchange rate of late. On the part of the oil price, it accounted for 1.22% in the beginning of the period to 0.22% by the end of the year.

Table 6.11: Variance decomposition of GDPGR for ECOWAS

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 8.446374 | 0.651160 | 0.317330 | 0.142811 | 97.04970 | 0.071878 | 0.219244 | 1.245306 | 0.302568 |
| 6 | 8.528228 | 0.695824 | 0.577373 | 0.382314 | 96.09799 | 0.074618 | 0.219493 | 1.287178 | 0.665209 |
| 9 | 8.558627 | 0.707477 | 0.653446 | 0.889272 | 95.41996 | 0.084296 | 0.222139 | 1.283227 | 0.740179 |
| 12 | 8.628687 | 0.702148 | 0.657819 | 2.358431 | 93.88949 | 0.116705 | 0.223568 | 1.275550 | 0.776287 |

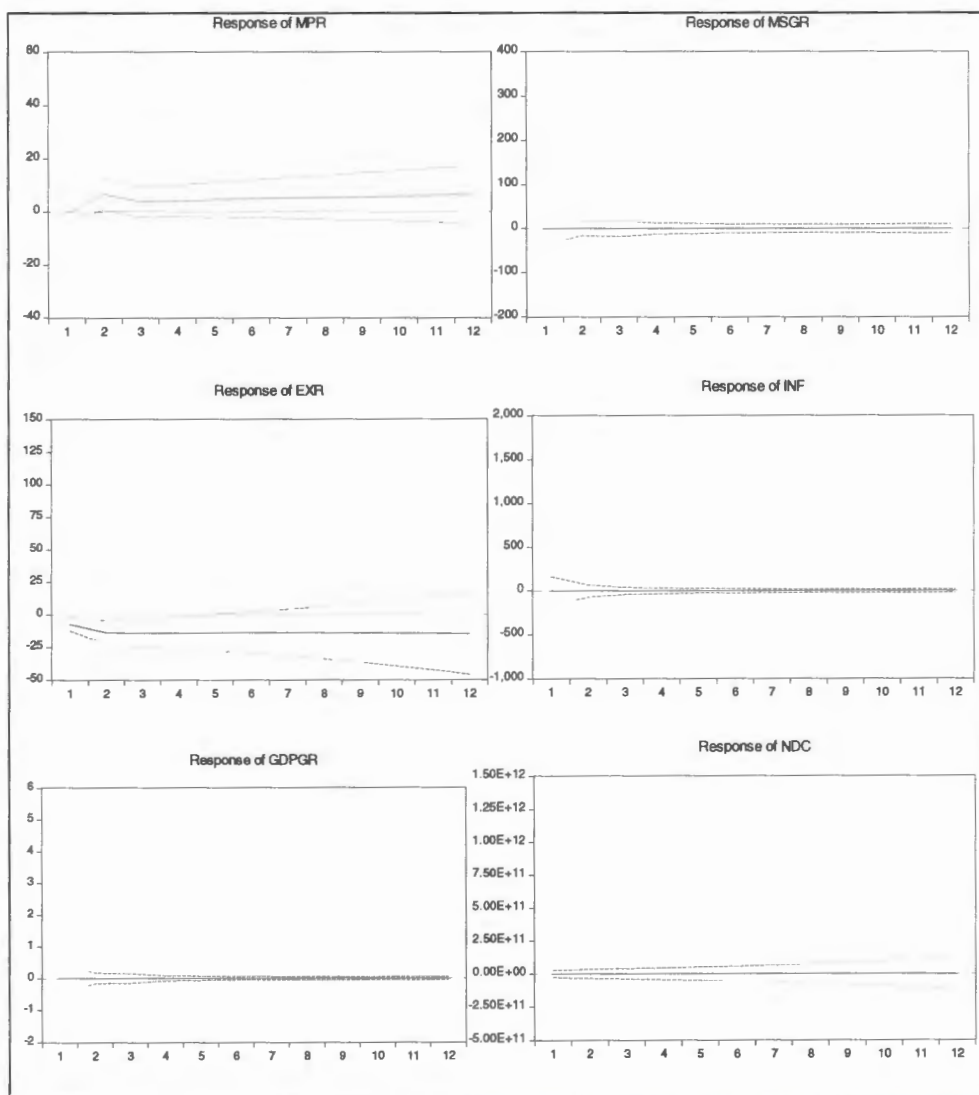
The behaviour of gross domestic product growth rate is mostly affected by money supply growth rate apart from own. This is because it contributes the largest shock to gross domestic product growth rate behaviour after the own shock. It maintained an average of 2.26% throughout

the period under review. However, the links through which the exogenous shocks affect the economic growth of the ECOWAS are exchange rate and money supply growth rate.

6.5. Impulse response analysis for SADC

South Africa Development Community is the last economic bloc in focus in SSA. The observed impulse response functions are discussed as follows:

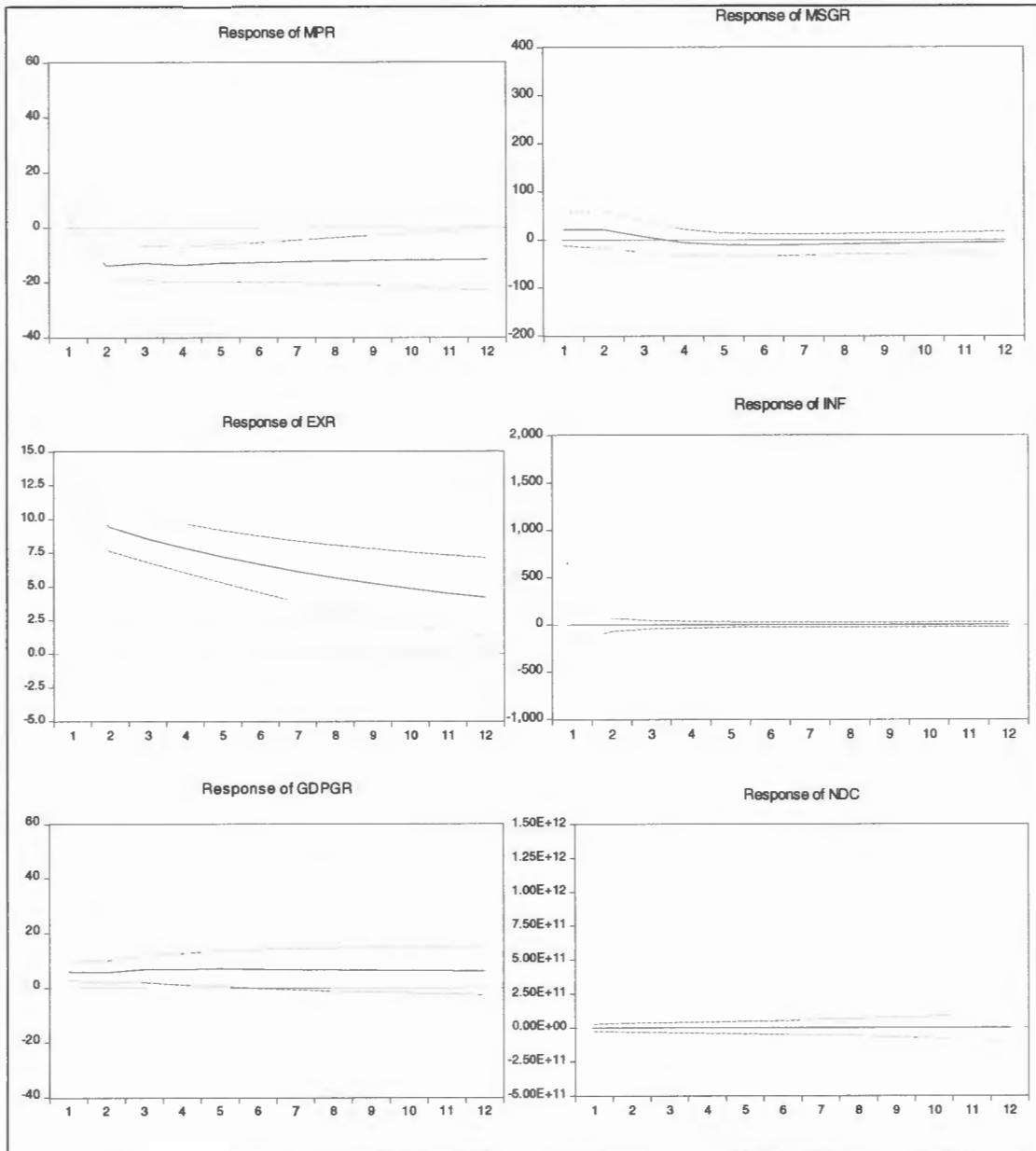
Figure 6.13: Responses to oil price shock for SADC



The impulse response function that describes the responses of the variables (to 1% standard deviation) in oil price in SADC indicates that exchange rate shows the most significant response to the oil price shock. It caused the currency to appreciate with a constant decrease after the third

month. However, this could not be sustained throughout the period as the effect becomes weak as the period progresses. Another variable of significance is monetary policy rate with a constant increase after the third month of the period. All other variables fail to show significant response to oil price shock.

Figure 6.14: Response to commodity price shock for SADC



From Figure 6.14, three variables respond significantly to commodity price shock. They are monetary policy rate, exchange rate and gross domestic product growth rate. The implication

is that a positive shock to commodity price causes currency to appreciate significantly, hence the monetary policy rate falls and the gross domestic product growth rate rises steadily and significantly. There was a continuous decrease in the exchange rate from the beginning of the period till the end. When compared to oil price shock, it appears that commodity price has a greater influence on the SADC economy than oil price.

Figure 6.15: Response to Monetary policy rate shock for SADC

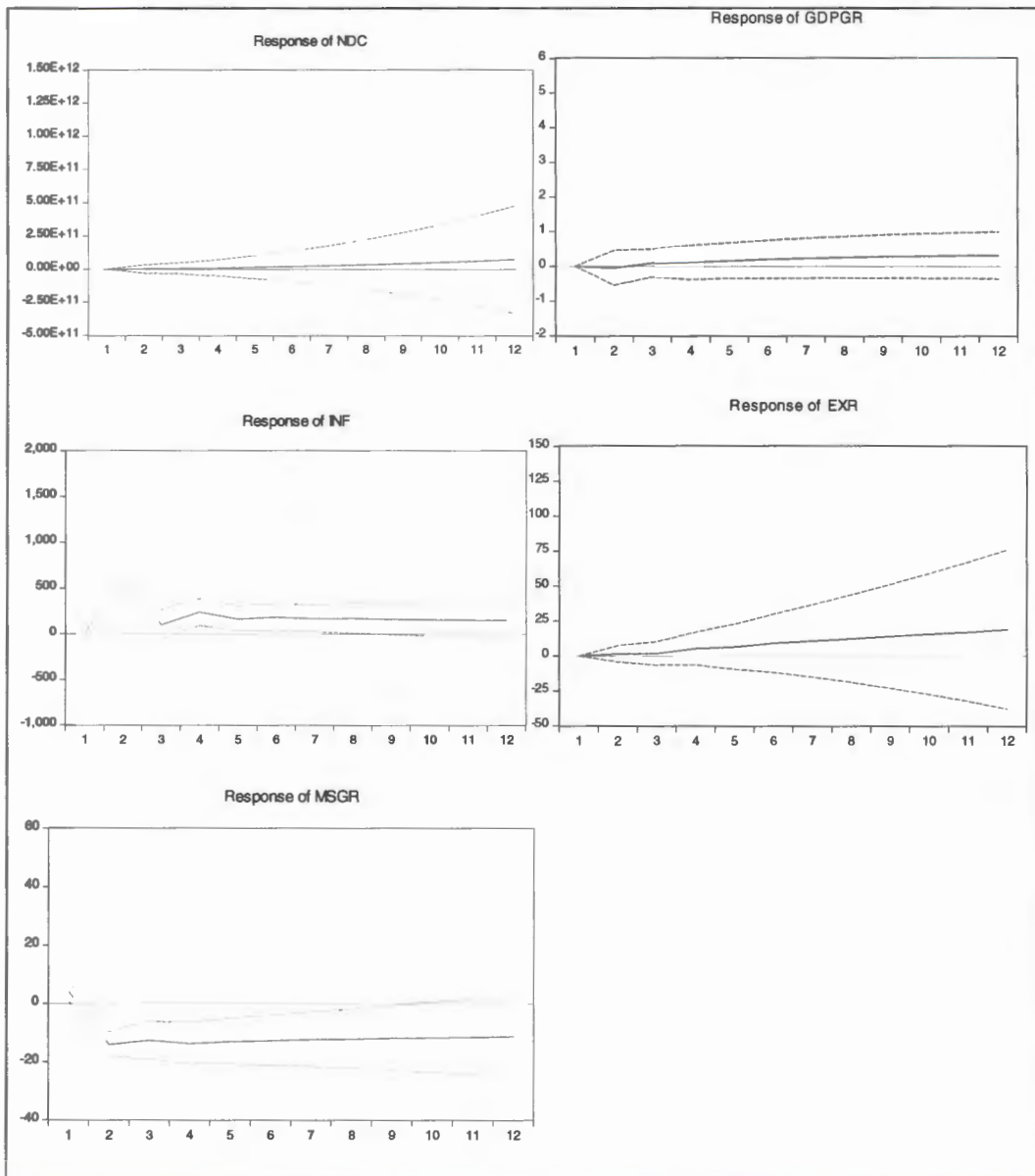
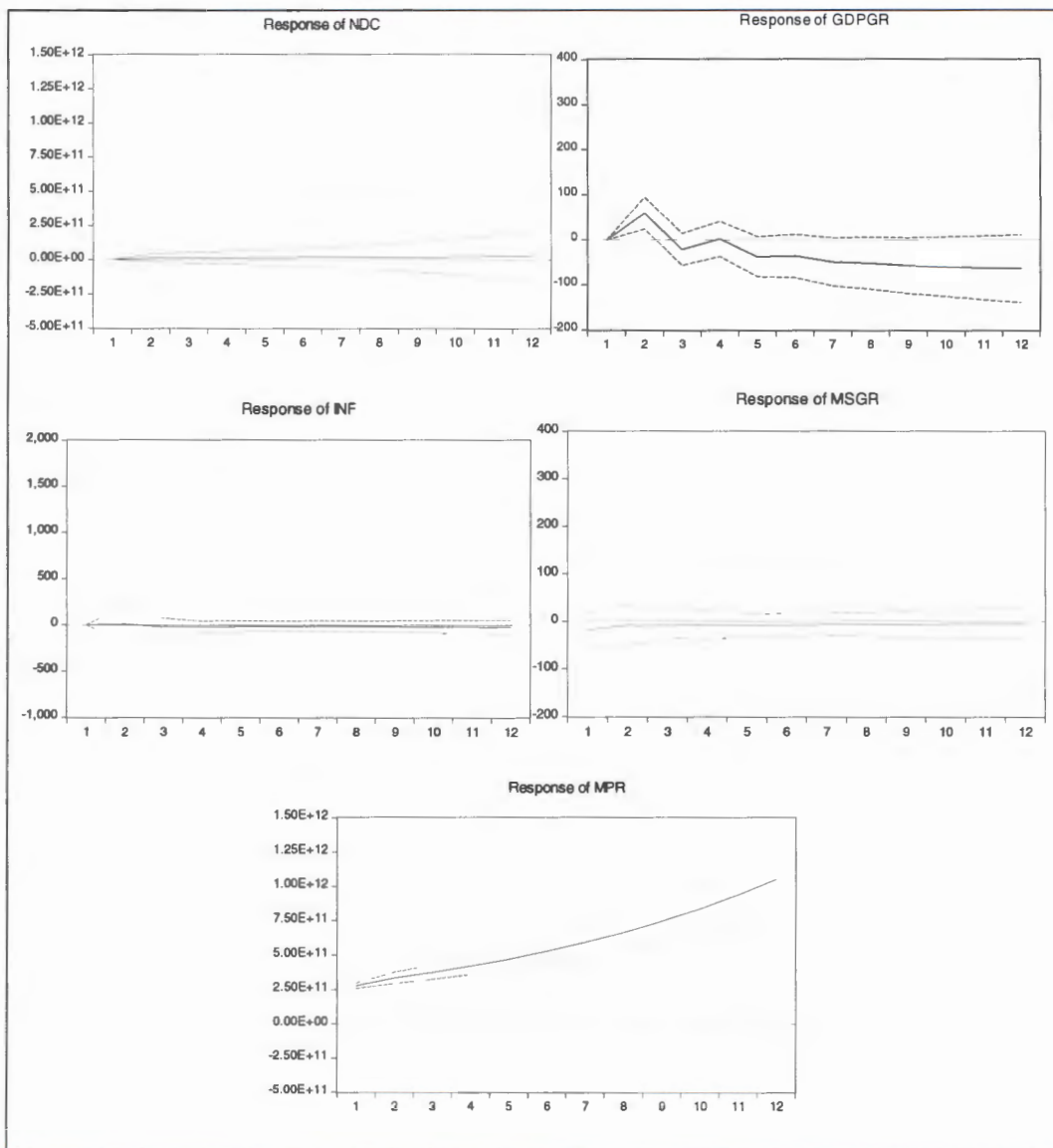


Figure 6.15 describes the impulse response function for monetary policy rate in the SADC. The result shows that inflation rate and money supply growth rate are most responsive to the shock from monetary policy rate. Inflation rate increased in the early period, fell a bit before maintaining a steady fall for the period. The implication is that the SADC appears to be targeted towards controlling inflation because the positive shock caused money supply to fall and inflation rate also fell steadily. The effects on economic growth by other variables are not so significant.

Figure 6.16: Responses to exchange rate shock in SADC



The response of the variables to 1% standard deviation in exchange rate is shown in Figure 6.16. The result indicates that monetary policy rate and gross domestic product growth rate are the two variables that respond significantly to exchange rate shock in SADC. The positive shock caused monetary policy rate to rise and the gross domestic product growth rate recorded a steady significant fall after an initial undulating decrease. All other variables fail to respond significantly to the shock in the exchange rate.

6.5.1 Variance decomposition analysis for SADC

The contributions of each shock variable in the SVAR model to the behaviour of some variables are explained by the following variance decomposition tables. Only three variables of MPR, EXR and GDPGR show influence on other variables but yet, the response of OILP and COMP are equally discussed briefly even though, with less significance.

Table 6.12: Variance decomposition of MPR for SADC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 55.83338 | 1.842625 | 5.259224 | 0.201209 | 0.064222 | 0.658621 | 12.12827 | 3.707821 | 76.13801 |
| 6 | 76.00903 | 1.990895 | 3.399281 | 0.527135 | 0.055063 | 0.473362 | 15.53453 | 4.487112 | 73.53262 |
| 9 | 90.69212 | 2.452727 | 2.484898 | 1.122384 | 0.048161 | 0.371742 | 16.31071 | 4.759474 | 72.44990 |
| 12 | 102.9862 | 2.954184 | 1.975610 | 2.131219 | 0.039681 | 0.306060 | 16.54300 | 4.803237 | 71.24701 |

From the above table, it can be concluded that apart from the own shock, exchange rate, commodity price and money supply growth rate have the largest influence on the behaviour of monetary policy rate in that order. The result underscores the importance of commodity price and exchange rate *vis-a-vis* dynamics in monetary policy in the SADC. The response of exchange rate accounted for the highest percentage out of all the variables with, an initial rate of 12.13% in the first three months and ended at 16.54% by the end of the period. Next is commodity price with an early response of 5.26% to a low 1.98% at the end of the period. Though with little response, money supply growth rate accounted for 3.71% in the first quarter of the year and ended up with 4.80% by the end of the period. All other variables accounted for a very low percentage during the period under consideration.

Table 6.13: Variance decomposition of EXR for SADC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 104.2829 | 4.000269 | 0.201848 | 0.097716 | 0.166709 | 0.852031 | 94.38163 | 0.068389 | 0.231413 |
| 6 | 283.3195 | 2.770348 | 1.636478 | 0.048336 | 1.891174 | 0.805411 | 91.82686 | 0.030209 | 0.991187 |
| 9 | 1787.825 | 1.321846 | 10.89719 | 0.072146 | 0.091362 | 0.010622 | 79.74621 | 0.231680 | 7.628943 |
| 12 | 1847.251 | 1.245791 | 13.71741 | 0.088666 | 0.353844 | 0.036969 | 75.56449 | 0.228980 | 8.763845 |

Table 6.11 further underscores the importance of the two exogenous shocks, namely oil price and commodity price volatilities, in determining the behaviours of exchange rate in the SADC. Commodity price volatility contributes the largest shock to the behaviour of exchange rate with an unnoticeable percentage of 0.20% during the first three months to 13.72% by the end of the last quarter of the period. Next in the response criteria is the oil price volatility, with 4% in the first quarters only to come down to 1.25% by the end of the period. The other variables display little or no response to the behaviour of exchange rate shock.

Table 6.14: Variance decomposition of GDPGR for SADC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 4.851653 | 0.370909 | 0.782716 | 0.204306 | 97.02616 | 0.260034 | 0.266150 | 1.015551 | 0.074170 |
| 6 | 369.7686 | 0.120629 | 0.665834 | 0.002945 | 89.25023 | 0.323402 | 6.790523 | 0.301668 | 2.544771 |
| 9 | 469.9019 | 0.429291 | 0.602811 | 0.018305 | 63.00690 | 0.348090 | 29.03266 | 2.473828 | 4.088118 |
| 12 | 484.7130 | 0.843374 | 0.629523 | 0.063204 | 59.22050 | 0.368317 | 29.71321 | 2.784198 | 6.377672 |

The result presented in Table 6.12 describes the contributions of each shock to the behaviour of gross domestic product growth rate in the SADC. Apart from the own shock, exchange rate has the largest influence on the economic growth of the SADC followed by monetary policy rate and money supply growth rate. The linkage that can be deduced from this interaction is that the exogenous variables, especially the commodity price, influences the economic growth of the SADC through the exchange rate, monetary policy rate and money supply growth rate. The initial response of exchange rate was very little but jumped to a high of 29.71%

by the end of the period. Next to that was monetary policy rate which accounted for 6.38% by the end of the twelfth month.

Table 6.15: Variance Decomposition of OILP for SADC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3 | 28.72728 | 90.53576 | 5.694153 | 1.673807 | 0.337493 | 0.038155 | 0.221398 | 0.057397 | 1.441841 |
| 6 | 36.68977 | 90.36143 | 5.739690 | 2.145840 | 0.252999 | 0.059436 | 0.423232 | 0.047664 | 0.969707 |
| 9 | 41.23497 | 89.90106 | 5.253735 | 2.035322 | 0.324702 | 0.320583 | 0.616258 | 0.093279 | 1.455065 |
| 12 | 44.43151 | 88.04814 | 4.796236 | 1.823095 | 0.396037 | 0.838277 | 0.853804 | 0.248536 | 2.995880 |

The summary from the above table is that apart from own shock, only COMP show unnoticed response to the shock from OILP in this bloc. In fact, the response of OILP reduced towards the end of the period under consideration.

6.6 Summary of Findings

6.6.1 Central Africa Community (CEMAC)

Firstly, the CEMAC economic region of the SSA shows that MPR is the only variable that responds most significantly to oil price shock. The reason for this is premised on the fact that five out of the six countries used that make up the CEMAC in the analysis are predominantly oil producers and four of them are net oil exporters. This makes their economies to be highly susceptible to oil price volatilities because oil is the major driver of the economies of these countries (AfDB, 2014). However, commodity price shocks also play the same role but with wider influence on the macroeconomic variables. Apart from monetary policy rate, exchange rate and money supply growth rate are also significantly affected. This is because commodity price covers a wide range of commodities hence the influence appears to be more significant in the region.

Secondly, the results from CEMAC show that exchange rate responds most significantly to monetary policy rate shock. Money supply growth rate is another variable that responds significantly to the shock. However, it can be deduced from the analysis that the behaviour of exchange rate is controlled by the monetary policy rate. The reason for this might not be unconnected with the conclusion of Omolade and Ngalawa (2014) that the region practices a fixed exchange rate and hence the behaviour is monitored and controlled by a unified monetary policy

in the region. The results from the CEMAC show a strong linkage between monetary policy rate and exchange rate in the region.

Again, the behaviour of the GDP growth rate is mostly affected by the exchange rate shock and the two exogenous shocks of oil price and commodity prices. The implication and summary of the findings in terms of the interaction among the variables from the CEMAC region shows that the effects of the exogenous shocks are transmitted to the CEMAC economies via the monetary policy rates to the exchange rate and from the exchange rate to the GDP growth rate.

6.6.2 East Africa Community (EAC)

The East Africa Community (EAC) is another economic bloc in the SSA. It comprises six major countries in our analysis. Findings from this bloc indicate that commodity price shocks affect the EAC economies more than oil price shocks. None of the macroeconomic variables in the P-SVAR model for the EAC showed significant response to oil price shock but monetary policy rate, exchange rate and the gross domestic product growth rate all show significant responses to the shock from commodity price. The reason for this might not be unconnected with the fact that the countries in this economic bloc are not predominantly oil producers, unlike in CEMAC. An upward movement of commodity price is capable of increasing the economic growth of the EAC (see AfDB, 2013).

Furthermore, money supply growth rate and inflation rate are significantly responsive to monetary policy rate shock in the region. Monetary policy dynamics in the EAC affect the rates of money supply growth as well as inflation mostly. Unlike what was obtained for the CEMAC, monetary policy rate is significantly responsive to exchange rate shock but the reverse is the case in the CEMAC. In addition, money supply and gross domestic product growth rates also show significant response to the exchange rate shocks in the EAC.

Finally in the EAC, the behaviour of the gross domestic product growth rate is mostly dictated by monetary policy rate. Therefore the linkage of interaction in the region shows that commodity price shocks affect the exchange rate significantly and the effect is transmitted to the economic growth of the EAC via monetary policy instruments, namely monetary policy, monetary policy rate and money supply. The implication is that commodity price shocks cause monetary policy dynamics to affect the growth of the region through the exchange rate.

6.6.3 Economic Community of West Africa States (ECOWAS)

ECOWAS is the largest of all the economic blocs in SSA in terms of economy. The economic bloc includes the largest economy in Africa, which is Nigeria; hence the analysis of this economic bloc has important implication for the whole SSA economy.

Just as what was obtained under CEMAC, oil price shock attracts significant response from exchange rate. This is an indication that Nigeria, which is the largest oil producer in Africa, might have influenced this result (see Omolade and Ngalawa, 2014). Notwithstanding, commodity price also has additional influence on monetary policy rate. Other economies in the region are not major oil producers but are primary commodity exporters (on which their economies depend), hence there is a significant influence of commodity price shocks on both exchange rate and monetary policy rate in ECOWAS. Particularly, the oil price shock caused the exchange rate to fall significantly, which is currency appreciation. The reverse is currently being witnessed in Nigeria where a sharp fall in the oil price caused the local currency to depreciate significantly. This is similar to results of other researchers such as Mordi and Adebisi (2010), Olomola (2007), and Omolade and Ngalawa (2014) among others.

Again, the reactions to monetary policy shocks in the ECOWAS show that money supply and gross domestic products growth rate react significantly. It caused both the money supply and GDP growth rate to fall steadily. The same chains of reactions are repeated for commodity price shock. The results on the ECOWAS also show that monetary policy rate reacts most significantly to exchange rate shocks. In other words, the monetary policy response to exchange rate shock is significant as it causes the monetary policy rate to rise significantly. The reason for this behaviour is explained by Kutu and Ngalawa (2014), who posit that a sharp depreciation in currency will lead to excessive demand for local currency to meet foreign transactions and this will put pressure on the interest rate.

The ECOWAS analysis has further shown the strong linkage between monetary policy dynamics and exchange rate. The variance decomposition of the monetary policy rate for the bloc indicates that exchange rate plays a very important role in determining the dynamics in monetary policy. This is also supported by the impulse response function as earlier explained. In a different direction from what was witnessed in the EAC, money supply transmits all these interactions to gross domestic product growth rate as it dictates the behaviour of the gross domestic product growth rate more than other variables in the ECOWAS P-SVAR model.

In a nutshell, in the ECOWAS bloc, oil price and commodity price shocks constitute important exogenous disturbances to monetary policy dynamics and the medium through which this works is the exchange rate. The exchange rate passes the shock to monetary policy rate and through this channel to money supply and money supply to the growth rate of gross domestic product. The findings here have shown some similarities between CEMAC and ECOWAS in terms of the dominant role of oil price as an important exogenous shock. The only difference is the medium through which it affects the economy. While it uses the monetary policy rate channel in the CEMAC, it uses the exchange rate channel in the ECOWAS. The reason for this difference lies in the economic framework of the two regions. CEMAC has a fixed exchange rate and practices a common monetary policy controlled by a single Central Bank (BEAC) but such is not the case for ECOWAS, where monetary policy administration is decentralized (Omolade and Ngalawa, 2014).

6.6.4 Southern Africa Development Community (SADC)

The SADC is another economic bloc in SSA that was focused on. It can be rated as the second largest economy after ECOWAS, because South Africa is among the countries in the economic bloc. Both oil price and commodity price shocks affect the variables in the model but commodity price shock has a greater impact. Exchange rate is the only variable that reacts significantly to oil price shock while monetary policy rate, exchange rate and gross domestic products growth rate react significantly to commodity price shock in the SADC. Just as in the EAC, the reason for this might not be unconnected with the fact that most economies in the SADC are not major oil producers and consequently, the effect of oil price shock only affects them as oil importing countries and the effect is transmitted via the exchange rate.

According to AfDB (2012), countries in the SADC predominantly rely on commodity exports as the major driver of their economies; hence they are susceptible to commodity price volatilities. This position is supported by the findings that monetary policy dynamics in this region are highly responsive to commodity price shocks. Also the exchange rate and the gross domestic product growth rate in the region respond significantly to commodity price shocks. The shock makes their currencies to appreciate and the economic growth rises steadily.

The SADC has also been shown as a region that uses the monetary policy rate effectively to control inflation and money supply. Monetary policy rate shocks only produce significant responses from these two macroeconomic variables. The implication is that monetary policy

dynamics in this region significantly affect their inflation as well as the money supply. Exchange rate shock has also been identified as a major shock that affects monetary policy dynamics in the SADC. The findings revealed that monetary policy rate is most responsive to the shock from the exchange rate. Kutu and Ngalawa (2016) have also identified exchange rate shock as the most important shock affecting the macroeconomic variables of most countries in the SADC.

Finally, the results from SADC have shown that commodity prices shock is the major exogenous determinant of monetary policy dynamics in the SADC and the effect is transmitted via the exchange rate channel to the macroeconomics of the region, with inflation rate and money supply playing a major role in the transmission mechanism as it affects the economies of the countries in this region.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

7.1 Summary

The study assessed the dynamic effects of monetary policy on the economic growth of the Sub-Sahara African Countries (SSACs) spanning 1980-2015. Investigation of the repeated policy changes by the monetary authorities occasioned by some external and internal influences and the attendant effects on economic growth of SSA is the broad objective of the study. The nature of the economies in SSA which is characterized by a narrow and mono-economic base and primary-goods-dominated export base makes SSA largely an import dependent economy which is highly susceptible to external cyclical changes in oil and commodity prices. In order to cope with this situation, the monetary authorities of SSA usually make use of monetary policy to maintain internal economic stability and to ensure sustainable economic growth. This often leads to uncertainty in monetary policy framework as it is highly prone to frequent adjustments which make it less static. No consensus was found in the literature on what should be or what really the effect of this situation is on the economic outlook of SSA. Consequently, to contribute to the existing literature and to fill some important gaps as stated in the first chapter is one of the motives for this research work.

The study focused on SSA and covered 36 countries in the four major economic blocs within the region. The broad objective of the study is further split into four sub objectives namely: (i) to investigate the determinants of monetary policy dynamics in SSA, (ii) looking at the impact of monetary policy dynamics on the economic growth of SSA, (iii) examining the dynamic interactions between the identified policy variables and (iv) to assess the influence of external factors in terms of oil and commodity price volatilities on monetary policy dynamics and growth in SSA. Consequently, empirical literature that spans recent periods on the investigation of the links between monetary policy and growth form the bulk of the review of literature. Basically, growth and monetary theories were critically reviewed in the study. Explicitly, the empirical literature is divided into two aspects, namely empirical literature on SSA and those ones outside SSA. This empirical review was done in order to bring out the identified gaps in the studies reviewed and ways through which the gaps could be filled in clear terms.

To achieve all the objectives stated in the study, models were formulated for each of the sub-objectives of the study. Both the monetary theories and growth theories, especially the endogenous growth models, served as precursors for the models which were eventually estimated for the purpose of achieving each of the stated sub-objectives. Consequently, the model specification to assess the determinants of monetary policy dynamics in SSA expresses interest rate or the monetary policy rate as a function of output, money supply, exchange rate, inflation rate, capital formation, net domestic credit, government expenditures, oil and commodity price volatilities and a dummy variable for the global financial crisis. All these variables were adjudged in the literature as determinants of monetary policy dynamics in the SSA. The second model, which has to do with the investigation of the impact of monetary policy dynamics on the economic growth of SSA, expresses the GDP growth rate of the SSA as a function of the explanatory variables identified. The third model was an eight variables S-VAR model to capture objectives three and four i.e. the dynamic interactions between the monetary policy variables and also the effects of external forces in terms of oil and commodity price volatilities on growth respectively.

Various methods of analysis were adopted in the study to estimate the models. For instance it was discovered in the literature that oil and commodity price volatilities are important factors that determine monetary policy dynamics, therefore the investigation starts from examining the asymmetric effects of these prices on economic growth of SSA. Under this aspect the Exponential Generalized Auto-regressive Conditional Heteroskedasticity (EGARCH) was adopted. To capture objective one, the ARDL panel cointegration analysis was employed but this approach could not be used for objective two since the dependent variable, which is GDP growth rate, was stationary in levels for all the three unit root tests conducted. As a result of this, both the fixed and random effects were conducted using the Hausman test to decide which model gave a better result. The FE was favoured by the outcome of the Hausman test. The impulse response functions and the variance decomposition generated by the S-VAR model were the basis of the analysis for objectives three and four.

Findings from the study are in diverse forms based on the objectives and sub-objectives of the study. Firstly, based on the overwhelming support from the literature about the influence of oil and commodity prices volatilities on monetary policy dynamics and economic growth, the study used the EGARCH approach to investigate this and the results show that both oil price and commodity prices are volatile but their nature of volatility is more symmetric than asymmetric.

The implication is that a positive price shock will have a more pronounced effect on volatility than negative price shock and hence the resultant effect on economic growth. Before the estimation of Panel ARDL, the panel unit root tests were conducted and the results show a mixture of variables that are integration of order one and zero. This result dismissed the usage of Westerlund (2007) cointegration method proposed in the methodology and the study opted for Panel ARDL approach to panel cointegration analysis.

Secondly, the panel results on the determinants of monetary policy dynamics in SSA show that there is presence of cross sectional dependence in the analysis for the whole pool of SSA. This necessitates breaking the analysis down to individual economic blocs for the estimation. The countries are grouped into four economic regions namely: CEMAC, ECOWAS, EAC and SADC. The reason for the decentralization of the analysis is justified as the results from the individual economic blocs fail to show complete similarities with the pooled SSA results. However, across the economic blocs some similarities are found, while some areas of differences are also discovered. In the first place, GDP growth rate is the first variable in the model and the result across the economic blocs confirm output growth rate of SSA as an important determinant of monetary policy dynamics, though it is also discovered from the result that the effect is more pronounced where the financial deepening is very effective, especially in SADC and CEMAC.

Again, another variable investigated is money supply growth rate which is proxy by financial deepening, that is, the ratio of money supply to the GDP. The variable is also found to have significant impact on monetary policy dynamics in SSA but the effect is more pronounced in SADC, EAC and CEMAC. The findings further underscore the effect of financial deepening or effective money supply in monetary policy effectiveness in SSA. In addition, exchange rate is also confirmed from the result for all the economic blocs as an important factor that determines monetary policy dynamics in SSA. Though it plays different roles across the economic blocs, the impacts have generally been shown to be significant on monetary policy dynamics in the SSA.

However, unlike other variables whose results have been discussed so far, inflation rate has no overwhelming support as an important variable that affects monetary policy dynamics in SSA but yet, in the two largest economic blocs namely ECOWAS and SADC, the effect of inflation on monetary policy dynamics is found to be very significant. This speaks volume for inflation-targeting monetary policy that is in operation in some countries within these blocs.

Both oil and commodity price volatilities are shown to have a significant impact on monetary policy dynamics in SSA. The findings from the study have also supported the existing literature that attributes uncertainty in monetary policy outlook in SSA to commodity and oil price fluctuations. However, the effects have some small differences across the four economic blocs. While oil price volatilities show more pronounced effects in economic blocs with oil producing members, the effect is not very significant in non-oil producing countries. Again, commodity price volatilities exhibit an overwhelmingly commanding influence on the monetary policy dynamics generally in all the four economic unions. On the contrary however, government expenditure, net domestic credit and gross capital formation fail to exhibit noticeable impact on monetary policy dynamics across all the economic unions in SSA.

Generally the results on the determinants of monetary policy dynamics in the SSA have confirmed that money supply, exchange rate, inflation rate, oil price volatility, commodity price volatility and GDP growth rate are all important determinants of monetary policy dynamics in SSA. The study further shows that monetary policy dynamics in the SSA can better be studied when the investigation is based on economic blocs or individual countries, as the result from the panel of the whole of SSA might be misleading because it cannot be completely generalized for all the countries in the SSA.

The results on the impact of monetary policy dynamics on the economic growth of the SSA can be summarized as follows. Firstly, the results from the whole of SSA show some degrees of differences from the ones obtained based on the economic blocs. Only monetary policy rate and exchange rate show significant influence on the growth of SSA from the whole pooled results of SSA while other variables in the model fail to show a significant impact. However, the test of cross sectional dependence is significant in two economic blocs, meaning that the results might not represent the general situation in all the cross-sectional units and hence, the results are also decentralized based on individual economic blocs. This effort again was effective as it shows some variances from the results obtained for the whole of SSA, just as was noticed in the results for the determinants of monetary policy dynamics.

The monetary policy rate which is used as proxy for monetary policy dynamics shows a significant impact across all the economic unions except the CEMAC. The reason for this has been discussed earlier. Also exchange rate shows a more diverse result as it reveals that its impact is mostly pronounced in ECOWAS and inflation rate maintains its insignificant impact as it was the

same under the determinants of monetary policy dynamics in SSA. The study has shown that exchange rate exerts more impact on economic growth of SSA than inflation rate.

Government expenditure, which was used as proxy for fiscal policy in the model, shows a significant impact in both SADC and CEMAC. This underscores the important role fiscal policy might be playing in growth process of these two economic blocs. The same result is obtained concerning the relationship between capital formation and economic growth; it shows a more significant relationship in SADC and CEMAC than other regions.

Money supply growth rate (which is proxy by the ratio of money supply to the GDP), that is, financial deepening also shows a commanding effect on the economy of SSA with a high level of significance in three out of the four economic blocs. This is used as the second instrument of monetary policy apart from the monetary policy rate. Therefore, this finding further underscores the impact of monetary policy dynamics on the economic growth of SSA. However, net domestic credit continues to show its insignificance in SSA as the result shows its failure to exert significant impact on economic growth of SSA.

Generally on the impact of monetary policy dynamics on the economic growth of SSA, it can be concluded that monetary policy dynamics have significant impact on the economic growth of SSA but the impact varies from one economic bloc to another. The influence of other macroeconomic variables such as exchange rate and inflation rate, among others, on economic growth account for significant changes in the economic outlook in SSA with their attendant effect on the relationship between monetary policy and economic growth as well.

The third aspect of the analysis investigates the dynamic interaction among monetary policy variables and economic growth in Sub-Saharan African Countries. This is where SVAR was used to generate impulse response functions and the variance decompositions. The result shows that oil and commodity price volatilities generally affect the macroeconomic performance of SSA in various ways. For instance, MPR is the most responsive to oil price shocks in the CEMAC followed by commodity price shocks. But in the other economic blocs, commodity price shocks play a more dominant role in influencing the macroeconomic variables than oil price while exchange rate is the most influential among the macroeconomic variables. The results further show that GDP growth rate across all the economic blocs is more responsive to exchange rate shock than MPR. On the other hand, MPR is also highly responsive to exchange rate shock except in CEMAC where the reverse is the case. Here, the exchange rate is responsive to MPR shock. However, other

macroeconomic variables such as money supply growth rate and inflation rate among others have been shown to be responsive to monetary policy shocks. This result further underscores the importance of monetary policy dynamics on the economic growth of SSA.

Finally, from the results of the dynamic interactions between monetary policy variables and economic growth of SSA, the results have shown that monetary policy is highly influenced by external shocks of both oil and commodity price shocks, and the transmission mechanism indicates that it passes through the MPR to exchange rate and to the GDP growth rate in CEMAC, while for other economic blocs, the medium of transmission is exchange rate to MPR and GDP growth rate. Consequently the medium of transmission of external shocks to the domestic economies of SSA is exchange rate for ECOWAS, SADC and EAC but in CEMAC, MPR is the medium of transmission.

7.2 Conclusion and Policy Recommendations

There is no doubting the fact that this empirical research has made many original contributions to the existing literature on monetary policy dynamics and economic growth in various ways which have been empirically substantiated. Notwithstanding, this aspect of the research work will highlight those areas with important policy implications and conclusions that can enhance growth in the face of dynamic monetary policy.

Starting with the determinants of monetary policy dynamics in SSA, both oil and commodity prices were shown to be very germane to monetary policy dynamics in SSA. The effects of volatilities in both oil and commodity prices are found to be symmetric and not asymmetric. The symmetric effects of commodity prices were found to be dictating the pace of monetary policy dynamics in SSA. The reason for this might not be unconnected with the fact that most of the countries in SSA are primary commodity exporters. This has a lot of implications for the revenues of these countries and, by extension, other macroeconomic variables. The study has shown that many of the countries in SSA are mono-economy in nature, with a narrow economic base which is solely dependent on primary good export. For this reason, SSA economies are vulnerable to external commodity price shocks. The implication is that diversification of SSA economies will make them less vulnerable to cyclical changes in commodity prices.

Secondly, it can be concluded from the findings of the study that there exists a strong linkage between GDP growths and monetary policy dynamics in SSA. In other words, the economic growth rate of SSA is an important factor that can determine the level of monetary policy

dynamics in the region. However, when the analysis is broken down into economic blocs, only the ECOWAS region suggests a reduction in the monetary policy rate to enhance growth. The implication of the result is that the current policy of monetary policy tightening in most of the ECOWAS countries to mitigate rise in the inflation rate may adversely affect economic growth since this will discourage investment. This is evident in the Nigerian economy where the Central Bank has been following contractionary monetary policy for more than four quarters and the economic recession situation has continued to worsen. The Manufacturing Association of Nigeria as well as the other stakeholders in the real sector of the Nigerian economy have been clamouring for a reduction in the lending rate but the CBN has decided to prioritize combating inflation at the expense of investment. Consequently, the policy direction is for the countries in the ECOWAS region to avoid an excessive lending rate that discourages investment.

Thirdly, a strong relationship has been identified between money supply and monetary policy dynamics. This relationship is expected because both monetary policy rate and money supply are key instruments of monetary policy. However, the level of financial deepening in the economy was used to proxy money supply and it shows a significant impact on monetary policy dynamics in SSA except in ECOWAS. The study shows that the level of financial deepening in ECOWAS appears to be weaker than in other economic blocs in SSA. The implication is that the level of money supply that actually affects the volume of economic activity in ECOWAS is very low, hence the weak impact of the dynamics of monetary policy in the region. The policy implication is that countries in the ECOWAS region will need a stronger policy measure that will give more attention to financial deepening at the expense of money supply, because previous empirical studies have shown that money supply exerts a significant impact on monetary policy dynamics but the case is different with financial deepening.

Again, the dynamics in monetary policy of the SSA is strongly influenced by the exchange rate. However, the relationship varies from one economic bloc to another. For instance in ECOWAS and CEMAC, the study concludes that a fall in the local currency value, that is, currency depreciation, is capable of causing upward movement in the monetary policy dynamics. The implication is that these regions are made up of largely import-dependent countries that rely heavily on importation of varieties of commodities from abroad. Therefore a fall in their local currency will increase domestic demand for money to meet the international transactions. Hence the rise in the monetary policy rate which automatically signifies upward movement in the

monetary policy dynamics. However, the situation is not the same for SADC due to the fact that most of the imports are limited to capital goods; hence they are not dependent on import like other regions in SSA. The implication of this result for policy formulation is that a country with high import bills, especially on goods that can be produced locally, might be highly susceptible to monetary policy dynamics. Other regions in SSA are advised to copy from South Africa where import is largely of capital goods that can aid production processes, as against import of primary goods, that dominate the imports of other regions. It is important for ECOWAS, CEMAC and EAC to encourage domestic outputs to limit the adverse effects of monetary policy dynamics on their economies.

Inflation also has been identified as another important variable that accounts for the dynamics in the monetary policy of SSA. It is shown from the study that this might not be unconnected with the role of commodity prices which has affected the consumers' price index in SSA. As earlier posited, this finding is only corroborating the conclusion that SSA is made up of countries that are heavily dependent on commodity imports. This singular reason makes them to be prone to imported inflation as the goods brought in from other countries cause domestic price distortions which portend a serious impact on the domestic inflation rate. The monetary authorities in SSA just like other economies usually attack inflation from the monetary angle hence the implication of imported inflation on monetary policy dynamics. Therefore encouraging domestic output at the expense of huge importation might go a long way to reduce the inflationary pressure on monetary policy dynamics.

In terms of oil price volatility impact on monetary policy dynamics, the study appears to have different result for oil dominant regions and regions that are not oil producers. Downward movement of oil prices has been shown to have more serious implications on monetary policy dynamics in the oil producing regions of the SSA than the non-oil producing regions. Mostly, the net oil exporters prime their revenue on oil production and therefore a fall in oil price puts pressure on monetary policy to provide funds for the real sector of the economy so as to enhance growth. The reverse of this case is noticed in the non-oil-producing regions of SSA. The policy direction, according to the findings from this study, is that an oil-producing country faced with fall in oil price should have a downward review of the monetary policy rate in order to re-arrange the economy. But the situation in Nigeria, which is currently the largest oil producing country in Africa, contradicts this policy direction since the drastic fall in oil price. Monetary policy dynamics

in the country has been an upward movement against the policy direction obtained from this study for an oil-producing country. This appears to have worsened their current economic recession situation.

The study has also concluded that commodity price volatilities are important determinants of monetary policy dynamics in SSA. The study further concludes that a fall in commodity prices is capable of putting downward pressure on monetary policy dynamics. The implication is that SSA is dominated by countries that are primary commodity exporters and therefore the effect of the volatility in world commodity prices has implications for the domestic monetary policy directions. The narrow export base of SSA has compounded the problem. The recent fall in commodity prices has affected revenue accruable to many SSA countries and funds meant for domestic economic expansion have dwindled seriously. Many SSA countries, as earlier stated, mobilize funds for the real sector through monetary policy and this aggravates the pressure on monetary policy dynamics. The policy implication is that a more diversified export base for SSA might limit the effect of commodity price volatility on the monetary policy dynamics of this region.

On the impact of monetary policy dynamics on SSA economic growth in SSA, some conclusions and policy implications are also important to project the economic outlook of the sub-region. It should be noted that the first sets of policy implications are on the determinants of monetary policy dynamics in SSA. In other words, policy options for SSA as they affect the macroeconomic variables that are responsible for monetary policy dynamics were discussed in the previous paragraphs. The following sets of policy implications are expected to give policy directions to the monetary authorities in SSA on how they can reduce the adverse effects of monetary policy dynamics on the economic growth of the sub region.

Firstly, it can be concluded from the study that the impact of monetary policy on the economy of SSA is significant. However, there is a slight difference in the results when SSA is broken down into economic blocs because the coefficient of monetary policy rate, which is the variable used to capture monetary policy dynamics, fails to exert a significant impact on the economic growth of the region. This reason further justifies breaking the analysis into various economic blocs within the SSA. The implication of the result is that monetary policy is a key macroeconomic policy that can significantly influence the economic growth of the SSA but the fluctuating effect appears to be limited in a region where unified monetary policy is in practice. Monetary policy rate is relatively stable in the CEMAC because of the unified monetary policy,

hence the effect is insignificant, but in other regions where different monetary policy rates are in operation the economic growth is highly susceptible to the dynamics in monetary policy. The policy implication is that forming a unified monetary policy zone within SSA can minimize the effect of monetary policy dynamics but the *caveat* is that each domestic economy might not enjoy independent monetary policy which can be tailored to suit their individual economic situations since the countries are still different in institutional and political structures.

Secondly, findings from the study have further underscored the importance of exchange rate and inflation rate in determining the growth of SSA. However, the exchange rate effect appears to be having a more pronounced effect on SSA economic growth than the inflation rate. The situation is more noticeable in the countries where flexible exchange rate is practiced. The study has shown that for countries in SSA where fixed exchange rate is practiced this neutralizes the effect of exchange rate variations on their economies. This is the reason for the less significant impact of exchange rate on the CEMAC economy. The policy implication is that flexible exchange rate paves the way for exchange rate manipulations in such a way that it will have pronounced impact on economic growth. It is advised that a floating exchange rate system is adopted by other blocs in SSA so as to increase the effectiveness of their exchange rate policies in promoting economic growth.

In addition, government expenditure, which is used to capture fiscal policy, is shown to have more pronounced effects on the growth of the SADC and CEMAC. These two regions appear to be using fiscal policy more effectively in growth process than other regions. According to the AfDB (2014) South Africa, which is the largest economy in the SADC, achieved the most improved economic growth when fiscal policy is used simultaneously with monetary policy. The implication of these findings is that monetary policy alone might not be able to have the pronounced positive effect on growth, most expected unless it is used in conjunction with fiscal policy. Other regions in SSA can actually learn a lesson from the SADC and CEMAC who have been using government expenditure to influence their growth rates more positively.

The impact of money supply on the growth of SSA economy gives diverse results when the analysis is broken down into economic blocs. This further justifies the need to break the analyses of the study into individual economic blocs. The proxy for money supply used in the study is financial deepening and it appears to have a significant impact on individual economic blocs as against the non-significance it has when analysis is done for SSA as a whole. Studies in

the past have shown that money supply failed to exert noticeable influence on economic growth in many SACs but the result here has negated those findings and the reason might not be unconnected with the proxy of money supply used in this study, which is financial deepening. The implication is that the ratio of money supply to the GDP (financial deepening) which actually measures the influence of money supply on the economic activity in SSA appears to be playing a more significant role in economic growth than nominal money supply. Monetary authorities are advised to be more concerned about the effect of money supply on the economic activities than the money supply itself.

On the interaction between monetary policy variables and other macroeconomic variables in SSA the results have shown that this is better studied by decentralizing the analysis because the result reveals various differences in the monetary policy transmission mechanisms in the four major economic blocs in the SSA which formed the basis for decentralization.

Firstly, it was shown from the study that oil price shock affects the CEMAC region more than other economic blocs in SSA and the effect is transmitted to the domestic economies via monetary policy rate. The reason for this kind of relationship is not unconnected with the fact that CEMAC countries are predominantly oil-exporting countries that practice a unified monetary policy and fixed exchange rate system. The implication of this result is that oil-producing countries are more affected by oil price shocks than non-oil producing countries in SSA. Again, the transmission of the shock is done via monetary policy rate due to the fact that they have a unified monetary policy which makes monetary policy rate also a kind of exogenous shock to individual countries in the CEMAC region. This is as a result of the fact that each domestic economy cannot fix its individual monetary policy rate other than the one fixed by the common Central Bank for the region.

Secondly, commodity price shock affects wider economies in the SSA more than oil price shocks. This could be as a result of that fact that virtually all SSA countries rely on export of primary commodities. Therefore, the cyclical changes in the global commodity price index have implications on their macroeconomic framework. However, the dominance of commodity price is more visible in economic blocs other than CEMAC. In ECOWAS, EAC and SADC, the exchange rate is mostly affected by commodity price shocks. This further underscores the importance of flexible an exchange rate which is the practice in these economic blocs. The monetary policy and the GDP growth rate responses to exchange rate shock are also very pronounced in these economic

blocs. The implication is that external shocks such as commodity prices transmit their effects through the exchange rate channel to the domestic economies in EAC, ECOWAS and SADC where flexible exchange rates are practiced. The policy implication is that monetary policy dynamics are again highly prone to exchange rate shocks, while exchange rate is highly prone to commodity price shocks in turn. A flexible exchange rate policy might also aid the influence of monetary policy dynamics in SSA than a fixed exchange rate policy.

Finally, the study revealed that monetary policy dynamics in SSA can better be studied when the analysis is decentralized. In other words, analyses based on economic blocs offer more insight into the influence of monetary policy dynamics on the SSA economy. This is evident from the variations in results from the panel analysis on the SSA as a whole and across economic blocs. This has implications for policy formulations in SSA especially on issues relating to monetary policy. Holistic policy formulation on monetary policy direction for the whole SSA region might be misleading since the economic unions that each country belongs to has been shown to have significant impact on the relationship between SSA economic growth and monetary policy dynamics. Consequently, regional agencies such as the Africa Development Bank, the International Monetary Fund and World Bank, among others, are advised to take cognizance of the influence of economic unions in their appraisal of monetary policy outlook for SSA.

7.3 Policy Recommendations

7.3.1 Expansion of the economic base of SSACs

The research work has shown that the narrow economic base of SSACs makes them highly susceptible to oil and commodity prices fluctuations. This is because more of their export base are primary products hence these international prices are highly influential in the determination of macroeconomic outlook of many of SSA countries. Consequently, it is recommended that the economic diversification efforts of SSA should be more industrial sector driven and not just diversified to any sector.

7.3.2 Increase in domestic output

Findings from the research work have shown that the negative effect of monetary policy dynamics can be mitigated by increased output locally. In French-speaking African countries, for example, the imbibed spirit of assimilation is still very much in place such that a high percentage of their consumables are still being imported from their old colonial masters. Therefore, it is advisable that

the SSACs should embark on an aggressive crusade to boost their domestic output in order to make their economies less vulnerable to the adverse effects of external dependency.

7.3.3 Collaborative efforts

There should be a collaborative efforts among the Central Banks in SSA and the ministries of trade and Industry or any other related ministries on policy consistency and effectiveness. This is to address the challenges inherent in commodity price volatility which is a major issue across the countries in the four major blocs under investigation.

7.3.4 Increased net domestic credit

The study revealed that net domestic credit has little effect on growth in most of the analyses. To this end, this is not desirable for the growth potential of the region. Lending rates in most of the SSACs are still very high while interests on deposits are not impressive. Policy makers are therefore advised to allow the forces of the market to fix interest rates. This will allow the discount rate to work in favour of gross domestic products in each of the countries of SSA.

7.3.5 Policy harmonization

The results clearly show that inflation and exchange rate are the two major significant drivers of monetary policy in SSA. It is therefore recommended that inflation targeting and monetary targeting should be adopted as policy instruments across the countries in SSA. With monetary targeting, exchange rate should be the nominal anchor for its implementation.

7.5.6 Import restrictions

There should be legislation in favour of the consumption of locally made goods. This must be based on leading-by-examples such that people in high places must be seen consuming locally made goods rather than having a preference for imported goods. Equally important here are restrictions on imported goods which can be substituted for locally made ones or a form of targeted subsidies that will make locally produced ones competitive. The export drive capacity of the region is also recommended for stimulation not only in terms of volumes but also in value terms. Most of the oil producing countries of SSA still export crude oil and import refined outputs since they do not have well-functioning refineries. To this end, most of the multinational corporations should be encouraged to set up their factories for some resource-abundant and high technology industries locally so as to improve the overall economic propensity of the region.

7.5.7 Improved infrastructural facilities and increased agricultural productivity

Many of the countries in SSA are bedevilled with poor infrastructural facilities coupled with poor agricultural products. For instance, the provision of electricity and good roads should be prioritized in the SSA region. Good roads will ensure easy transportation of finished goods to the final consumers. In addition to this is consistency in government policies that should be adhered to. A stable macroeconomic environment is the twin brother of policy consistency. A situation where an incoming government will neglect or discard the policy frameworks of an outgoing government will not only slow down the growth yearning of the region but also put the region on the track of stagnation or retrogression. Governance should therefore be based on economic issues rather than self-motivated or self-interest based.

7.6 Limitations of the study

This study is limited by availability of data which would have made it possible to cover more countries in SSA and thereby making the acceptability of our findings more generalized and robust. Another limitation is the choice of proxy for our monetary policy in view of the fact that other variables are available in the literature that can be employed. The choice of monetary policy rate might be adequate for this study but the fact remains that some important information might be missing in the monetary policy dynamics. To this end, other available proxies such as real interest rate or money supply can be adopted by future researchers.

7.7 Recommendations for future studies

Any further research in this area should incorporate the trend analysis of the movements of the variables considered in the study. Not only that, other fiscal variables such as taxation and government debt should be included such that the need for policy harmonization by policy makers within the region can further be established. This will guide those countries whose major policy weapon is monetary policy targeting against the possibility of harmonizing the two policies together for the achievement of better and sound economic growth.

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Appendices

Appendix 1: Variance Decomposition for CEMAC

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 11.42690 | 100.0000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 15.00591 | 90.39649 (3.37494) | 5.629521 (2.43968) | 1.313214 (1.05744) | 1.89E-07 (0.60508) | 0.106377 (0.48903) | 0.751003 (1.12157) | 0.027818 (0.53139) | 1.775578 (1.52940) |
| 18.01798 | 89.11240 (3.66138) | 7.152259 (2.87559) | 1.376543 (1.34572) | 0.011445 (0.77027) | 0.268542 (0.82654) | 0.610103 (1.05956) | 0.220885 (0.78300) | 1.247824 (1.28585) |
| 20.20351 | 88.98453 (4.02149) | 7.356466 (3.14377) | 1.585399 (1.89214) | 0.016937 (1.08833) | 0.368235 (1.04072) | 0.487001 (0.99242) | 0.190131 (0.83642) | 1.011301 (1.12976) |
| 21.83979 | 88.77229 (4.45621) | 7.329066 (3.34524) | 1.722735 (2.42356) | 0.023809 (1.39364) | 0.411334 (1.14106) | 0.418634 (1.00634) | 0.162732 (0.97954) | 1.159404 (1.15846) |
| 23.17097 | 88.29474 (4.93075) | 7.187707 (3.53407) | 1.803698 (2.96100) | 0.024741 (1.65048) | 0.420070 (1.16416) | 0.372952 (1.00586) | 0.145024 (1.09099) | 1.751066 (1.55702) |
| 24.20496 | 87.48159 (5.51412) | 7.135798 (3.75227) | 1.844846 (3.49010) | 0.048492 (1.90441) | 0.416194 (1.15870) | 0.343505 (1.02397) | 0.134020 (1.21286) | 2.595558 (2.17327) |
| 25.02651 | 86.42058 (6.13810) | 7.126854 (3.96492) | 1.843885 (3.99974) | 0.092031 (2.13441) | 0.401074 (1.13173) | 0.324132 (1.03788) | 0.129252 (1.32791) | 3.662189 (2.86721) |
| 25.67080 | 85.18269 (6.79016) | 7.180699 (4.18111) | 1.818516 (4.49551) | 0.164726 (2.34737) | 0.384141 (1.09852) | 0.309697 (1.05242) | 0.130728 (1.43533) | 4.828804 (3.55009) |
| 26.17833 | 83.85199 (7.44306) | 7.285712 (4.39812) | 1.778116 (4.97950) | 0.260382 (2.53957) | 0.369541 (1.06564) | 0.298097 (1.06331) | 0.138533 (1.53357) | 6.017628 (4.18763) |
| 26.57597 | 82.51671 (8.07195) | 7.435305 (4.61553) | 1.733823 (5.46113) | 0.372559 (2.70924) | 0.359003 (1.03813) | 0.289388 (1.07195) | 0.151150 (1.61914) | 7.142061 (4.74803) |
| 26.88582 | 81.25100 (8.65815) | 7.618365 (4.82880) | 1.694445 (5.94520) | 0.493181 (2.85700) | 0.352969 (1.01794) | 0.284609 (1.07818) | 0.167269 (1.69326) | 8.138159 (5.21251) |

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 17.24300 | 92.47784 (1.07131) | 7.522160 (1.07131) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 24.17265 | 77.76802 (4.18891) | 19.13869 (3.78958) | 0.954362 (0.91296) | 0.017737 (0.61886) | 0.041275 (0.40082) | 0.300221 (0.82453) | 0.015255 (0.47568) | 1.764441 (1.45759) |
| 29.67061 | 76.44478 (4.58462) | 20.82862 (4.36126) | 0.994849 (1.27133) | 0.017669 (0.71133) | 0.132363 (0.68068) | 0.277162 (0.90552) | 0.093928 (0.73513) | 1.210624 (1.26670) |
| 33.80408 | 76.69761 (4.97565) | 20.59323 (4.84368) | 1.165467 (1.80746) | 0.026248 (0.96563) | 0.218765 (0.86801) | 0.234444 (0.96113) | 0.109087 (0.81433) | 0.955152 (1.10435) |
| 36.99417 | 76.86486 (5.42231) | 20.14416 (5.24051) | 1.290257 (2.33525) | 0.022172 (1.21080) | 0.282415 (0.98188) | 0.253767 (1.03723) | 0.099520 (0.96112) | 1.042848 (1.16111) |
| 39.54798 | 76.92697 (5.88108) | 19.59804 (5.59297) | 1.366283 (2.87328) | 0.019488 (1.43040) | 0.314886 (1.03178) | 0.248364 (1.05786) | 0.093413 (1.08379) | 1.432551 (1.53821) |
| 41.51339 | 76.72312 (6.37300) | 19.22420 (5.91490) | 1.403029 (3.40952) | 0.023547 (1.65048) | 0.327181 (1.04692) | 0.239295 (1.08396) | 0.085326 (1.21198) | 1.974306 (2.08682) |
| 43.04156 | 76.33003 (6.84776) | 18.93781 (6.18516) | 1.403649 (3.93270) | 0.038726 (1.85579) | 0.324203 (1.03663) | 0.228418 (1.10160) | 0.079444 (1.32906) | 2.657725 (2.70544) |
| 44.22285 | 75.75652 (7.31796) | 18.75655 (6.42331) | 1.383516 (4.44699) | 0.070906 (2.04764) | 0.315807 (1.01660) | 0.220028 (1.12017) | 0.076520 (1.43654) | 3.420150 (3.33045) |
| 45.13994 | 75.05250 (7.77940) | 18.66151 (6.63725) | 1.351601 (4.95534) | 0.118155 (2.22204) | 0.306185 (0.99395) | 0.214615 (1.13626) | 0.077032 (1.53339) | 4.218403 (3.92804) |
| 45.84888 | 74.27590 (8.22899) | 18.64200 (6.83380) | 1.316900 (5.46656) | 0.177764 (2.37752) | 0.297363 (0.97339) | 0.212244 (1.15119) | 0.080692 (1.61792) | 4.997142 (4.46708) |
| 46.39357 | 73.48367 (8.65753) | 18.68215 (7.01507) | 1.286412 (5.98462) | 0.245599 (2.51439) | 0.290426 (0.95730) | 0.213003 (1.16476) | 0.087044 (1.69133) | 5.711701 (4.92674) |

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1.69E+11 | 0.355089 (0.97212) | 0.276373 (0.92159) | 99.36854 (1.29722) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 2.46E+11 | 0.731144 (1.18016) | 1.148493 (1.69617) | 97.69017 (2.42194) | 0.056799 (0.44176) | 0.002935 (0.33259) | 0.187403 (0.55618) | 0.177476 (0.47415) | 0.005578 (0.30826) |
| 3.05E+11 | 0.844042 (1.54089) | 2.070587 (2.34161) | 96.36755 (3.54698) | 0.102861 (0.65229) | 0.119201 (0.68912) | 0.276518 (0.83055) | 0.205084 (0.63474) | 0.014160 (0.49386) |
| 3.52E+11 | 0.894614 | 2.421303 | 95.63352 | 0.291136 | 0.164535 | 0.282636 | 0.301510 | 0.010750 |

| | | | | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | (1.88309) | (2.68127) | (4.46819) | (1.19243) | (0.88507) | (0.94145) | (0.80348) | (0.71688) |
| 3.91E+11 | 0.910077 | 2.477095 | 95.23883 | 0.479073 | 0.168530 | 0.293809 | 0.402861 | 0.029724 |
| | (2.13161) | (2.84749) | (5.22242) | (1.72146) | (0.91698) | (1.03554) | (0.97877) | (0.98181) |
| 4.25E+11 | 0.879337 | 2.441102 | 94.91225 | 0.680706 | 0.178495 | 0.319966 | 0.496835 | 0.091314 |
| | (2.32485) | (2.97015) | (5.86861) | (2.19460) | (0.93351) | (1.12241) | (1.14916) | (1.29187) |
| 4.55E+11 | 0.811454 | 2.378308 | 94.60570 | 0.892793 | 0.197588 | 0.342438 | 0.592243 | 0.179481 |
| | (2.46270) | (3.08198) | (6.44056) | (2.63253) | (0.95523) | (1.19860) | (1.30578) | (1.63704) |
| 4.81E+11 | 0.732221 | 2.305185 | 94.30217 | 1.109602 | 0.220067 | 0.358702 | 0.694924 | 0.277127 |
| | (2.59010) | (3.18333) | (6.97998) | (3.03018) | (0.98242) | (1.26837) | (1.45816) | (1.98999) |
| 5.05E+11 | 0.666176 | 2.227890 | 93.99244 | 1.323536 | 0.245323 | 0.372042 | 0.795706 | 0.376890 |
| | (2.73698) | (3.27925) | (7.50551) | (3.38534) | (1.01505) | (1.33343) | (1.60069) | (2.33405) |
| 5.26E+11 | 0.630875 | 2.152183 | 93.66561 | 1.531226 | 0.272869 | 0.385253 | 0.890851 | 0.471134 |
| | (2.91600) | (3.37409) | (8.01622) | (3.70126) | (1.05164) | (1.39294) | (1.72775) | (2.65553) |
| 5.46E+11 | 0.637908 | 2.080786 | 93.32045 | 1.727184 | 0.301306 | 0.399066 | 0.980198 | 0.553107 |
| | (3.13126) | (3.46874) | (8.50649) | (3.98039) | (1.08950) | (1.44614) | (1.83825) | (2.94485) |
| 5.63E+11 | 0.693213 | 2.014328 | 92.96052 | 1.907665 | 0.329651 | 0.413585 | 1.063108 | 0.617931 |
| | (3.38063) | (3.56320) | (8.97197) | (4.22370) | (1.12728) | (1.49415) | (1.93452) | (3.19559) |

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 12.59644 | 0.019403 | 0.489701 | 0.014268 | 99.47663 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| | (0.56233) | (1.00789) | (0.70701) | (1.34807) | (0.00000) | (0.00000) | (0.00000) | (0.00000) |
| 13.50834 | 0.126847 | 0.428831 | 0.013226 | 96.42299 | 0.202098 | 0.073834 | 2.681626 | 0.050552 |
| | (1.16579) | (1.01172) | (0.78653) | (3.11703) | (0.83443) | (0.71839) | (1.97540) | (0.57136) |
| 14.02095 | 0.153164 | 0.467139 | 0.053101 | 92.22335 | 0.268841 | 0.074230 | 6.655496 | 0.104682 |
| | (1.29994) | (1.00375) | (0.78387) | (4.34341) | (1.02404) | (0.78205) | (3.65709) | (0.72206) |
| 14.23685 | 0.174827 | 0.501118 | 0.052295 | 91.07168 | 0.881477 | 0.101722 | 6.966952 | 0.249928 |
| | (1.57091) | (1.04531) | (0.87700) | (4.70023) | (1.40556) | (0.83323) | (3.77757) | (1.10235) |
| 14.41785 | 0.351844 | 0.572264 | 0.066191 | 90.29979 | 1.021666 | 0.114230 | 7.190488 | 0.383526 |
| | (1.77395) | (1.14786) | (1.07412) | (4.91749) | (1.46019) | (0.86375) | (3.76580) | (1.48277) |
| 14.51175 | 0.445333 | 0.626769 | 0.082237 | 89.68645 | 1.028282 | 0.168563 | 7.333962 | 0.628407 |
| | (1.91665) | (1.27333) | (1.37454) | (5.24458) | (1.45763) | (0.91083) | (3.80759) | (1.85465) |
| 14.58526 | 0.615497 | 0.711323 | 0.110351 | 89.12800 | 1.034221 | 0.257355 | 7.380629 | 0.762623 |
| | (2.04231) | (1.41915) | (1.75052) | (5.56324) | (1.44762) | (0.95715) | (3.86368) | (2.07892) |
| 14.64470 | 0.869754 | 0.787667 | 0.136813 | 88.62139 | 1.049297 | 0.324027 | 7.403031 | 0.808024 |
| | (2.20098) | (1.55413) | (2.15358) | (5.87464) | (1.45339) | (0.98902) | (3.89136) | (2.20569) |
| 14.69305 | 1.191977 | 0.836143 | 0.157987 | 88.16731 | 1.060219 | 0.366286 | 7.411092 | 0.808986 |
| | (2.40970) | (1.66283) | (2.57019) | (6.20941) | (1.46205) | (1.01225) | (3.90284) | (2.26064) |

| | | | | | | | | |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 14.73339 | 1.533289 (2.65091) | 0.858990 (1.74367) | 0.175546 (2.99679) | 87.75728 (6.56211) | 1.066207 (1.46582) | 0.398321 (1.03295) | 7.404991 (3.90388) | 0.805379 (2.27583) |
| 14.76802 | 1.859993 (2.90225) | 0.866907 (1.80593) | 0.192861 (3.43861) | 87.38351 (6.93020) | 1.069128 (1.46363) | 0.424256 (1.05006) | 7.388743 (3.89562) | 0.814607 (2.26725) |
| 14.79845 | 2.151562 (3.14018) | 0.867264 (1.85219) | 0.211376 (3.89547) | 87.04155 (7.30844) | 1.069567 (1.45849) | 0.444120 (1.06368) | 7.368642 (3.88156) | 0.845922 (2.25093) |

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 7.478785 | 1.036597 (1.75348) | 0.004800 (0.50615) | 0.056783 (0.78322) | 0.000504 (0.72427) | 98.90132 (1.98506) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 7.872046 | 2.139613 (2.89822) | 0.274313 (1.24752) | 0.083581 (1.01266) | 0.410300 (1.24340) | 93.35997 (3.61257) | 1.455095 (1.48224) | 1.989708 (1.60412) | 0.287420 (0.86811) |
| 8.018089 | 2.414997 (2.74769) | 0.309145 (1.24284) | 0.271882 (1.21321) | 0.401203 (1.21758) | 92.11747 (3.61920) | 1.448398 (1.38654) | 2.204159 (1.68292) | 0.832742 (1.21247) |
| 8.150160 | 2.645818 (2.85809) | 0.343036 (1.19334) | 0.269083 (1.20995) | 0.424845 (1.19761) | 89.40232 (4.24342) | 2.742945 (1.93464) | 2.354093 (1.85067) | 1.817855 (1.73785) |
| 8.200192 | 2.614221 (2.87798) | 0.690104 (1.23004) | 0.293586 (1.24728) | 0.515883 (1.21760) | 88.32915 (4.73468) | 3.273773 (2.14548) | 2.326673 (1.79754) | 1.956606 (1.82906) |
| 8.217078 | 2.678225 (2.84350) | 0.856515 (1.30200) | 0.292953 (1.33627) | 0.538239 (1.22908) | 87.97021 (4.91918) | 3.286177 (2.15193) | 2.420637 (1.84553) | 1.957040 (1.81177) |
| 8.227404 | 2.790820 (2.82472) | 0.874453 (1.31989) | 0.306471 (1.42397) | 0.555508 (1.24147) | 87.75217 (5.03282) | 3.279503 (2.13612) | 2.446516 (1.86020) | 1.994561 (1.80485) |
| 8.234750 | 2.898226 (2.81649) | 0.873012 (1.32044) | 0.317607 (1.51705) | 0.567197 (1.25511) | 87.60026 (5.12193) | 3.280705 (2.12553) | 2.443671 (1.85815) | 2.019325 (1.80227) |
| 8.240548 | 2.985335 (2.79825) | 0.872199 (1.31438) | 0.324030 (1.60881) | 0.569224 (1.26438) | 87.47756 (5.18957) | 3.285930 (2.11928) | 2.440795 (1.85541) | 2.044927 (1.80380) |
| 8.245423 | 3.048944 (2.77994) | 0.872487 (1.30834) | 0.328399 (1.70171) | 0.568552 (1.26619) | 87.37419 (5.23978) | 3.288089 (2.11372) | 2.438427 (1.85315) | 2.080913 (1.80642) |
| 8.249891 | 3.095436 (2.77165) | 0.874613 (1.30839) | 0.331174 (1.79242) | 0.568598 (1.26600) | 87.27959 (5.29666) | 3.287019 (2.10882) | 2.435827 (1.85048) | 2.127739 (1.81518) |
| 8.253923 | 3.126833 (2.76881) | 0.879487 (1.31430) | 0.332710 (1.87999) | 0.569645 (1.26503) | 87.19435 (5.35660) | 3.284504 (2.10337) | 2.433489 (1.84746) | 2.178979 (1.83208) |

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 54.25753 | 5.599438 (3.37233) | 0.880401 (1.58875) | 0.565103 (1.14982) | 0.300495 (1.12267) | 0.815703 (1.79881) | 91.83886 (4.09041) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 69.44957 | 4.678906 (3.28130) | 5.890404 (3.30779) | 0.356555 (0.84538) | 0.755730 (1.57756) | 0.564952 (1.62118) | 86.40778 (4.85740) | 0.062742 (0.41684) | 1.282933 (1.09437) |
| 77.50067 | 3.834241 (2.61756) | 6.528161 (3.58055) | 0.323722 (0.90581) | 0.640405 (1.61964) | 1.096875 (2.04827) | 74.63449 (5.55528) | 0.504091 (1.14068) | 12.43801 (3.61410) |
| 83.88848 | 3.484981 (2.50215) | 5.616967 (3.06553) | 0.507605 (1.30678) | 0.779020 (1.68648) | 1.194746 (2.27546) | 64.38447 (5.82783) | 0.542093 (1.45048) | 23.49011 (5.45076) |
| 89.27819 | 3.216945 (2.52088) | 5.985876 (2.73010) | 0.599931 (1.76319) | 0.971674 (1.67130) | 1.104107 (2.20542) | 56.94329 (6.06973) | 0.488532 (1.32727) | 30.68965 (6.31264) |
| 93.68880 | 2.925293 (2.45641) | 7.218503 (2.79091) | 0.600908 (2.14478) | 1.303432 (1.72017) | 1.077170 (2.12247) | 51.70904 (6.16567) | 0.487237 (1.23275) | 34.67842 (6.63931) |
| 97.31269 | 2.783200 (2.34452) | 8.698702 (3.15106) | 0.565748 (2.45404) | 1.732733 (1.88618) | 1.119097 (2.04064) | 47.95286 (6.17334) | 0.510291 (1.18775) | 36.63737 (6.73449) |
| 100.2326 | 2.903001 (2.31908) | 10.11721 (3.64064) | 0.534243 (2.72103) | 2.122297 (2.10228) | 1.157328 (1.96810) | 45.27799 (6.14532) | 0.551780 (1.17742) | 37.33615 (6.74345) |
| 102.5553 | 3.284982 (2.47092) | 11.35162 (4.13628) | 0.526985 (2.97383) | 2.415215 (2.30918) | 1.178762 (1.90242) | 43.38883 (6.10762) | 0.594028 (1.19302) | 37.25958 (6.70942) |
| 104.3974 | 3.887827 (2.78448) | 12.35778 (4.57159) | 0.547866 (3.22983) | 2.610678 (2.47855) | 1.192848 (1.84471) | 42.05111 (6.07409) | 0.625462 (1.22181) | 36.72643 (6.64301) |
| 105.8594 | 4.641333 (3.19049) | 13.11824 (4.92113) | 0.593433 (3.49367) | 2.720183 (2.60326) | 1.200475 (1.79367) | 41.08943 (6.05357) | 0.645747 (1.25409) | 35.99116 (6.55113) |
| 107.0244 | 5.452243 (3.60828) | 13.63812 (5.18123) | 0.656824 (3.76514) | 2.761270 (2.68506) | 1.200870 (1.75015) | 40.38040 (6.04983) | 0.655395 (1.28200) | 35.25488 (6.44054) |

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 17.35071 | 0.036431 (0.59840) | 2.615559 (2.37074) | 0.665151 (1.60238) | 0.898572 (1.27978) | 3.017274 (2.64402) | 0.753891 (1.18539) | 92.01312 (3.91396) | 0.000000 (0.00000) |
| 18.80286 | 3.474844 (3.39729) | 2.232359 (2.13907) | 0.622675 (1.58354) | 0.836307 (1.26008) | 9.419559 (3.55563) | 4.732712 (2.73454) | 78.37411 (4.76947) | 0.307439 (0.84411) |
| 19.85537 | 3.126616 (3.02183) | 2.348924 (2.16667) | 0.994246 (1.58314) | 8.917226 (3.61860) | 8.730802 (3.25706) | 4.578549 (2.40068) | 70.81968 (5.36987) | 0.483958 (1.01810) |

| | | | | | | | | |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 20.39510 | 3.962544 (3.36259) | 2.302974 (2.03373) | 1.251241 (1.75169) | 9.007330 (3.65733) | 8.333739 (3.05819) | 4.715144 (2.35755) | 67.44763 (5.92141) | 2.979397 (1.99873) |
| 20.75735 | 3.919191 (3.29506) | 2.717996 (2.09378) | 1.679799 (2.10931) | 9.424149 (3.83503) | 8.051241 (2.89995) | 5.025482 (2.42407) | 65.36071 (6.32254) | 3.821436 (2.38226) |
| 20.98851 | 3.833408 (3.24342) | 3.041307 (2.15963) | 1.959838 (2.43637) | 9.749690 (3.92032) | 7.926997 (2.83609) | 5.069573 (2.41438) | 64.16890 (6.51198) | 4.250285 (2.68662) |
| 21.14180 | 3.878999 (3.16213) | 3.222789 (2.25699) | 2.157128 (2.76504) | 10.02933 (4.07184) | 7.865557 (2.80484) | 5.044714 (2.38199) | 63.41485 (6.62371) | 4.386634 (2.83689) |
| 21.25650 | 4.035642 (3.13946) | 3.300369 (2.32975) | 2.294511 (3.07623) | 10.20978 (4.15627) | 7.811399 (2.77796) | 5.034584 (2.35437) | 62.85277 (6.74716) | 4.460946 (2.94916) |
| 21.34894 | 4.267873 (3.19069) | 3.339906 (2.39385) | 2.415095 (3.39369) | 10.30587 (4.21268) | 7.766086 (2.75209) | 5.040658 (2.33705) | 62.37522 (6.87915) | 4.489295 (3.03778) |
| 21.43019 | 4.561199 (3.30768) | 3.363320 (2.44830) | 2.523911 (3.72599) | 10.35003 (4.23692) | 7.724319 (2.73147) | 5.050930 (2.32289) | 61.95016 (7.00905) | 4.476126 (3.08812) |
| 21.50098 | 4.882493 (3.46478) | 3.372127 (2.49456) | 2.621629 (4.06860) | 10.35648 (4.24265) | 7.686715 (2.71492) | 5.055792 (2.31012) | 61.57712 (7.14080) | 4.447650 (3.10727) |
| 21.56424 | 5.205366 (3.64528) | 3.368793 (2.53122) | 2.711806 (4.42625) | 10.34082 (4.23290) | 7.651893 (2.70141) | 5.055409 (2.29966) | 61.23960 (7.28065) | 4.426313 (3.10479) |

| S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1.391563 | 0.144457 (0.82653) | 0.312657 (0.99226) | 0.042532 (0.71566) | 2.922741 (2.28766) | 0.001160 (0.89278) | 4.529246 (2.68649) | 0.713163 (1.35410) | 91.33404 (3.73411) |
| 1.786659 | 1.298343 (1.63095) | 0.210198 (0.93155) | 0.061294 (1.02733) | 2.148081 (1.43303) | 0.106291 (1.37999) | 6.467594 (3.88785) | 1.617584 (1.63190) | 88.09061 (5.01469) |
| 2.051322 | 3.921662 (2.93699) | 0.562226 (1.27800) | 0.090548 (1.16090) | 2.244474 (1.43661) | 0.235722 (1.51411) | 5.122908 (3.52214) | 1.229890 (1.33647) | 86.59257 (5.02307) |
| 2.262940 | 6.423577 (4.30048) | 1.496065 (1.95353) | 0.263443 (1.31628) | 2.318117 (1.70497) | 0.691283 (1.75440) | 4.241603 (3.14136) | 1.032725 (1.13187) | 83.53319 (5.69027) |
| 2.430722 | 9.671644 (5.63035) | 2.783265 (2.68117) | 0.559333 (1.64667) | 2.708323 (2.10956) | 0.923824 (1.82727) | 3.680679 (2.79549) | 0.969624 (1.04435) | 78.70331 (6.56211) |
| 2.567185 | 12.89685 (6.74686) | 3.959389 (3.30696) | 0.975066 (2.12496) | 2.988635 (2.47668) | 1.034591 (1.83588) | 3.382283 (2.53032) | 0.948110 (1.05280) | 73.81508 (7.25679) |
| 2.680668 | 16.07514 (7.66411) | 4.979336 (3.84297) | 1.427486 (2.68562) | 3.137961 (2.75144) | 1.098830 (1.79467) | 3.291730 (2.36451) | 0.924050 (1.09385) | 69.06547 (7.82346) |
| 2.775809 | 19.05043 (8.36929) | 5.765992 (4.26298) | 1.893684 (3.28872) | 3.163601 (2.91956) | 1.126890 (1.73290) | 3.316295 (2.29111) | 0.901966 (1.14166) | 64.78114 (8.21748) |

| | | | | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 2.855632 | 21.66313 | 6.277719 | 2.351454 | 3.098184 | 1.126406 | 3.382109 | 0.874960 | 61.22604 |
| | (8.85850) | (4.56202) | (3.89978) | (2.99587) | (1.67062) | (2.27588) | (1.17906) | (8.44059) |
| 2.923141 | 23.79467 | 6.536367 | 2.775373 | 2.989345 | 1.107931 | 3.452079 | 0.843216 | 58.50102 |
| | (9.13494) | (4.74772) | (4.49805) | (3.00836) | (1.61294) | (2.28492) | (1.19855) | (8.50291) |
| 2.980451 | 25.38324 | 6.600733 | 3.145337 | 2.877147 | 1.079872 | 3.504652 | 0.811947 | 56.59707 |
| | (9.23378) | (4.83876) | (5.06554) | (2.98072) | (1.56187) | (2.29401) | (1.20017) | (8.45898) |
| 3.029279 | 26.43405 | 6.539292 | 3.450214 | 2.792105 | 1.048995 | 3.529960 | 0.786696 | 55.41868 |
| | (9.19870) | (4.85493) | (5.59151) | (2.93570) | (1.51923) | (2.29270) | (1.19126) | (8.36006) |

Appendix 2: Variance Decomposition for EAC

| Code | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | 3.44E-12 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| | | (0.00000) | (0.00000) | (0.00000) | (0.00000) | (0.00000) | (0.00000) | (0.00000) | (0.00000) |
| | 3.57E-12 | 93.01515 | 2.70E-06 | 0.257671 | 0.030382 | 0.133788 | 0.012802 | 0.404008 | 6.146195 |
| | | (4.11321) | (0.06524) | (1.26128) | (0.78424) | (0.73711) | (0.87689) | (0.92551) | (3.40307) |
| | 3.59E-12 | 92.28315 | 6.91E-06 | 0.317685 | 0.075669 | 0.132857 | 0.112128 | 0.946421 | 6.132084 |
| | | (4.32742) | (0.07317) | (1.39601) | (1.31151) | (0.88317) | (0.94586) | (1.40503) | (3.39971) |
| | 3.59E-12 | 92.05088 | 7.86E-06 | 0.327892 | 0.087435 | 0.191398 | 0.255871 | 0.958906 | 6.127616 |
| | | (4.35131) | (0.07457) | (1.37779) | (1.30752) | (0.99931) | (1.02152) | (1.44030) | (3.35980) |
| | 3.59E-12 | 91.82700 | 8.67E-06 | 0.444788 | 0.087303 | 0.238451 | 0.293609 | 0.966794 | 6.142043 |
| | | (4.40281) | (0.07504) | (1.53826) | (1.31928) | (1.08973) | (1.04478) | (1.44928) | (3.34989) |
| | 3.60E-12 | 91.59687 | 8.96E-06 | 0.625290 | 0.087570 | 0.252908 | 0.325489 | 0.969559 | 6.142304 |
| | | (4.52191) | (0.07696) | (1.88905) | (1.30475) | (1.14962) | (1.06850) | (1.44161) | (3.34049) |
| | 3.61E-12 | 91.21792 | 9.19E-06 | 0.993599 | 0.089088 | 0.254588 | 0.349602 | 0.965576 | 6.129617 |
| | | (4.85373) | (0.08223) | (2.71318) | (1.28820) | (1.18551) | (1.08774) | (1.42289) | (3.32798) |
| | 3.62E-12 | 90.57107 | 9.39E-06 | 1.646664 | 0.094504 | 0.252809 | 0.382340 | 0.959406 | 6.093198 |
| | | (5.63514) | (0.09643) | (4.18829) | (1.26059) | (1.20413) | (1.11019) | (1.39576) | (3.31071) |
| | 3.64E-12 | 89.42929 | 9.65E-06 | 2.814607 | 0.105771 | 0.250568 | 0.429997 | 0.947311 | 6.022446 |
| | | (7.17918) | (0.12551) | (6.49612) | (1.22365) | (1.20899) | (1.13988) | (1.35818) | (3.28875) |
| | 3.68E-12 | 87.45045 | 1.00E-05 | 4.847574 | 0.127043 | 0.249017 | 0.504430 | 0.926378 | 5.895097 |
| | | (9.67224) | (0.17432) | (9.70293) | (1.17252) | (1.19813) | (1.18972) | (1.31074) | (3.26583) |
| | 3.76E-12 | 84.10502 | 1.06E-05 | 8.296909 | 0.163740 | 0.249117 | 0.616962 | 0.891342 | 5.676896 |
| | | (13.0174) | (0.24240) | (13.6657) | (1.11751) | (1.16867) | (1.27773) | (1.25628) | (3.24693) |
| | 3.88E-12 | 78.70173 | 1.13E-05 | 13.88525 | 0.223370 | 0.251986 | 0.780669 | 0.835053 | 5.321922 |
| | | (16.8193) | (0.32496) | (17.9756) | (1.07018) | (1.12272) | (1.41910) | (1.19854) | (3.23018) |

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|----|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| | 5.25E-13 | 31.76537 (5.11668) | 68.23463 (5.11668) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| | 5.42E-13 | 29.87931 (4.66673) | 64.18321 (5.29730) | 1.435444 (1.83976) | 1.225450 (1.58315) | 0.715626 (1.27795) | 0.653806 (1.32685) | 1.847147 (1.83242) | 0.060009 (0.95491) |
| | 5.54E-13 | 28.52351 (4.49854) | 61.27084 (5.34431) | 1.614455 (1.97455) | 2.466789 (2.68310) | 1.171149 (1.67617) | 0.628289 (1.34022) | 1.768205 (1.96404) | 2.556760 (1.84843) |
| | 5.59E-13 | 28.02196 (4.46088) | 60.19349 (5.46645) | 1.851993 (2.08331) | 2.451034 (2.60813) | 1.166618 (1.77064) | 1.041433 (1.38623) | 2.043047 (2.04662) | 3.230419 (2.27781) |
| | 5.61E-13 | 27.81772 (4.44343) | 59.75477 (5.53597) | 1.887867 (2.12157) | 2.433173 (2.58563) | 1.171283 (1.79724) | 1.397609 (1.51248) | 2.082611 (2.03864) | 3.454959 (2.42231) |
| | 5.63E-13 | 27.65259 (4.43777) | 59.40006 (5.59746) | 1.960492 (2.36558) | 2.420733 (2.54663) | 1.268669 (1.85285) | 1.589434 (1.62380) | 2.143087 (2.03397) | 3.564928 (2.48208) |
| | 5.64E-13 | 27.51329 (4.45342) | 59.10082 (5.68466) | 2.013018 (2.84079) | 2.412623 (2.50308) | 1.448916 (1.95351) | 1.676607 (1.68900) | 2.164348 (2.00819) | 3.670381 (2.53482) |
| | 5.66E-13 | 27.38059 (4.50056) | 58.81577 (5.88731) | 2.082711 (3.82384) | 2.406221 (2.45047) | 1.666314 (2.08500) | 1.713711 (1.72625) | 2.182341 (1.97405) | 3.752346 (2.55821) |
| | 5.67E-13 | 27.26176 (4.61075) | 58.56050 (6.32147) | 2.175033 (5.48440) | 2.400724 (2.38318) | 1.864912 (2.22367) | 1.726268 (1.74316) | 2.191402 (1.92228) | 3.819402 (2.55481) |
| | 5.68E-13 | 27.15182 (4.83074) | 58.32434 (7.18268) | 2.316887 (8.01390) | 2.394264 (2.29797) | 2.021287 (2.34932) | 1.726810 (1.73932) | 2.196479 (1.85352) | 3.868116 (2.51872) |
| | 5.69E-13 | 27.03941 (5.21924) | 58.08288 (8.62432) | 2.543939 (11.4611) | 2.385641 (2.19718) | 2.130001 (2.44920) | 1.721197 (1.71410) | 2.196503 (1.76536) | 3.900427 (2.45338) |
| | 5.71E-13 | 26.90185 (5.80177) | 57.78740 (10.6200) | 2.921471 (15.6592) | 2.373591 (2.09276) | 2.195719 (2.51917) | 1.712485 (1.67393) | 2.191158 (1.66466) | 3.916321 (2.37189) |

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|----|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| | 2.00E+11 | 9.86E-05 (0.61286) | 2.99E-06 (0.83060) | 99.99990 (0.98376) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| | 2.77E+11 | 9.80E-05 (0.59124) | 9.40E-06 (0.81336) | 97.72083 (2.42708) | 0.530953 (0.95680) | 0.092201 (0.61856) | 1.229540 (1.31562) | 0.002496 (0.50985) | 0.423876 (0.90781) |
| | 3.96E+11 | 9.81E-05 (0.59031) | 1.22E-05 (0.81323) | 97.45580 (2.71946) | 0.709686 (1.13781) | 0.061196 (0.68084) | 1.440095 (1.66479) | 0.006012 (0.61232) | 0.327105 (0.89114) |
| | 5.41E+11 | 9.79E-05 (0.58969) | 1.45E-05 (0.82048) | 97.00133 (3.12837) | 0.831154 (1.29836) | 0.080321 (0.88189) | 1.800136 (2.03038) | 0.005481 (0.77223) | 0.281466 (0.95937) |
| | 7.33E+11 | 9.74E-05 | 1.56E-05 | 96.78071 | 0.896052 | 0.110826 | 1.970364 | 0.009591 | 0.232340 |

| | | | | | | | | | |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | (0.58902) | (0.82115) | (3.36839) | (1.39156) | (1.02495) | (2.24485) | (0.82790) | (0.96041) |
| 5 | 9.87E+11 | 9.69E-05 | 1.61E-05 | 96.61401 | 0.944400 | 0.151313 | 2.083096 | 0.012443 | 0.194623 |
| | | (0.58880) | (0.82269) | (3.57692) | (1.45814) | (1.17218) | (2.40857) | (0.87885) | (0.96680) |
| 7 | 1.32E+12 | 9.64E-05 | 1.62E-05 | 96.51369 | 0.976537 | 0.189606 | 2.138432 | 0.015845 | 0.165781 |
| | | (0.58872) | (0.82331) | (3.73089) | (1.50156) | (1.28342) | (2.52617) | (0.90554) | (0.97356) |
| 8 | 1.77E+12 | 9.60E-05 | 1.61E-05 | 96.44958 | 0.998940 | 0.221956 | 2.165883 | 0.018475 | 0.145055 |
| | | (0.58890) | (0.82380) | (3.85241) | (1.52969) | (1.37138) | (2.61221) | (0.92676) | (0.98664) |
| 9 | 2.37E+12 | 9.57E-05 | 1.60E-05 | 96.41234 | 1.013813 | 0.246718 | 2.175708 | 0.020630 | 0.130680 |
| | | (0.58910) | (0.82407) | (3.94330) | (1.54731) | (1.43560) | (2.67437) | (0.94050) | (1.00121) |
| 0 | 3.17E+12 | 9.55E-05 | 1.59E-05 | 96.39215 | 1.023529 | 0.264564 | 2.176482 | 0.022193 | 0.120973 |
| | | (0.58929) | (0.82422) | (4.01083) | (1.55831) | (1.48195) | (2.71866) | (0.95069) | (1.01539) |
| 1 | 4.24E+12 | 9.53E-05 | 1.58E-05 | 96.38297 | 1.029645 | 0.276817 | 2.172579 | 0.023313 | 0.114560 |
| | | (0.58942) | (0.82430) | (4.05971) | (1.56503) | (1.51429) | (2.74999) | (0.95762) | (1.02756) |
| 2 | 5.67E+12 | 9.52E-05 | 1.57E-05 | 96.38040 | 1.033375 | 0.284913 | 2.166740 | 0.024078 | 0.110388 |
| | | (0.58952) | (0.82433) | (4.09476) | (1.56910) | (1.53663) | (2.77196) | (0.96252) | (1.03735) |

| Mod | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 6.144080 | 5.06E-06 | 0.000145 | 0.847410 | 99.15244 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| | | (0.92139) | (0.81725) | (1.55536) | (1.97091) | (0.00000) | (0.00000) | (0.00000) | (0.00000) |
| 2 | 6.217804 | 4.95E-06 | 0.000142 | 0.829314 | 96.82086 | 0.074341 | 0.006360 | 0.095002 | 2.173972 |
| | | (0.84648) | (0.78077) | (1.74961) | (3.89134) | (1.14489) | (0.89458) | (0.85384) | (2.49742) |
| 3 | 6.228362 | 4.93E-06 | 0.000141 | 0.841456 | 96.49658 | 0.074595 | 0.014869 | 0.118110 | 2.454247 |
| | | (0.83441) | (0.77285) | (1.77596) | (4.03847) | (1.22809) | (0.97103) | (1.12188) | (2.51989) |
| 4 | 6.245842 | 4.93E-06 | 0.000141 | 0.839993 | 95.95944 | 0.163245 | 0.103286 | 0.185410 | 2.748483 |
| | | (0.82674) | (0.76173) | (1.82970) | (4.24510) | (1.32458) | (1.02444) | (1.25344) | (2.65945) |
| 5 | 6.263840 | 4.91E-06 | 0.000141 | 0.835324 | 95.41233 | 0.306537 | 0.268275 | 0.238364 | 2.939026 |
| | | (0.81683) | (0.75486) | (1.88802) | (4.45650) | (1.40742) | (1.05269) | (1.27575) | (2.80921) |
| 6 | 6.281070 | 4.88E-06 | 0.000141 | 0.835408 | 94.90033 | 0.488358 | 0.435774 | 0.281881 | 3.058101 |
| | | (0.80601) | (0.74985) | (2.11007) | (4.75617) | (1.49149) | (1.13356) | (1.29671) | (2.85343) |
| 7 | 6.297378 | 4.86E-06 | 0.000141 | 0.858988 | 94.42462 | 0.690546 | 0.577758 | 0.311374 | 3.136564 |
| | | (0.79214) | (0.74663) | (2.66125) | (5.21480) | (1.58024) | (1.23824) | (1.29327) | (2.89410) |
| 8 | 6.313662 | 4.85E-06 | 0.000140 | 0.935092 | 93.95695 | 0.893776 | 0.696070 | 0.332440 | 3.185531 |
| | | (0.77366) | (0.74409) | (3.80976) | (6.04886) | (1.67781) | (1.35832) | (1.28620) | (2.90121) |
| 9 | 6.331746 | 4.92E-06 | 0.000140 | 1.118283 | 93.44318 | 1.080032 | 0.799203 | 0.347002 | 3.212151 |
| | | (0.74750) | (0.74305) | (5.77259) | (7.53270) | (1.77544) | (1.49243) | (1.27018) | (2.89414) |
| 0 | 6.354968 | 5.13E-06 | 0.000139 | 1.500640 | 92.78764 | 1.239970 | 0.896823 | 0.356913 | 3.217871 |
| | | (0.71206) | (0.74202) | (8.62537) | (9.84203) | (1.85708) | (1.63616) | (1.24517) | (2.86512) |

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|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1 | 6.389292 | 5.65E-06 (0.66745) | 0.000138 (0.73935) | 2.243591 (12.2879) | 91.82512 (12.9273) | 1.370269 (1.90934) | 0.997478 (1.78454) | 0.362731 (1.20797) | 3.200667 (2.81727) |
| 2 | 6.445082 | 6.75E-06 (0.61910) | 0.000136 (0.73257) | 3.619285 (16.4451) | 90.28285 (16.4761) | 1.470141 (1.92881) | 1.109168 (1.93015) | 0.364309 (1.15857) | 3.154106 (2.75141) |

| iod | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1 | 15.98038 | 1.19E-05 (0.77148) | 0.000121 (0.66611) | 0.017764 (1.08948) | 0.267218 (1.67956) | 99.71489 (2.20006) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 2 | 22.01466 | 1.41E-05 (0.69057) | 0.000167 (0.66327) | 0.074031 (1.74588) | 1.108050 (2.41438) | 96.74597 (3.21112) | 0.770965 (1.45045) | 0.019083 (0.47199) | 1.281720 (1.34391) |
| 3 | 24.98482 | 1.47E-05 (0.69935) | 0.000183 (0.67303) | 0.155234 (1.76409) | 1.831549 (3.33027) | 93.96450 (4.58776) | 1.252120 (2.50662) | 0.151682 (0.97635) | 2.644720 (2.28134) |
| 4 | 26.31879 | 1.49E-05 (0.71331) | 0.000187 (0.67422) | 0.215198 (1.88852) | 2.157930 (3.86309) | 92.41458 (5.57091) | 1.421702 (2.99446) | 0.264655 (1.36179) | 3.525730 (2.83490) |
| 5 | 26.87800 | 1.47E-05 (0.72535) | 0.000187 (0.67100) | 0.288230 (2.15216) | 2.301784 (4.10178) | 91.63649 (6.19517) | 1.490244 (3.26915) | 0.353344 (1.64814) | 3.929708 (3.17809) |
| 6 | 27.10917 | 1.46E-05 (0.72908) | 0.000188 (0.66112) | 0.391553 (2.81299) | 2.362644 (4.17983) | 91.21900 (6.70560) | 1.536378 (3.44806) | 0.400708 (1.79321) | 4.089510 (3.38622) |
| 7 | 27.21704 | 1.45E-05 (0.72622) | 0.000188 (0.64131) | 0.550372 (4.14516) | 2.385318 (4.15445) | 90.91615 (7.38541) | 1.581931 (3.57009) | 0.424110 (1.86282) | 4.141912 (3.52134) |
| 8 | 27.28784 | 1.44E-05 (0.71653) | 0.000188 (0.61110) | 0.798544 (6.37686) | 2.390961 (4.05694) | 90.59574 (8.55702) | 1.630154 (3.64012) | 0.433787 (1.87931) | 4.150611 (3.60895) |
| 9 | 27.36036 | 1.45E-05 (0.69986) | 0.000187 (0.57313) | 1.190058 (9.54825) | 2.387501 (3.91131) | 90.16804 (10.4888) | 1.678561 (3.65649) | 0.437027 (1.85880) | 4.138611 (3.65929) |
| 10 | 27.45838 | 1.49E-05 (0.67587) | 0.000186 (0.53377) | 1.811845 (13.4679) | 2.376816 (3.73322) | 89.54161 (13.1850) | 1.720996 (3.62058) | 0.436682 (1.80508) | 4.111849 (3.67450) |
| 11 | 27.60701 | 1.55E-05 (0.64462) | 0.000185 (0.50108) | 2.806755 (17.6692) | 2.357620 (3.52977) | 88.58436 (16.2919) | 1.749366 (3.53818) | 0.433651 (1.71899) | 4.068048 (3.65071) |
| 12 | 27.84357 | 1.66E-05 (0.60669) | 0.000182 (0.48163) | 4.405769 (21.5446) | 2.326423 (3.29764) | 87.08641 (19.2617) | 1.754369 (3.42041) | 0.427552 (1.60402) | 3.999275 (3.57809) |

| iod | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----|------|------|------|-----|-------|-----|-----|------|-----|
|-----|------|------|------|-----|-------|-----|-----|------|-----|

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|----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 74.87817 | 7.22E-07 | 0.000500 | 10.46373 | 0.040703 | 2.167580 | 87.32749 | 0.000000 | 0.000000 |
| | | (1.00182) | (0.88224) | (3.96307) | (0.76708) | (1.89303) | (4.16558) | (0.00000) | (0.00000) |
| 2 | 123.7815 | 5.76E-07 | 0.000538 | 6.371761 | 0.322237 | 1.095890 | 91.99495 | 0.005930 | 0.208695 |
| | | (1.06661) | (0.82746) | (3.34509) | (1.29214) | (1.44676) | (3.51002) | (0.26525) | (0.38598) |
| 3 | 166.1394 | 1.01E-06 | 0.000538 | 4.307193 | 0.658041 | 0.985044 | 93.63537 | 0.013494 | 0.400321 |
| | | (1.09055) | (0.80190) | (2.86493) | (1.75626) | (1.74729) | (3.36549) | (0.41461) | (0.72856) |
| 4 | 203.6025 | 2.05E-06 | 0.000527 | 2.892795 | 0.933306 | 1.397964 | 94.30438 | 0.018065 | 0.452960 |
| | | (1.08641) | (0.76736) | (2.21317) | (2.14713) | (2.47052) | (3.54388) | (0.58480) | (0.96289) |
| 5 | 239.2012 | 3.83E-06 | 0.000510 | 2.350079 | 1.224968 | 2.190426 | 93.77963 | 0.017137 | 0.437249 |
| | | (1.06267) | (0.72313) | (1.72059) | (2.48752) | (3.40640) | (4.13955) | (0.70153) | (1.15114) |
| 6 | 275.6775 | 6.95E-06 | 0.000485 | 3.240690 | 1.539355 | 3.140111 | 91.67701 | 0.013452 | 0.388893 |
| | | (1.02382) | (0.67068) | (2.69406) | (2.76153) | (4.35587) | (5.30926) | (0.76727) | (1.30463) |
| 7 | 316.3860 | 1.21E-05 | 0.000452 | 6.339308 | 1.853211 | 4.022133 | 87.44345 | 0.010413 | 0.331022 |
| | | (0.97291) | (0.61824) | (5.27883) | (2.96198) | (5.16084) | (7.19286) | (0.79116) | (1.43229) |
| 8 | 365.8703 | 1.99E-05 | 0.000409 | 12.41842 | 2.127643 | 4.639213 | 80.53078 | 0.009895 | 0.273625 |
| | | (0.91352) | (0.57538) | (8.71187) | (3.08633) | (5.72629) | (9.64810) | (0.78782) | (1.53054) |
| 9 | 430.5304 | 3.03E-05 | 0.000356 | 21.76515 | 2.317943 | 4.858448 | 70.82463 | 0.012107 | 0.221338 |
| | | (0.84957) | (0.55090) | (12.2596) | (3.13598) | (6.01534) | (12.1571) | (0.77408) | (1.58466) |
| 10 | 519.1307 | 4.25E-05 | 0.000294 | 33.72293 | 2.390859 | 4.651848 | 59.04059 | 0.016108 | 0.177332 |
| | | (0.78542) | (0.54841) | (15.1111) | (3.11733) | (6.03251) | (14.0532) | (0.76395) | (1.58213) |
| 11 | 643.1061 | 5.50E-05 | 0.000232 | 46.71291 | 2.344059 | 4.114119 | 46.66434 | 0.020497 | 0.143792 |
| | | (0.72608) | (0.56554) | (16.6434) | (3.03583) | (5.80258) | (14.8509) | (0.76711) | (1.52634) |
| 12 | 816.8864 | 6.62E-05 | 0.000177 | 58.94114 | 2.208229 | 3.414434 | 35.29079 | 0.024161 | 0.121004 |
| | | (0.67634) | (0.59638) | (16.6806) | (2.89485) | (5.36388) | (14.4609) | (0.78496) | (1.44038) |

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 7.770124 | 1.58E-07 | 0.000150 | 0.000753 | 0.016377 | 1.827836 | 0.449504 | 97.70538 | 0.000000 |
| | | (0.83735) | (0.80594) | (0.73587) | (0.93648) | (2.25066) | (1.04665) | (2.87674) | (0.00000) |
| 2 | 8.296266 | 5.03E-07 | 0.000152 | 0.334598 | 0.298804 | 3.946125 | 5.052736 | 85.72614 | 4.641443 |
| | | (0.73733) | (0.70489) | (1.12700) | (1.38660) | (2.65733) | (3.47158) | (4.84492) | (3.16492) |
| 3 | 8.765549 | 7.37E-07 | 0.000153 | 0.318988 | 0.270206 | 7.148736 | 6.350228 | 81.15707 | 4.754617 |
| | | (0.72791) | (0.67740) | (1.16793) | (1.69666) | (3.29085) | (3.71486) | (5.37299) | (3.15240) |
| 4 | 9.045937 | 9.78E-07 | 0.000145 | 0.304136 | 0.399510 | 10.08262 | 7.135599 | 76.30576 | 5.772229 |
| | | (0.69960) | (0.64309) | (1.19968) | (1.72420) | (4.04661) | (4.00736) | (6.04591) | (3.34543) |
| 5 | 9.293686 | 1.04E-06 | 0.000138 | 0.387582 | 0.520334 | 12.67499 | 7.312539 | 72.83901 | 6.265413 |
| | | (0.68281) | (0.62370) | (1.51899) | (1.86030) | (4.86115) | (4.07129) | (6.71631) | (3.42091) |
| 6 | 9.493600 | 1.00E-06 | 0.000132 | 0.668605 | 0.665091 | 14.61733 | 7.402005 | 69.93998 | 6.706861 |

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|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | (0.66294) | (0.61003) | (2.08645) | (1.97641) | (5.51566) | (4.15528) | (7.36271) | (3.48459) |
| 7 | 9.668793 | 1.05E-06 | 0.000127 | 1.333912 | 0.793129 | 15.95144 | 7.415636 | 67.59764 | 6.908119 |
| | | (0.64373) | (0.60165) | (3.44304) | (2.10888) | (6.01230) | (4.18066) | (8.02056) | (3.52306) |
| 8 | 9.841578 | 1.51E-06 | 0.000123 | 2.660629 | 0.913175 | 16.72839 | 7.402784 | 65.33360 | 6.961302 |
| | | (0.61972) | (0.59521) | (5.58445) | (2.21338) | (6.35473) | (4.17398) | (8.78832) | (3.54297) |
| | 10.05114 | 2.93E-06 | 0.000118 | 5.111512 | 1.020459 | 16.98508 | 7.332094 | 62.71061 | 6.840126 |
| | | (0.59061) | (0.58938) | (8.68330) | (2.27906) | (6.57424) | (4.12092) | (9.81850) | (3.53972) |
| 0 | 10.35275 | 6.05E-06 | 0.000112 | 9.340451 | 1.116902 | 16.68333 | 7.167417 | 59.15771 | 6.534070 |
| | | (0.55472) | (0.58594) | (12.4746) | (2.29150) | (6.72163) | (4.04084) | (11.1582) | (3.52425) |
| 1 | 10.83076 | 1.18E-05 | 0.000103 | 16.12563 | 1.197398 | 15.73129 | 6.852537 | 54.08741 | 6.005616 |
| | | (0.51228) | (0.58970) | (16.5709) | (2.25087) | (6.85381) | (3.95647) | (12.6907) | (3.51027) |
| 2 | 11.61068 | 2.09E-05 | 9.10E-05 | 26.02236 | 1.254536 | 14.05250 | 6.343707 | 47.09182 | 5.234972 |
| | | (0.46820) | (0.60432) | (20.4160) | (2.16738) | (6.99973) | (3.88696) | (14.1816) | (3.50555) |

| iod | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | 2.471326 | 3.06E-06 | 2.48E-05 | 0.018147 | 0.111399 | 2.803172 | 1.417776 | 8.496585 | 87.15289 |
| | | (0.64178) | (0.77648) | (0.78802) | (0.80299) | (2.55230) | (1.84752) | (3.39989) | (4.38326) |
| | 3.657231 | 4.27E-06 | 5.45E-05 | 0.213077 | 0.067532 | 10.64338 | 7.326758 | 9.569756 | 72.17944 |
| | | (0.59294) | (0.70857) | (1.26108) | (1.24183) | (4.60389) | (3.72593) | (4.21408) | (6.70323) |
| | 4.475124 | 4.36E-06 | 5.66E-05 | 0.143394 | 0.335233 | 17.43934 | 9.996381 | 10.17958 | 61.90601 |
| | | (0.57567) | (0.67138) | (1.21343) | (1.85173) | (6.21089) | (4.93296) | (4.55744) | (7.51948) |
| | 5.087342 | 4.16E-06 | 4.96E-05 | 0.212672 | 0.680657 | 23.20772 | 10.62608 | 10.04154 | 55.23128 |
| | | (0.56957) | (0.65165) | (1.32103) | (2.39624) | (7.53037) | (5.56717) | (4.76921) | (7.77975) |
| | 5.566819 | 3.70E-06 | 4.25E-05 | 0.680529 | 0.998030 | 27.78110 | 10.33902 | 9.720421 | 50.48085 |
| | | (0.56561) | (0.64375) | (1.80558) | (2.80776) | (8.57555) | (5.83488) | (4.82371) | (7.89328) |
| | 5.956191 | 3.23E-06 | 3.71E-05 | 1.827320 | 1.280981 | 30.99097 | 9.764982 | 9.319766 | 46.81594 |
| | | (0.56188) | (0.63883) | (3.07930) | (3.14156) | (9.35970) | (5.89961) | (4.79614) | (7.99885) |
| | 6.295047 | 3.21E-06 | 3.33E-05 | 4.081382 | 1.523255 | 32.77344 | 9.125200 | 8.881189 | 43.61550 |
| | | (0.55831) | (0.62978) | (5.37090) | (3.38724) | (9.95511) | (5.81368) | (4.69674) | (8.17353) |
| | 6.630679 | 4.37E-06 | 3.01E-05 | 8.033374 | 1.718869 | 33.09512 | 8.452453 | 8.355280 | 40.34487 |
| | | (0.55347) | (0.61218) | (8.74445) | (3.53905) | (10.4561) | (5.62106) | (4.53939) | (8.56563) |
| | 7.026602 | 7.73E-06 | 2.68E-05 | 14.40582 | 1.856150 | 31.86595 | 7.693765 | 7.669539 | 36.50874 |
| | | (0.54598) | (0.58909) | (12.9672) | (3.59676) | (10.9206) | (5.36307) | (4.34657) | (9.29908) |
| 0 | 7.569336 | 1.44E-05 | 2.31E-05 | 23.77452 | 1.918676 | 29.00882 | 6.788652 | 6.757457 | 31.75184 |
| | | (0.53564) | (0.57048) | (17.4685) | (3.56574) | (11.3273) | (5.08483) | (4.15113) | (10.3273) |
| 1 | 8.375628 | 2.47E-05 | 1.91E-05 | 36.04588 | 1.893209 | 24.66382 | 5.731387 | 5.614217 | 26.05145 |
| | | (0.52336) | (0.56686) | (21.4995) | (3.45502) | (11.5710) | (4.81555) | (3.97519) | (11.3942) |

| | | | | | | | | | |
|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 2 | 9.596733 | 3.81E-05 (0.51033) | 1.54E-05 (0.58187) | 49.99995 (24.4620) | 1.784839 (3.28132) | 19.38965 (11.5612) | 4.611530 (4.56114) | 4.337483 (3.81562) | 19.87649 (12.2035) |
|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|

Appendix 3: Variance Decomposition for ECOWAS

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|----|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| | 3.51E-12 | 100.0000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| | 3.67E-12 | 91.53972 (2.48333) | 1.10E-07 (0.02583) | 0.821460 (0.97139) | 0.283354 (0.74177) | 0.330660 (0.47764) | 0.121353 (0.36151) | 0.206713 (0.48247) | 6.696734 (2.05542) |
| | 3.67E-12 | 91.22175 (2.57238) | 1.09E-07 (0.02586) | 0.890835 (1.01892) | 0.338986 (0.77846) | 0.377445 (0.55049) | 0.128879 (0.34279) | 0.356399 (0.68177) | 6.685706 (2.04599) |
| | 3.67E-12 | 91.14706 (2.58981) | 1.09E-07 (0.02580) | 0.890459 (1.02178) | 0.340388 (0.78513) | 0.394918 (0.56330) | 0.128794 (0.33913) | 0.385644 (0.71158) | 6.712734 (2.04645) |
| | 3.67E-12 | 91.10904 (2.56687) | 1.20E-07 (0.02587) | 0.903695 (1.05452) | 0.341808 (0.78587) | 0.418745 (0.58869) | 0.130425 (0.33820) | 0.386233 (0.71535) | 6.710048 (2.04444) |
| | 3.68E-12 | 91.06742 (2.56194) | 1.31E-07 (0.02593) | 0.928884 (1.16235) | 0.342141 (0.78608) | 0.428010 (0.60209) | 0.132024 (0.33763) | 0.391122 (0.71311) | 6.710398 (2.04424) |
| | 3.68E-12 | 91.01971 (2.60380) | 1.47E-07 (0.02609) | 0.968546 (1.41233) | 0.341971 (0.78440) | 0.435947 (0.61406) | 0.134014 (0.33818) | 0.392023 (0.70944) | 6.707794 (2.04538) |
| | 3.68E-12 | 90.95569 (2.76400) | 1.66E-07 (0.02639) | 1.028448 (1.87982) | 0.342144 (0.78189) | 0.440396 (0.62141) | 0.135957 (0.33985) | 0.392793 (0.70474) | 6.704574 (2.04823) |
| | 3.68E-12 | 90.86596 (3.14754) | 1.91E-07 (0.02700) | 1.118248 (2.62729) | 0.342239 (0.77825) | 0.443014 (0.62603) | 0.138034 (0.34324) | 0.393134 (0.69849) | 6.699371 (2.05333) |
| | 3.68E-12 | 90.73671 (3.87095) | 2.25E-07 (0.02818) | 1.252203 (3.71009) | 0.342424 (0.77330) | 0.444051 (0.62740) | 0.140354 (0.34928) | 0.392996 (0.69026) | 6.691261 (2.06208) |
| | 3.69E-12 | 90.54796 (5.01146) | 2.71E-07 (0.03036) | 1.451202 (5.17178) | 0.342671 (0.76684) | 0.443874 (0.62599) | 0.143050 (0.35930) | 0.392454 (0.67955) | 6.678785 (2.07641) |
| | 3.69E-12 | 90.27100 (6.59229) | 3.35E-07 (0.03409) | 1.745802 (7.03513) | 0.342979 (0.75868) | 0.442710 (0.62195) | 0.146340 (0.37519) | 0.391386 (0.66602) | 6.659778 (2.09893) |

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|----|------|------|------|-----|-------|-----|-----|------|-----|
|----|------|------|------|-----|-------|-----|-----|------|-----|

| | | | | | | | | |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 2.11E-12 | 60.73770 (3.04420) | 39.26230 (3.04420) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 2.13E-12 | 59.70849 (3.09018) | 38.59700 (2.99952) | 0.206517 (0.62119) | 0.000718 (0.33289) | 0.004506 (0.22909) | 0.122527 (0.33948) | 0.604984 (0.74862) | 0.755250 (0.74653) |
| 2.15E-12 | 58.82151 (3.08802) | 38.02364 (2.99346) | 0.220094 (0.59522) | 1.008920 (1.00726) | 0.246852 (0.48418) | 0.134521 (0.35693) | 0.700091 (0.86138) | 0.844374 (0.71762) |
| 2.15E-12 | 58.59565 (3.09416) | 37.87764 (2.99816) | 0.338459 (0.65029) | 1.209576 (1.12775) | 0.296793 (0.55088) | 0.134632 (0.35857) | 0.705339 (0.87036) | 0.841914 (0.71311) |
| 2.15E-12 | 58.37664 (3.12196) | 37.73606 (2.99767) | 0.567611 (0.93783) | 1.265562 (1.18608) | 0.351982 (0.63644) | 0.135485 (0.36101) | 0.715134 (0.87407) | 0.851526 (0.70744) |
| 2.16E-12 | 58.13409 (3.20030) | 37.57927 (3.00900) | 0.930112 (1.51083) | 1.294113 (1.20261) | 0.363569 (0.66560) | 0.135348 (0.36405) | 0.712229 (0.86499) | 0.851274 (0.70345) |
| 2.16E-12 | 57.79713 (3.38500) | 37.36146 (3.05912) | 1.479338 (2.40152) | 1.298756 (1.20167) | 0.366173 (0.68498) | 0.134682 (0.36899) | 0.708837 (0.85197) | 0.853622 (0.69980) |
| 2.17E-12 | 57.30931 (3.75582) | 37.04611 (3.18834) | 2.294088 (3.65805) | 1.297759 (1.19161) | 0.363191 (0.68712) | 0.133585 (0.37558) | 0.703654 (0.83520) | 0.852304 (0.69547) |
| 2.19E-12 | 56.60058 (4.39263) | 36.58798 (3.45106) | 3.485852 (5.32598) | 1.290569 (1.17378) | 0.359780 (0.68132) | 0.131998 (0.38472) | 0.696120 (0.81404) | 0.847120 (0.69000) |
| 2.21E-12 | 55.57890 (5.34163) | 35.92754 (3.89712) | 5.205422 (7.42328) | 1.277439 (1.14871) | 0.358793 (0.66910) | 0.129885 (0.39694) | 0.685622 (0.78917) | 0.836400 (0.68296) |
| 2.24E-12 | 54.12825 (6.59047) | 34.98980 (4.54488) | 7.646427 (9.91630) | 1.257053 (1.11675) | 0.362090 (0.65468) | 0.127391 (0.41278) | 0.670736 (0.76128) | 0.818250 (0.67438) |
| 2.28E-12 | 52.11069 (8.07307) | 33.68560 (5.36753) | 11.03957 (12.7086) | 1.227344 (1.07887) | 0.370991 (0.64165) | 0.125064 (0.43273) | 0.650079 (0.73125) | 0.790656 (0.66451) |

| | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|-----------------------|
| 2.43E+11 | 1.25E-05 (0.31666) | 1.38E-05 (0.29177) | 99.99997 (0.41994) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 4.35E+11 | 1.25E-05 (0.31702) | 1.52E-05 (0.28711) | 99.86607 (0.51167) | 0.040015 (0.12691) | 0.012029 (0.09901) | 0.080258 (0.18919) | 0.000229 (0.09586) | 0.001369 (0.08114) | |
| 6.30E+11 | 1.24E-05 (0.31773) | 1.60E-05 (0.28569) | 99.62011 (0.67214) | 0.147250 (0.28231) | 0.065705 (0.17192) | 0.161944 (0.34330) | 0.003721 (0.16484) | 0.001241 (0.13184) | |
| 8.43E+11 | 1.22E-05 (0.31899) | 1.65E-05 (0.28495) | 99.39296 (0.83608) | 0.238155 (0.42427) | 0.135514 (0.27358) | 0.222007 (0.44222) | 0.009959 (0.22089) | 0.001377 (0.16751) | |
| 1.09E+12 | 1.22E-05 (0.32050) | 1.68E-05 (0.28494) | 99.20172 (0.97473) | 0.301723 (0.53182) | 0.207453 (0.37707) | 0.268219 (0.50817) | 0.019116 (0.26313) | 0.001744 (0.19908) | |
| 1.37E+12 | 1.21E-05 | 1.69E-05 | 99.04581 | 0.343847 | 0.273671 | 0.306669 | 0.027692 | 0.002287 | |

| | | | | | | | | | |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | (0.32212) | (0.28510) | (1.08724) | (0.60774) | (0.47383) | (0.55764) | (0.29287) | (0.22820) |
| 7 | 1.70E+12 | 1.20E-05 | 1.71E-05 | 98.92005 | 0.370416 | 0.330374 | 0.341283 | 0.035087 | 0.002765 |
| | | (0.32371) | (0.28530) | (1.17764) | (0.65979) | (0.55852) | (0.59873) | (0.31531) | (0.25519) |
| 8 | 2.10E+12 | 1.20E-05 | 1.72E-05 | 98.81845 | 0.387220 | 0.376474 | 0.373756 | 0.040930 | 0.003136 |
| | | (0.32521) | (0.28547) | (1.25032) | (0.69509) | (0.62963) | (0.63525) | (0.33234) | (0.28015) |
| | 2.58E+12 | 1.20E-05 | 1.73E-05 | 98.73631 | 0.397790 | 0.412339 | 0.404801 | 0.045344 | 0.003390 |
| | | (0.32659) | (0.28560) | (1.30891) | (0.71900) | (0.68753) | (0.66885) | (0.34548) | (0.30303) |
| 0 | 3.16E+12 | 1.20E-05 | 1.74E-05 | 98.66965 | 0.404501 | 0.439155 | 0.434571 | 0.048549 | 0.003544 |
| | | (0.32786) | (0.28567) | (1.35637) | (0.73522) | (0.73354) | (0.70018) | (0.35564) | (0.32374) |
| 1 | 3.87E+12 | 1.20E-05 | 1.75E-05 | 98.61536 | 0.408810 | 0.458420 | 0.462978 | 0.050784 | 0.003621 |
| | | (0.32901) | (0.28570) | (1.39501) | (0.74629) | (0.76937) | (0.72949) | (0.36349) | (0.34228) |
| 2 | 4.72E+12 | 1.20E-05 | 1.76E-05 | 98.57092 | 0.411626 | 0.471655 | 0.489857 | 0.052272 | 0.003643 |
| | | (0.33004) | (0.28569) | (1.42667) | (0.75390) | (0.79678) | (0.75682) | (0.36954) | (0.35865) |

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | 7.820536 | 8.56E-07 | 6.13E-06 | 0.014144 | 99.98585 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| | | (0.28126) | (0.33656) | (0.31572) | (0.55568) | (0.00000) | (0.00000) | (0.00000) | (0.00000) |
| 2 | 8.218656 | 9.13E-07 | 6.52E-06 | 0.075582 | 99.27790 | 0.013703 | 0.206815 | 0.205967 | 0.220022 |
| | | (0.27246) | (0.33090) | (0.47996) | (1.09123) | (0.30121) | (0.40833) | (0.46860) | (0.61307) |
| 3 | 8.430534 | 8.86E-07 | 6.77E-06 | 0.114593 | 97.95818 | 0.061823 | 0.256780 | 1.241636 | 0.366976 |
| | | (0.26972) | (0.32445) | (0.61307) | (1.60482) | (0.38063) | (0.52106) | (1.05755) | (0.68562) |
| 4 | 8.480927 | 9.38E-07 | 6.76E-06 | 0.144988 | 97.59706 | 0.061389 | 0.275107 | 1.262279 | 0.659173 |
| | | (0.26772) | (0.32158) | (0.74006) | (1.82134) | (0.44410) | (0.57041) | (1.09275) | (0.80619) |
| 5 | 8.493323 | 9.51E-07 | 6.76E-06 | 0.175105 | 97.43730 | 0.062848 | 0.282630 | 1.303613 | 0.738498 |
| | | (0.26642) | (0.32006) | (0.92680) | (1.97806) | (0.52442) | (0.59019) | (1.14632) | (0.86347) |
| 5 | 8.499781 | 9.72E-07 | 6.74E-06 | 0.213419 | 97.32261 | 0.062764 | 0.284507 | 1.302991 | 0.813703 |
| | | (0.26509) | (0.31875) | (1.26407) | (2.17900) | (0.57874) | (0.59718) | (1.14929) | (0.91672) |
| 7 | 8.504260 | 9.90E-07 | 6.74E-06 | 0.266894 | 97.22275 | 0.063552 | 0.285127 | 1.301622 | 0.860052 |
| | | (0.26371) | (0.31748) | (1.82484) | (2.53742) | (0.62590) | (0.60063) | (1.14838) | (0.96009) |
| 8 | 8.509402 | 1.01E-06 | 6.74E-06 | 0.344873 | 97.10537 | 0.065252 | 0.285193 | 1.300918 | 0.898382 |
| | | (0.26224) | (0.31601) | (2.66589) | (3.16827) | (0.66237) | (0.60327) | (1.14366) | (0.99768) |
| 9 | 8.516043 | 1.04E-06 | 6.74E-06 | 0.460229 | 96.95426 | 0.068904 | 0.284942 | 1.301192 | 0.930461 |
| | | (0.26067) | (0.31419) | (3.83640) | (4.16053) | (0.69254) | (0.60656) | (1.13723) | (1.02852) |
| 0 | 8.525062 | 1.07E-06 | 6.75E-06 | 0.631257 | 96.75016 | 0.074874 | 0.284419 | 1.301520 | 0.957761 |
| | | (0.25910) | (0.31193) | (5.38073) | (5.56535) | (0.71812) | (0.61127) | (1.12943) | (1.05124) |
| 1 | 8.537697 | 1.11E-06 | 6.77E-06 | 0.884484 | 96.46552 | 0.083539 | 0.283585 | 1.301599 | 0.981262 |
| | | (0.25765) | (0.30914) | (7.32730) | (7.40044) | (0.74180) | (0.61817) | (1.12021) | (1.06452) |

| | | | | | | | | | |
|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 2 | 8.555675 | 1.17E-06 (0.25656) | 6.79E-06 (0.30580) | 1.258178 (9.67285) | 96.06275 (9.64591) | 0.095177 (0.76522) | 0.282418 (0.62810) | 1.300637 (1.10959) | 1.000827 (1.06735) |
|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|-----------------------|
| 13.40797 | 2.31E-06 (0.17346) | 5.90E-06 (0.30082) | 0.031611 (0.30840) | 0.041549 (0.38759) | 99.92683 (0.62720) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 14.83264 | 2.07E-06 (0.16854) | 7.45E-06 (0.28274) | 0.027449 (0.41136) | 0.043292 (0.48597) | 97.23565 (1.61268) | 1.263136 (0.93681) | 1.050625 (0.81984) | 0.379837 (0.53269) | |
| 16.25910 | 1.92E-06 (0.16623) | 7.70E-06 (0.27699) | 0.031029 (0.51986) | 0.115379 (0.53734) | 95.13201 (2.27541) | 1.437715 (1.12015) | 2.951490 (1.40072) | 0.332362 (0.42406) | |
| 16.93526 | 1.92E-06 (0.16586) | 8.02E-06 (0.27595) | 0.031533 (0.66273) | 0.119522 (0.61989) | 94.61061 (2.66213) | 1.627200 (1.34618) | 3.288172 (1.58090) | 0.322954 (0.42234) | |
| 17.42417 | 1.88E-06 (0.16554) | 8.10E-06 (0.27509) | 0.029886 (0.84553) | 0.160847 (0.72551) | 94.12848 (2.96488) | 1.650476 (1.43611) | 3.725074 (1.78807) | 0.305222 (0.43802) | |
| 17.72085 | 1.87E-06 (0.16533) | 8.16E-06 (0.27488) | 0.031392 (1.15131) | 0.169552 (0.78763) | 93.94865 (3.20517) | 1.653939 (1.50078) | 3.901348 (1.88489) | 0.295108 (0.47090) | |
| 17.91909 | 1.86E-06 (0.16473) | 8.19E-06 (0.27434) | 0.042402 (1.65847) | 0.183249 (0.83705) | 93.80867 (3.49042) | 1.635970 (1.53273) | 4.038972 (1.95764) | 0.290726 (0.49952) | |
| 18.04810 | 1.86E-06 (0.16392) | 8.20E-06 (0.27340) | 0.070834 (2.45525) | 0.190150 (0.86609) | 93.70985 (3.93312) | 1.616257 (1.54793) | 4.122104 (2.00030) | 0.290797 (0.53306) | |
| 18.13564 | 1.87E-06 (0.16310) | 8.20E-06 (0.27173) | 0.126372 (3.61998) | 0.196122 (0.88292) | 93.60493 (4.67159) | 1.600751 (1.55063) | 4.176439 (2.02309) | 0.295374 (0.56746) | |
| 18.19801 | 1.87E-06 (0.16294) | 8.20E-06 (0.26917) | 0.222530 (5.21547) | 0.200441 (0.88893) | 93.47006 (5.83065) | 1.593872 (1.54779) | 4.209596 (2.02935) | 0.303493 (0.60457) | |
| 18.24747 | 1.89E-06 (0.16440) | 8.19E-06 (0.26553) | 0.378275 (7.27057) | 0.203979 (0.88676) | 93.27874 (7.46942) | 1.597788 (1.54689) | 4.226758 (2.02249) | 0.314447 (0.64363) | |
| 18.29333 | 1.90E-06 (0.16841) | 8.18E-06 (0.26073) | 0.620717 (9.76159) | 0.206969 (0.87796) | 93.00054 (9.56673) | 1.613215 (1.55727) | 4.230954 (2.00654) | 0.327592 (0.68384) | |

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 66.24385 | 2.09E-06 (0.24859) | 5.44E-05 (0.37218) | 0.021094 (0.33625) | 0.986556 (1.06566) | 0.528493 (0.76791) | 98.46380 (1.32791) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |

| | | | | | | | | |
|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 108.3859 | 2.11E-06 (0.22635) | 5.40E-05 (0.39196) | 0.087511 (0.42504) | 1.645165 (1.46386) | 1.138978 (1.14951) | 96.82049 (1.93769) | 0.018050 (0.12403) | 0.289751 (0.36593) |
| 143.7082 | 2.13E-06 (0.21961) | 5.28E-05 (0.39195) | 0.178470 (0.70538) | 1.223420 (1.35425) | 1.620355 (1.46501) | 96.47429 (2.15374) | 0.091752 (0.26277) | 0.411656 (0.55247) |
| 175.8210 | 2.21E-06 (0.21494) | 5.21E-05 (0.38905) | 0.224659 (0.93785) | 0.905245 (1.23794) | 2.229550 (1.87419) | 95.98117 (2.43870) | 0.162148 (0.38615) | 0.497175 (0.69365) |
| 206.4685 | 2.29E-06 (0.21130) | 5.16E-05 (0.38463) | 0.235172 (1.13690) | 0.691483 (1.16237) | 2.819503 (2.27709) | 95.45399 (2.75768) | 0.257542 (0.50618) | 0.542262 (0.79682) |
| 236.5915 | 2.37E-06 (0.20800) | 5.13E-05 (0.37961) | 0.224035 (1.34541) | 0.545714 (1.12410) | 3.395307 (2.67489) | 94.90941 (3.11448) | 0.351514 (0.61149) | 0.573965 (0.88439) |
| 266.7064 | 2.46E-06 (0.20503) | 5.13E-05 (0.37412) | 0.200736 (1.61123) | 0.443982 (1.11086) | 3.932015 (3.04642) | 94.39037 (3.49518) | 0.440160 (0.70428) | 0.592680 (0.96238) |
| 297.1562 | 2.55E-06 (0.20233) | 5.13E-05 (0.36812) | 0.171728 (1.98767) | 0.370646 (1.11007) | 4.425166 (3.38860) | 93.90954 (3.91031) | 0.520401 (0.78576) | 0.602462 (1.03415) |
| 328.1886 | 2.64E-06 (0.19999) | 5.15E-05 (0.36152) | 0.142502 (2.53242) | 0.316567 (1.11389) | 4.870405 (3.69791) | 93.47347 (4.38987) | 0.591457 (0.85685) | 0.605549 (1.10111) |
| 360.0071 | 2.75E-06 (0.19809) | 5.18E-05 (0.35422) | 0.118888 (3.30113) | 0.276017 (1.11794) | 5.267166 (3.97399) | 93.08023 (4.98537) | 0.653931 (0.91872) | 0.603712 (1.16329) |
| 392.7956 | 2.86E-06 (0.19678) | 5.21E-05 (0.34616) | 0.107987 (4.34023) | 0.245303 (1.11981) | 5.616059 (4.21690) | 92.72393 (5.76009) | 0.708375 (0.97211) | 0.598295 (1.22016) |
| 426.7336 | 2.99E-06 (0.19617) | 5.26E-05 (0.33731) | 0.119020 (5.68162) | 0.222002 (1.11825) | 5.918394 (4.42716) | 92.39484 (6.77341) | 0.755471 (1.01778) | 0.590215 (1.27063) |

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|----|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1 | 36.66149 | 2.03E-06 (0.47724) | 3.21E-06 (0.26433) | 0.005418 (0.29418) | 0.246569 (0.71294) | 0.127111 (0.48675) | 0.175328 (0.46063) | 99.44557 (1.20043) | 0.000000 (0.00000) |
| 2 | 38.69863 | 3.16E-06 (0.43633) | 3.30E-06 (0.24537) | 0.007043 (0.44643) | 1.831432 (1.25298) | 2.635695 (1.44044) | 0.324083 (0.66160) | 91.43669 (2.44445) | 3.765046 (1.75561) |
| 3 | 39.65805 | 3.14E-06 (0.42629) | 3.20E-06 (0.23851) | 0.008447 (0.47330) | 2.393666 (1.40457) | 3.691209 (1.27052) | 0.310621 (0.63838) | 89.28769 (2.33280) | 4.308362 (1.78065) |
| 4 | 39.96757 | 3.12E-06 (0.41991) | 3.30E-06 (0.23469) | 0.009593 (0.50264) | 2.418530 (1.44515) | 4.990910 (1.65996) | 0.364475 (0.65278) | 87.95422 (2.52458) | 4.262266 (1.74016) |
| 5 | 40.21967 | 3.08E-06 (0.41552) | 3.37E-06 (0.23204) | 0.014060 (0.54782) | 2.425528 (1.45028) | 5.765353 (1.77084) | 0.384724 (0.65708) | 87.01756 (2.53768) | 4.392771 (1.72221) |
| 6 | 40.40626 | 3.06E-06 (0.41198) | 3.42E-06 (0.23001) | 0.024881 (0.63610) | 2.403645 (1.43914) | 6.346485 (1.94566) | 0.399874 (0.56175) | 86.33658 (2.60833) | 4.488532 (1.70864) |
| 7 | 40.54894 | 3.04E-06 | 3.46E-06 | 0.045290 | 2.389017 | 6.761427 | 0.407230 | 85.80664 | 4.590386 |

| | | | | | | | | | |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | (0.40878) | (0.22841) | (0.80870) | (1.42840) | (2.06073) | (0.66661) | (2.64993) | (1.70704) |
| 8 | 40.66779 | 3.02E-06 | 3.48E-06 | 0.079951 | 2.376365 | 7.056445 | 0.409650 | 85.37778 | 4.699806 |
| | | (0.40564) | (0.22702) | (1.12018) | (1.41797) | (2.16733) | (0.66954) | (2.71117) | (1.71584) |
| 9 | 40.76721 | 3.01E-06 | 3.51E-06 | 0.135933 | 2.365561 | 7.270288 | 0.409611 | 85.01416 | 4.804442 |
| | | (0.40228) | (0.22573) | (1.62777) | (1.40796) | (2.25373) | (0.67105) | (2.82071) | (1.73285) |
| 0 | 40.85724 | 2.99E-06 | 3.53E-06 | 0.223081 | 2.355963 | 7.420913 | 0.408268 | 84.68348 | 4.908284 |
| | | (0.39843) | (0.22448) | (2.39950) | (1.39778) | (2.32811) | (0.67120) | (3.06376) | (1.75871) |
| 1 | 40.94401 | 2.99E-06 | 3.56E-06 | 0.355938 | 2.346722 | 7.524426 | 0.406546 | 84.35948 | 5.006883 |
| | | (0.39379) | (0.22318) | (3.51274) | (1.38744) | (2.39302) | (0.67113) | (3.56796) | (1.79401) |
| 2 | 41.03506 | 2.98E-06 | 3.58E-06 | 0.555553 | 2.337190 | 7.589724 | 0.404924 | 84.01334 | 5.099260 |
| | | (0.38805) | (0.22185) | (5.04926) | (1.37711) | (2.45336) | (0.67289) | (4.47027) | (1.84065) |

| iod | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 3.142557 | 5.74E-06 | 3.85E-08 | 0.024805 | 0.006672 | 3.880559 | 0.035401 | 0.141480 | 95.91108 |
| | | (0.24650) | (0.21430) | (0.25411) | (0.45810) | (1.39100) | (0.28078) | (0.41173) | (1.57021) |
| 2 | 4.424613 | 5.38E-06 | 9.50E-08 | 0.138703 | 0.143292 | 5.284308 | 0.221116 | 3.337278 | 90.87530 |
| | | (0.24832) | (0.19727) | (0.51259) | (0.72575) | (1.92738) | (0.56024) | (1.48042) | (2.40526) |
| 3 | 5.266505 | 5.00E-06 | 2.33E-07 | 0.215919 | 0.212574 | 6.519556 | 0.409898 | 4.282159 | 88.35989 |
| | | (0.25041) | (0.19279) | (0.82339) | (0.97493) | (2.39032) | (0.83968) | (1.90505) | (3.17057) |
| 4 | 5.979304 | 4.74E-06 | 3.43E-07 | 0.269729 | 0.201768 | 7.670554 | 0.506214 | 5.264416 | 86.08731 |
| | | (0.25364) | (0.18982) | (1.09271) | (1.11500) | (2.88911) | (0.97503) | (2.28459) | (3.89780) |
| 5 | 6.581409 | 4.49E-06 | 4.56E-07 | 0.327188 | 0.200881 | 8.803888 | 0.574599 | 5.857402 | 84.23604 |
| | | (0.25603) | (0.18783) | (1.40511) | (1.23524) | (3.40889) | (1.06228) | (2.52668) | (4.57306) |
| 6 | 7.113169 | 4.27E-06 | 5.66E-07 | 0.397548 | 0.190355 | 9.834816 | 0.615384 | 6.321838 | 82.64006 |
| | | (0.25849) | (0.18669) | (1.80160) | (1.31093) | (3.89346) | (1.11328) | (2.70275) | (5.20020) |
| 7 | 7.586222 | 4.07E-06 | 6.74E-07 | 0.490871 | 0.180639 | 10.76180 | 0.638971 | 6.679286 | 81.24843 |
| | | (0.26085) | (0.18622) | (2.33391) | (1.36586) | (4.33900) | (1.14825) | (2.83291) | (5.80603) |
| 8 | 8.011596 | 3.88E-06 | 7.82E-07 | 0.618079 | 0.170563 | 11.57768 | 0.648747 | 6.960572 | 80.02436 |
| | | (0.26325) | (0.18636) | (3.06229) | (1.40269) | (4.73237) | (1.17251) | (2.93330) | (6.41375) |
| 9 | 8.397249 | 3.69E-06 | 8.91E-07 | 0.793936 | 0.160915 | 12.28173 | 0.647912 | 7.184358 | 78.93114 |
| | | (0.26558) | (0.18705) | (4.06379) | (1.42539) | (5.06839) | (1.19057) | (3.01158) | (7.06470) |
| 0 | 8.749625 | 3.52E-06 | 1.01E-06 | 1.038994 | 0.151749 | 12.87652 | 0.638954 | 7.359459 | 77.93432 |
| | | (0.26763) | (0.18833) | (5.42243) | (1.43509) | (5.34545) | (1.20498) | (3.07355) | (7.82133) |
| 1 | 9.074703 | 3.34E-06 | 1.13E-06 | 1.382066 | 0.143072 | 13.36314 | 0.623894 | 7.492338 | 76.99548 |
| | | (0.26901) | (0.19046) | (7.20838) | (1.43175) | (5.56655) | (1.21780) | (3.12390) | (8.76291) |
| 2 | 9.378312 | 3.17E-06 | 1.27E-06 | 1.863630 | 0.134888 | 13.74167 | 0.604421 | 7.585385 | 76.07000 |
| | | (0.26925) | (0.19401) | (9.44702) | (1.41473) | (5.74103) | (1.23113) | (3.16649) | (9.96174) |

Appendix 4: Variance Decomposition for SADC

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1 | 17.61235 | 100.0000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 2 | 24.32709 | 92.47555 (2.00968) | 4.594049 (1.51603) | 0.952174 (0.80782) | 0.364928 (0.46646) | 7.70E-11 (0.25262) | 0.096404 (0.33199) | 0.026323 (0.14975) | 1.490572 (1.05461) |
| 3 | 28.72728 | 90.53576 (2.62216) | 5.694153 (1.93804) | 1.673807 (1.20818) | 0.337493 (0.49519) | 0.038155 (0.49726) | 0.221398 (0.54403) | 0.057397 (0.31857) | 1.441841 (1.24594) |
| 4 | 32.01493 | 90.22568 (2.90549) | 5.888405 (2.14767) | 1.983647 (1.43597) | 0.272611 (0.51699) | 0.045294 (0.74996) | 0.299782 (0.66596) | 0.059405 (0.50443) | 1.225171 (1.34165) |
| 5 | 34.59566 | 90.27996 (3.12025) | 5.857985 (2.28824) | 2.109227 (1.60462) | 0.247186 (0.60575) | 0.040237 (0.99694) | 0.363335 (0.75773) | 0.052834 (0.66456) | 1.049239 (1.39200) |
| 6 | 36.68977 | 90.36143 (3.40181) | 5.739690 (2.38792) | 2.145840 (1.74565) | 0.252999 (0.75409) | 0.059436 (1.28867) | 0.423232 (0.83847) | 0.047664 (0.79350) | 0.969707 (1.53283) |
| 7 | 38.43629 | 90.35148 (3.84904) | 5.585254 (2.45801) | 2.133681 (1.87351) | 0.273241 (0.91613) | 0.113402 (1.63018) | 0.484059 (0.92138) | 0.050715 (0.90117) | 1.008169 (1.86007) |
| 8 | 39.92976 | 90.20471 (4.49023) | 5.419224 (2.50591) | 2.092913 (1.99707) | 0.298725 (1.06127) | 0.201247 (1.99687) | 0.547977 (1.01236) | 0.065592 (0.99536) | 1.169612 (2.39289) |
| 9 | 41.23497 | 89.90106 (5.29626) | 5.253735 (2.53659) | 2.035322 (2.12961) | 0.324702 (1.18056) | 0.320583 (2.36774) | 0.616258 (1.11569) | 0.093279 (1.08250) | 1.455065 (3.07668) |
| 10 | 42.39857 | 89.43738 (6.21429) | 5.093844 (2.55344) | 1.968074 (2.29060) | 0.349792 (1.27402) | 0.468164 (2.72412) | 0.689686 (1.23400) | 0.133646 (1.16628) | 1.859410 (3.85588) |
| 11 | 43.45529 | 88.81706 (7.19579) | 4.941289 (2.55891) | 1.896080 (2.50722) | 0.373539 (1.34479) | 0.641522 (3.05544) | 0.768749 (1.36957) | 0.185774 (1.24860) | 2.375987 (4.68645) |
| 12 | 44.43151 | 88.04814 (8.20467) | 4.796236 (2.55443) | 1.823095 (2.81269) | 0.396037 (1.39678) | 0.838277 (3.35622) | 0.853804 (1.52397) | 0.248536 (1.32985) | 2.995880 (5.53785) |
| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |

| | | | | | | | | | |
|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1 | 11.99031 | 92.95001 (0.70529) | 7.049993 (0.70529) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 2 | 15.45201 | 93.16556 (1.69805) | 4.554662 (0.62809) | 0.503143 (0.63648) | 0.402286 (0.55002) | 0.002261 (0.29207) | 0.035989 (0.29572) | 0.005649 (0.14592) | 1.330445 (1.12337) |
| 3 | 17.77464 | 93.51904 (2.02450) | 3.625646 (0.65901) | 0.987232 (0.95264) | 0.396230 (0.58198) | 0.003047 (0.47293) | 0.121927 (0.45873) | 0.014047 (0.26333) | 1.332828 (1.28421) |
| 4 | 19.50479 | 93.88166 (2.27317) | 3.143760 (0.73367) | 1.224235 (1.14357) | 0.345409 (0.65464) | 0.005237 (0.75426) | 0.184315 (0.56817) | 0.013087 (0.42818) | 1.202301 (1.42392) |
| 5 | 20.84836 | 94.17473 (2.53000) | 2.863717 (0.81772) | 1.341019 (1.28368) | 0.302412 (0.72688) | 0.007699 (1.05989) | 0.242480 (0.66025) | 0.011543 (0.57772) | 1.056400 (1.52962) |
| 6 | 21.92589 | 94.33757 (2.91342) | 2.684262 (0.90546) | 1.393664 (1.40221) | 0.280313 (0.81754) | 0.024312 (1.40148) | 0.301362 (0.74739) | 0.014008 (0.70592) | 0.964505 (1.68394) |
| 7 | 22.81142 | 94.35909 (3.47760) | 2.559614 (0.98947) | 1.408406 (1.51373) | 0.273528 (0.91889) | 0.061904 (1.77205) | 0.363779 (0.83976) | 0.023145 (0.81616) | 0.950531 (1.95598) |
| 8 | 23.55730 | 94.24077 (4.21315) | 2.466473 (1.06548) | 1.398772 (1.62903) | 0.276930 (1.01750) | 0.121131 (2.14616) | 0.431144 (0.94195) | 0.040886 (0.91326) | 1.023895 (2.38629) |
| 9 | 24.19936 | 93.98211 (5.07577) | 2.392940 (1.13180) | 1.373548 (1.76449) | 0.286140 (1.10462) | 0.202563 (2.50860) | 0.504394 (1.05732) | 0.067610 (1.00189) | 1.190696 (2.95479) |
| 0 | 24.76374 | 93.58676 (6.01825) | 2.331914 (1.18780) | 1.338529 (1.94366) | 0.299014 (1.17768) | 0.305387 (2.84580) | 0.584244 (1.18761) | 0.103418 (1.08476) | 1.450732 (3.62503) |
| 1 | 25.26989 | 93.05824 (7.00327) | 2.279025 (1.23396) | 1.298085 (2.19606) | 0.314052 (1.23639) | 0.429091 (3.15129) | 0.671211 (1.33430) | 0.147889 (1.16369) | 1.802406 (4.35851) |
| 2 | 25.73265 | 92.40167 (8.00645) | 2.231464 (1.27071) | 1.255829 (2.55305) | 0.330485 (1.28217) | 0.572763 (3.42226) | 0.765743 (1.49819) | 0.200525 (1.23929) | 2.241520 (5.12588) |

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1 | 2.80E+11 | 0.179118 (0.51976) | 0.049147 (0.30283) | 99.77174 (0.61279) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 2 | 4.38E+11 | 0.180146 (0.72065) | 0.071627 (0.68319) | 99.67865 (1.08769) | 0.009896 (0.13387) | 0.008211 (0.20508) | 0.051412 (0.17972) | 1.50E-05 (0.11567) | 4.71E-05 (0.16258) |
| 3 | 5.78E+11 | 0.137465 (0.81883) | 0.135445 (0.92009) | 99.59433 (1.43013) | 0.016867 (0.19455) | 0.031533 (0.44123) | 0.080417 (0.26053) | 0.000490 (0.16516) | 0.003453 (0.24603) |
| 4 | 7.16E+11 | 0.101266 (0.86101) | 0.186150 (1.04320) | 99.52098 (1.66806) | 0.030662 (0.28730) | 0.052312 (0.63033) | 0.092874 (0.30216) | 0.000319 (0.25177) | 0.015440 (0.37583) |
| 5 | 8.59E+11 | 0.075243 (0.90220) | 0.224666 (1.11217) | 99.43784 (1.90259) | 0.044412 (0.38668) | 0.078132 (0.77651) | 0.097281 (0.33124) | 0.000355 (0.33584) | 0.042074 (0.57389) |
| 6 | 1.01E+12 | 0.056533 | 0.256173 | 99.34995 | 0.057100 | 0.104429 | 0.097803 | 0.000845 | 0.077168 |

| | | | | | | | | | |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | (0.95769) | (1.16191) | (2.17350) | (0.47661) | (0.90639) | (0.35711) | (0.41560) | (0.81960) |
| 7 | 1.17E+12 | 0.042902 | 0.281887 | 99.25772 | 0.067498 | 0.131434 | 0.096239 | 0.001728 | 0.120590 |
| | | (1.02892) | (1.20207) | (2.48689) | (0.55363) | (1.03270) | (0.38301) | (0.48772) | (1.10430) |
| 8 | 1.35E+12 | 0.032874 | 0.302766 | 99.16421 | 0.076150 | 0.158185 | 0.093450 | 0.002973 | 0.169389 |
| | | (1.11252) | (1.23591) | (2.83853) | (0.61785) | (1.15807) | (0.41046) | (0.55286) | (1.41713) |
| 9 | 1.55E+12 | 0.025406 | 0.319631 | 99.07062 | 0.083184 | 0.184639 | 0.089905 | 0.004477 | 0.222141 |
| | | (1.20371) | (1.26498) | (3.21957) | (0.67111) | (1.28203) | (0.43998) | (0.61140) | (1.74874) |
| 0 | 1.76E+12 | 0.019788 | 0.333172 | 98.97842 | 0.088952 | 0.210510 | 0.085899 | 0.006169 | 0.277089 |
| | | (1.29809) | (1.29007) | (3.62027) | (0.71524) | (1.40300) | (0.47178) | (0.66421) | (2.09106) |
| 1 | 2.00E+12 | 0.015526 | 0.343973 | 98.88859 | 0.093653 | 0.235656 | 0.081628 | 0.007974 | 0.332996 |
| | | (1.39211) | (1.31174) | (4.03136) | (0.75194) | (1.51958) | (0.50583) | (0.71196) | (2.43718) |
| 2 | 2.27E+12 | 0.012275 | 0.352532 | 98.80199 | 0.097487 | 0.259897 | 0.077229 | 0.009838 | 0.388753 |
| | | (1.48322) | (1.33039) | (4.44482) | (0.78254) | (1.63057) | (0.54197) | (0.75529) | (2.78150) |

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | 4.431887 | 0.408297 | 0.005381 | 0.185772 | 99.40055 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| | | (0.68578) | (0.34290) | (0.57064) | (0.98002) | (0.00000) | (0.00000) | (0.00000) | (0.00000) |
| 2 | 4.675664 | 0.369573 | 0.676969 | 0.197793 | 97.53023 | 0.267350 | 0.229098 | 0.692178 | 0.036804 |
| | | (0.82502) | (1.10543) | (0.76549) | (1.80347) | (0.46711) | (0.49627) | (0.77022) | (0.43970) |
| 3 | 4.851653 | 0.370909 | 0.782716 | 0.204306 | 97.02616 | 0.266150 | 0.260034 | 1.015551 | 0.074170 |
| | | (0.83124) | (1.17516) | (0.88199) | (1.99815) | (0.51271) | (0.52177) | (0.91308) | (0.44821) |
| 4 | 4.899562 | 0.372323 | 0.933605 | 0.200388 | 96.37991 | 0.402756 | 0.287598 | 1.298075 | 0.125347 |
| | | (0.88064) | (1.29539) | (0.93139) | (2.33450) | (0.66504) | (0.55874) | (1.19333) | (0.68462) |
| 5 | 4.932421 | 0.385930 | 0.995984 | 0.200284 | 95.72810 | 0.708657 | 0.296330 | 1.423116 | 0.261603 |
| | | (0.94901) | (1.33372) | (0.96314) | (2.78701) | (0.97871) | (0.56180) | (1.34962) | (1.05237) |
| 6 | 4.955480 | 0.408809 | 1.029154 | 0.209075 | 95.04799 | 1.064374 | 0.300912 | 1.472859 | 0.466828 |
| | | (1.03421) | (1.35577) | (0.99586) | (3.37506) | (1.30781) | (0.56409) | (1.42563) | (1.54976) |
| 7 | 4.976961 | 0.446189 | 1.040624 | 0.225537 | 94.33482 | 1.420005 | 0.302302 | 1.478892 | 0.751633 |
| | | (1.13320) | (1.35880) | (1.04565) | (4.03552) | (1.61261) | (0.56707) | (1.44844) | (2.08517) |
| 8 | 4.997951 | 0.497067 | 1.042541 | 0.249859 | 93.59258 | 1.743531 | 0.302328 | 1.469187 | 1.102911 |
| | | (1.24058) | (1.35186) | (1.12716) | (4.75182) | (1.87195) | (0.57426) | (1.44023) | (2.66868) |
| 9 | 5.019447 | 0.560392 | 1.039246 | 0.282150 | 92.81738 | 2.031081 | 0.301419 | 1.456821 | 1.511514 |
| | | (1.35157) | (1.33771) | (1.25255) | (5.50101) | (2.09422) | (0.58673) | (1.41605) | (3.26646) |
| 0 | 5.041731 | 0.633328 | 1.033332 | 0.323765 | 92.01018 | 2.286066 | 0.299909 | 1.447869 | 1.965552 |
| | | (1.46425) | (1.31928) | (1.43505) | (6.27428) | (2.28435) | (0.60548) | (1.38441) | (3.87539) |
| 1 | 5.064989 | 0.713201 | 1.025932 | 0.376731 | 91.17199 | 2.514904 | 0.297946 | 1.444374 | 2.454925 |
| | | (1.57634) | (1.29787) | (1.68610) | (7.06327) | (2.45137) | (0.63131) | (1.35136) | (4.48399) |

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|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 2 | 5.089301 | 0.797498 (1.68728) | 1.017645 (1.27453) | 0.443898 (2.01715) | 90.30459 (7.86369) | 2.723464 (2.59978) | 0.295634 (0.66512) | 1.446462 (1.32055) | 2.970812 (5.08822) |
|---|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|-----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 1 | 1604.810 | 0.249200 (0.83363) | 0.000703 (0.25598) | 0.010325 (0.44067) | 0.781874 (0.76349) | 98.95790 (1.18958) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 2 | 1758.430 | 1.313132 (1.36849) | 0.166252 (0.68865) | 0.056009 (0.60416) | 4.913747 (2.13743) | 82.42349 (3.11932) | 0.000543 (0.36394) | 0.022652 (0.29783) | 11.10418 (2.55851) |
| 3 | 1787.825 | 1.321846 (1.30271) | 0.231680 (0.68878) | 0.072146 (0.58291) | 7.628943 (2.46680) | 79.74621 (3.12500) | 0.010622 (0.36949) | 0.091362 (0.39856) | 10.89719 (2.46628) |
| 4 | 1815.407 | 1.285121 (1.26565) | 0.225214 (0.68384) | 0.082227 (0.57662) | 8.287116 (2.67037) | 77.71462 (3.26383) | 0.019034 (0.36462) | 0.131609 (0.41924) | 12.25506 (2.78117) |
| 5 | 1832.519 | 1.263854 (1.25266) | 0.227222 (0.67482) | 0.083451 (0.58118) | 8.743697 (2.77360) | 76.50686 (3.45857) | 0.027944 (0.36334) | 0.256364 (0.50843) | 12.89061 (2.98943) |
| 6 | 1847.251 | 1.245791 (1.24652) | 0.228980 (0.67196) | 0.088666 (0.59452) | 8.763845 (2.82110) | 75.56449 (3.66853) | 0.036969 (0.36462) | 0.353844 (0.55521) | 13.71741 (3.32332) |
| 7 | 1858.917 | 1.237193 (1.24286) | 0.231027 (0.66917) | 0.098586 (0.62403) | 8.737437 (2.84187) | 74.81317 (3.89359) | 0.044644 (0.36642) | 0.454520 (0.61582) | 14.38342 (3.63873) |
| 8 | 1869.705 | 1.233100 (1.24273) | 0.232042 (0.66712) | 0.116222 (0.67290) | 8.664853 (2.85300) | 74.12933 (4.14308) | 0.052561 (0.37081) | 0.533965 (0.66311) | 15.03793 (3.99674) |
| 9 | 1879.458 | 1.234788 (1.24515) | 0.232272 (0.66498) | 0.141986 (0.74958) | 8.590608 (2.86013) | 73.51575 (4.40700) | 0.060963 (0.37736) | 0.602256 (0.71045) | 15.62138 (4.34978) |
| 0 | 1888.762 | 1.240557 (1.25068) | 0.231945 (0.66276) | 0.177678 (0.86226) | 8.513753 (2.86669) | 72.94063 (4.69040) | 0.070490 (0.38735) | 0.657963 (0.75316) | 16.16699 (4.71548) |
| 1 | 1897.642 | 1.250525 (1.25930) | 0.231301 (0.66060) | 0.224746 (1.02095) | 8.439075 (2.87324) | 72.40045 (4.98923) | 0.081469 (0.40080) | 0.705255 (0.79433) | 16.66718 (5.07934) |
| 2 | 1906.295 | 1.264194 (1.27124) | 0.230486 (0.65869) | 0.285628 (1.23513) | 8.365605 (2.88032) | 71.88255 (5.30600) | 0.094291 (0.41863) | 0.745389 (0.83330) | 17.13186 (5.44470) |

| Period | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|--------|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1 | 54.19170 | 1.730954 (1.49536) | 0.119992 (0.44176) | 0.060078 (0.26701) | 0.175594 (0.63400) | 0.124928 (0.51650) | 97.78845 (1.75948) | 0.000000 (0.00000) | 0.000000 (0.00000) |

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|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 2 | 81.72792 | 3.528034 | 0.057455 | 0.049772 | 0.157881 | 0.496675 | 95.47443 | 0.128608 | 0.107144 |
| | | (2.22659) | (0.44932) | (0.48274) | (0.66532) | (0.97004) | (2.45911) | (0.22996) | (0.29026) |
| 3 | 104.2829 | 4.000269 | 0.068389 | 0.097716 | 0.231413 | 0.852031 | 94.38163 | 0.166709 | 0.201848 |
| | | (2.62549) | (0.55581) | (0.69046) | (0.66914) | (1.54639) | (3.17762) | (0.21739) | (0.44936) |
| 4 | 124.8289 | 4.062461 | 0.080816 | 0.121199 | 0.290199 | 1.182861 | 93.51076 | 0.302588 | 0.449120 |
| | | (2.83770) | (0.62263) | (0.82998) | (0.84897) | (2.04150) | (3.85980) | (0.46707) | (0.80224) |
| 5 | 144.3161 | 3.968468 | 0.079821 | 0.125982 | 0.373539 | 1.233967 | 93.06324 | 0.543797 | 0.611186 |
| | | (2.97080) | (0.65266) | (0.93664) | (1.04819) | (2.31753) | (4.43667) | (0.79531) | (1.20499) |
| 6 | 163.4122 | 3.809537 | 0.073936 | 0.117842 | 0.446832 | 1.207889 | 92.74966 | 0.786572 | 0.807736 |
| | | (3.06717) | (0.66509) | (1.03215) | (1.21811) | (2.51916) | (5.02563) | (1.10113) | (1.71151) |
| 7 | 182.4343 | 3.623104 | 0.065530 | 0.104745 | 0.533488 | 1.135750 | 92.53575 | 1.025976 | 0.975656 |
| | | (3.13675) | (0.66768) | (1.13608) | (1.36925) | (2.67271) | (5.61779) | (1.38278) | (2.24098) |
| 8 | 201.6395 | 3.434848 | 0.056710 | 0.090151 | 0.623469 | 1.057651 | 92.35889 | 1.242027 | 1.136260 |
| | | (3.19193) | (0.66554) | (1.26215) | (1.50297) | (2.80962) | (6.23432) | (1.63004) | (2.79719) |
| 9 | 221.2000 | 3.252410 | 0.048525 | 0.076260 | 0.718643 | 0.982042 | 92.20661 | 1.436085 | 1.279421 |
| | | (3.23587) | (0.66175) | (1.42204) | (1.62427) | (2.93761) | (6.86397) | (1.84771) | (3.35543) |
| 0 | 241.2571 | 3.080369 | 0.041366 | 0.064201 | 0.813118 | 0.914622 | 92.06876 | 1.607252 | 1.410311 |
| | | (3.27251) | (0.65833) | (1.62336) | (1.73349) | (3.06295) | (7.50453) | (2.03697) | (3.91209) |
| 1 | 261.9284 | 2.919635 | 0.035291 | 0.054707 | 0.904850 | 0.855803 | 91.94286 | 1.758267 | 1.528585 |
| | | (3.30365) | (0.65644) | (1.87114) | (1.83188) | (3.18638) | (8.14919) | (2.20166) | (4.45902) |
| 2 | 283.3195 | 2.770348 | 0.030209 | 0.048336 | 0.991187 | 0.805411 | 91.82686 | 1.891174 | 1.636478 |
| | | (3.33105) | (0.65671) | (2.16807) | (1.91974) | (3.30850) | (8.79463) | (2.34424) | (4.99370) |

| iod | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 335.7665 | 0.114717 | 0.402500 | 0.000616 | 0.331500 | 0.657772 | 0.318232 | 98.17466 | 0.000000 |
| | | (0.52712) | (0.77860) | (0.36090) | (0.75124) | (0.72371) | (0.65002) | (1.55501) | (0.00000) |
| 2 | 369.7686 | 0.120629 | 0.665834 | 0.002945 | 0.301668 | 6.790523 | 0.323402 | 89.25023 | 2.544771 |
| | | (0.75315) | (1.02003) | (0.45814) | (0.71966) | (2.71259) | (0.69934) | (3.13418) | (1.45319) |
| 3 | 416.7768 | 0.144309 | 0.550272 | 0.002738 | 0.340238 | 18.84898 | 0.318831 | 77.52778 | 2.266852 |
| | | (0.65980) | (0.88892) | (0.47187) | (0.73083) | (4.44796) | (0.64357) | (4.55864) | (1.11475) |
| 4 | 434.2808 | 0.136156 | 0.523511 | 0.010137 | 0.796023 | 23.34344 | 0.321104 | 72.77980 | 2.089824 |
| | | (0.72029) | (0.79555) | (0.55052) | (0.99254) | (5.13147) | (0.65311) | (5.12875) | (1.05519) |
| 5 | 450.8389 | 0.157691 | 0.539886 | 0.009735 | 1.515706 | 26.57356 | 0.326001 | 68.24647 | 2.630949 |
| | | (0.84342) | (0.75119) | (0.61521) | (1.33179) | (5.50538) | (0.65077) | (5.68712) | (1.26459) |
| 6 | 460.7360 | 0.274432 | 0.576738 | 0.010157 | 2.047368 | 28.13914 | 0.337397 | 65.49438 | 3.120384 |
| | | (1.07573) | (0.75718) | (0.71021) | (1.63677) | (5.67277) | (0.67040) | (6.08910) | (1.71523) |
| 7 | 469.9019 | 0.429291 | 0.602811 | 0.018305 | 2.473828 | 29.03266 | 0.348090 | 63.00690 | 4.088118 |

| | | | | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | (1.33191) | (0.77268) | (0.82802) | (1.87062) | (5.76091) | (0.68580) | (6.58304) | (2.48406) |
| 477.4429 | 0.630167 | 0.621242 | 0.035291 | 2.686972 | 29.49405 | 0.359187 | 61.03326 | 5.139833 |
| | (1.60703) | (0.79354) | (0.99680) | (2.02840) | (5.78748) | (0.71086) | (7.08010) | (3.33313) |
| 484.7130 | 0.843374 | 0.629523 | 0.063204 | 2.784198 | 29.71321 | 0.368317 | 59.22050 | 6.377672 |
| | (1.86724) | (0.81002) | (1.22243) | (2.12693) | (5.77240) | (0.73868) | (7.60831) | (4.25609) |
| 491.6242 | 1.064224 | 0.630957 | 0.101536 | 2.794853 | 29.77637 | 0.376145 | 57.58887 | 7.667043 |
| | (2.11035) | (0.82305) | (1.51731) | (2.18043) | (5.73265) | (0.77546) | (8.13179) | (5.18435) |
| 498.4863 | 1.281624 | 0.627107 | 0.151496 | 2.762053 | 29.73465 | 0.382408 | 56.05456 | 9.006097 |
| | (2.32951) | (0.83197) | (1.88651) | (2.20324) | (5.68050) | (0.81905) | (8.64561) | (6.10215) |
| 505.2918 | 1.493145 | 0.619821 | 0.214109 | 2.706400 | 29.62003 | 0.387530 | 54.61328 | 10.34569 |
| | (2.52559) | (0.83779) | (2.33544) | (2.20499) | (5.62637) | (0.87145) | (9.13983) | (6.98874) |

| od | S.E. | OILP | COMP | NDC | GDPGR | INF | EXR | MSGR | MPR |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----|
| 31.78205 | 0.028214 | 0.516441 | 0.064725 | 2.202961 | 1.635349 | 0.106532 | 3.481246 | 91.96453 | |
| | (0.37165) | (0.77743) | (0.44250) | (1.40855) | (1.42624) | (0.49333) | (1.86418) | (2.86706) | |
| 47.69915 | 1.908528 | 0.861266 | 0.108148 | 5.754878 | 9.306128 | 0.076079 | 3.003732 | 78.98124 | |
| | (1.45781) | (1.04580) | (0.56102) | (2.51879) | (2.34234) | (0.56790) | (1.73060) | (3.95182) | |
| 55.83338 | 1.842625 | 0.658621 | 0.201209 | 5.259224 | 12.12827 | 0.064222 | 3.707821 | 76.13801 | |
| | (1.62282) | (0.95686) | (0.79766) | (2.51527) | (3.31541) | (0.64007) | (2.04973) | (4.73805) | |
| 63.68270 | 1.792335 | 0.571286 | 0.293378 | 4.486505 | 13.97303 | 0.060423 | 3.994757 | 74.82828 | |
| | (1.72007) | (0.96138) | (0.97898) | (2.46180) | (3.85903) | (0.67204) | (2.28763) | (5.13468) | |
| 70.15622 | 1.879723 | 0.519727 | 0.395758 | 3.891442 | 14.93649 | 0.057381 | 4.304471 | 74.01501 | |
| | (1.90857) | (0.98424) | (1.16499) | (2.38872) | (4.26222) | (0.71908) | (2.55144) | (5.44005) | |
| 76.00903 | 1.990895 | 0.473362 | 0.527135 | 3.399281 | 15.53453 | 0.055063 | 4.487112 | 73.53262 | |
| | (2.11032) | (0.99879) | (1.37632) | (2.31463) | (4.57571) | (0.76626) | (2.76455) | (5.67075) | |
| 81.27535 | 2.134754 | 0.434576 | 0.689607 | 3.024651 | 15.89877 | 0.053013 | 4.622649 | 73.14198 | |
| | (2.34230) | (1.01157) | (1.64040) | (2.26269) | (4.83481) | (0.81936) | (2.94907) | (5.88184) | |
| 86.14835 | 2.289408 | 0.400803 | 0.886733 | 2.725319 | 16.14347 | 0.050708 | 4.705818 | 72.79774 | |
| | (2.58989) | (1.02221) | (1.97728) | (2.22735) | (5.05437) | (0.87739) | (3.09878) | (6.08698) | |
| 90.69212 | 2.452727 | 0.371742 | 1.122384 | 2.484898 | 16.31071 | 0.048161 | 4.759474 | 72.44990 | |
| | (2.84956) | (1.03250) | (2.40558) | (2.20804) | (5.24096) | (0.94171) | (3.22238) | (6.30550) | |
| 94.98353 | 2.619233 | 0.346619 | 1.402797 | 2.286095 | 16.42693 | 0.045394 | 4.789182 | 72.08375 | |
| | (3.11217) | (1.04242) | (2.93969) | (2.19909) | (5.40034) | (1.01291) | (3.32251) | (6.55098) | |
| 99.06735 | 2.787119 | 0.324898 | 1.735795 | 2.118969 | 16.50239 | 0.042528 | 4.802690 | 71.68560 | |
| | (3.37176) | (1.05235) | (3.59189) | (2.19699) | (5.53653) | (1.09195) | (3.40349) | (6.83859) | |
| 102.9862 | 2.954184 | 0.306060 | 2.131219 | 1.975610 | 16.54300 | 0.039681 | 4.803237 | 71.24701 | |
| | (3.62186) | (1.06206) | (4.37102) | (2.19846) | (5.65370) | (1.17970) | (3.46771) | (7.18290) | |

