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Exchange rate, inflation and macroeconomic performance in the West African Monetary Zone (WAMZ)

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**WEST AFRICAN
MONETARY INSTITUTE (WAMI)**

**INSTITUT MONETAIRE DE
L'AFRIQUE DE L'OUEST (IMAO)**



**WAMI OCCASIONAL PAPER SERIES
NO 2**

**EXCHANGE RATE, INFLATION AND
MACROECONOMIC PERFORMANCE IN THE
WEST AFRICAN MONETARY ZONE (WAMZ)**

**ACCRA, GHANA
JUNE, 2012**

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EXCHANGE RATE, INFLATION AND MACROECONOMIC PERFORMANCE IN THE WAMZ

Prepared by:

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June 2012

Abstract

The study investigates the effect of changes in the exchange rate on output growth and inflation in the WAMZ economies. It formulates an open-economy general equilibrium model which highlights the interrelationships among real GDP growth, inflation, exchange rate depreciation/ appreciation and money supply growth. Employing quarterly data series for the period 1981Q1 to 2010Q4 for all countries except Ghana (1983Q2 to 2010Q4) and Guinea (1989Q1 to 2010Q4), the study uses the vector autoregressive (VAR) model to estimate the impulse response functions and variance decompositions for inflation and output in order to determine how inflation and output respond to changes in the exchange rate, and what proportion of inflation and output variance can be explained by the exchange rate.

The results of the study suggest that exchange rate had significant impact on inflation in all the Member States. The results reveal a negative relationship between real exchange rate and real GDP growth for both Liberia and Sierra Leone, implying that depreciation of the real exchange rates in these countries could lead to output growth. However, the impact of exchange rates on output in The Gambia, Ghana, Guinea and Nigeria though positive, remained weak, which may be partly due to supply side factors as evident from the results. Overall, the key message of the study was that real exchange rate depreciation generates inflationary pressures and impact significantly on output growth. In addition, inflation and growth in the WAMZ are partly driven by structural factors. The policy implication arising from this study is that WAMZ Member States should continue to implement prudent fiscal and monetary policies to achieve and sustain price stability. Monetary, exchange rate and real sector policies should be well knitted to ensure macroeconomic stability. In this regard, Member States should implement sectoral and structural policies that promote food production in order to dampen inflationary pressures.

Key words: *Exchange rate, Inflation, Real GDP, VAR model, Impulse response, WAMZ countries, quarterly data.*

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1.0 INTRODUCTION

For many years economists and policy makers have been concerned with the effectiveness of exchange rate policy as shock absorbers. Following the collapse of the Bretton Woods system and the adoption of the Structural Adjustment Programme (SAP), the West African Monetary Zone (WAMZ) countries adopted the floating exchange rate system based on the argument that it would smooth domestic and international shocks and allow monetary policy independence. The floating exchange rate is expected to allow central banks to be able to make use of monetary policy with the sole goal of fighting inflation, and stabilise output. Recent depreciation of the WAMZ currencies have created fears of renewed inflation with implications for output growth. Thus, understanding the sources of fluctuations in output and inflation is important to policy makers in the WAMZ countries.

The WAMZ countries consider exchange rate as a key macroeconomic policy instrument that could significantly impact country's competitiveness as well as export promotion and economic growth. The currencies of most of the WAMZ countries have experienced series of depreciation in the past decades. Depreciation is believed to play a key role in eliminating market distortions thus correcting the price misalignment in these countries and making their products competitive in the international market, ultimately boosting exports and output growth. The Central Banks of the WAMZ countries have pursued exchange rate policies aimed at providing an environment that promotes exchange rate stability, with a view to maintaining price stability and promoting sustainable output growth. However, sharp currency depreciation in most of the countries causes increase in the general price levels and a reduction in output growth, due to the following reasons: (a) low import and export demand elasticities with respect to a change in the real exchange rate, (Marshall-Lerner condition does not hold), thereby resulting in a slow adjustment in their current accounts; (b) high cost of imports of intermediate and capital goods which raises

costs of production; (c) the existence of large external debt denominated in foreign currencies that increases in terms of domestic currency as a result of depreciation, reducing the economy's net wealth and leading to a reduction in expenditure; and (d) the increase in domestic price levels following a depreciation would cause a wage-price spiral which negatively affects output and reduces competitiveness (See Hanson, 1983; Gylfason and Risager, 1984).

The literature indicates that a depreciation of domestic currency makes the country's exports relatively cheaper while imports become more expensive for domestic consumers. This helps to increase the country's exports and switches demand towards domestically produced goods assuming the Marshall-Lerner condition is satisfied². In the short-run, a depreciation of the domestic currency will cause both output and price level to increase. However, in the long-run the price level will increase proportionately with no effect on the output level. Conversely, currency appreciation decreases net exports and the cost of production, by making export more expensive and imports become relatively cheaper for domestic consumers. However, studies have shown that while depreciation increases the general price level, it has a contractionary impact on output (See Kamin and Roger 2000). By increasing the general price level, depreciation lowers the international competitiveness of a country, thereby decreasing real income and reducing aggregate demand. In addition, depreciation increases the prices of imported intermediate goods and thereby adversely affecting production and output growth. The combined effects that occur through demand and supply channels determine the net results of exchange rate fluctuation on real output and price.

² *Marshall_Lerner condition states that depreciation/ devaluation will improve a countries trade balance if the sum of the elasticities of import and export is great than unity*

The aim of this study is to investigate the effect of changes in the exchange rate on output growth and inflation in the WAMZ economies. To achieve this objective, the study utilizes the vector autoregressive (VAR) model to estimate the impulse response functions and variance decompositions for inflation and output in order to determine how inflation and output respond to changes in the exchange rate, and what proportion of inflation and output variance can be explained by the exchange rate. Investigating the relation between exchange rate changes and economic activity is crucial in light of the debate of whether depreciation has expansionary or contractionary effects on the economy.

Following this introduction, the rest of the paper is organized as follows: section 2 consists of an overview of the linkage between the exchange rate, inflation and output growth from the theoretical aspects as well as empirical evidence. Section 3 provides an overview on exchange rate, inflation and output growth in the WAMZ. In section 4, a VAR model is specified in order to establish the link between exchange rate, inflation and output growth. The sources of data set used for the empirical analysis are also presented in this section. Section 5 presents the estimation techniques, and the empirical results, while section 6 presents the concluding remarks and policy implications.

2.0 BACKGROUND OF THE STUDY

This section discusses the behaviour of exchange rate, inflation and real GDP growth in the WAMZ countries. Specifically, it reviews the trends in exchange rate movements, inflation and real GDP growth.

Gambia

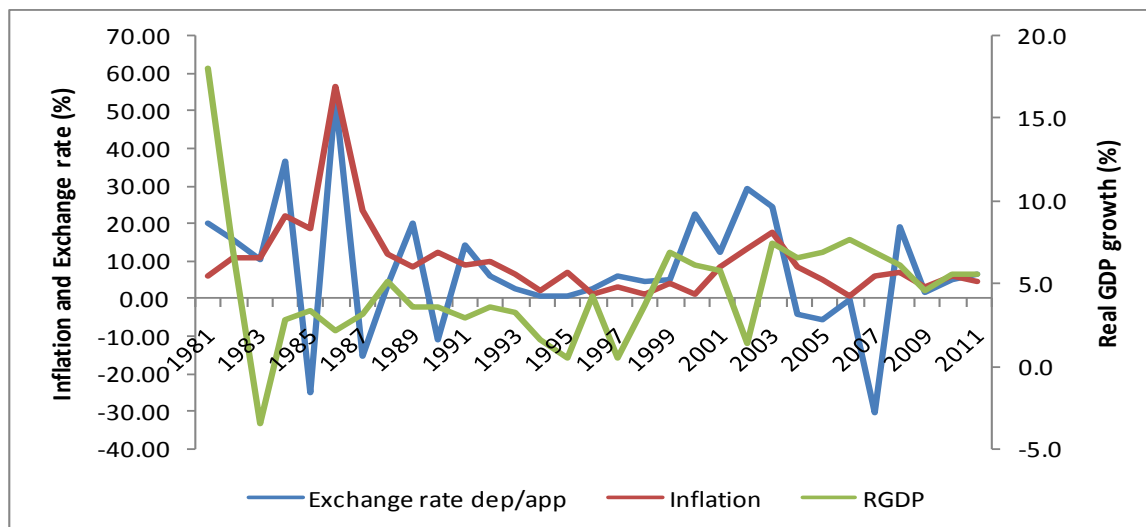
The Gambia operated a fixed exchange rate between 1965 and 1985, during which time the dalasi was pegged to the pound sterling. However, following the adoption of Structural Adjustment Programme, the government introduced an inter-bank floating exchange rate regime in 1986 which resulted in an immediate depreciation of 53.4 percent, followed by appreciation in 1987. In order to deepen the foreign exchange market, authorities permitted the establishment of foreign exchange bureaux in April 1990. The inter-bank foreign exchange market emerged, resulting in the lowering of the premium among the exchange rates prevailing in the two markets. Licensing of non-bank foreign exchange dealers and disbanding of parallel market operations in September 2003 provided additional market competition. Between 1992 and 1999, the dalasi remained relatively stable, following the implementation of the Economic Recovery Programme and the Programme for Sustained Development. However, the dalasi experienced series of depreciation during 2000 to 2003, and thereafter appreciated between 2004 and 2007. Since 2008, the dalasi had experienced a decline in the rate of depreciation as the dalasi strengthened against the US dollar.

Figure 2 shows a positive relationship between exchange rate movement and inflation in The

Gambia. The adoption of the floating exchange rate in 1986 and the significant depreciation of the dalasi resulted to a hike in price level as the rate of inflation accelerated to 56.6 percent. However, since 1990, the inflation rate decelerated from 12.2 percent in 1990 to 0.8 percent in 2000, and coincided with a relative stability in the external value of the dalasi. Between 2000 and 2003, inflationary pressure emerged as a result of the drought and depreciation of the dalasi. Since 2004, inflationary pressure in The Gambia was significantly contained with inflation declining to 5.0 percent in 2010 from 17.0 in 2005.

The introduction of the Structural Adjustment Programme (SAP) in 1986 aimed at reversing the economic down-turn of the early 1980s and setting the stage for a more stable macroeconomic environment resulted in real GDP increasing from 2.1 percent in 1986 to 3.1 percent in 1987. This coincided with an appreciation of the exchange rate. Although the dalasi remained relatively stable in the 1990s, real GDP declined from 3.6 percent in 1990 to 0.4 percent in 1997. The decline was partly due to slower growth in agricultural output and tourism as well as the military coup in 1994, which led to disruption in economic activities in the tourism sector and suspension of cooperation from donor countries. However, the growth in real GDP increased from 3.7 percent in 1998 to 9.2 percent in 2004. In addition, real GDP increased from negative 9.0 percent in 2005 to positive 6.1 percent in 2010, arising from improved agricultural output, increased tourist activities and relative stability in the exchange rate.

Figure 1: Exchange rate movement, real GDP and Inflation in The Gambia



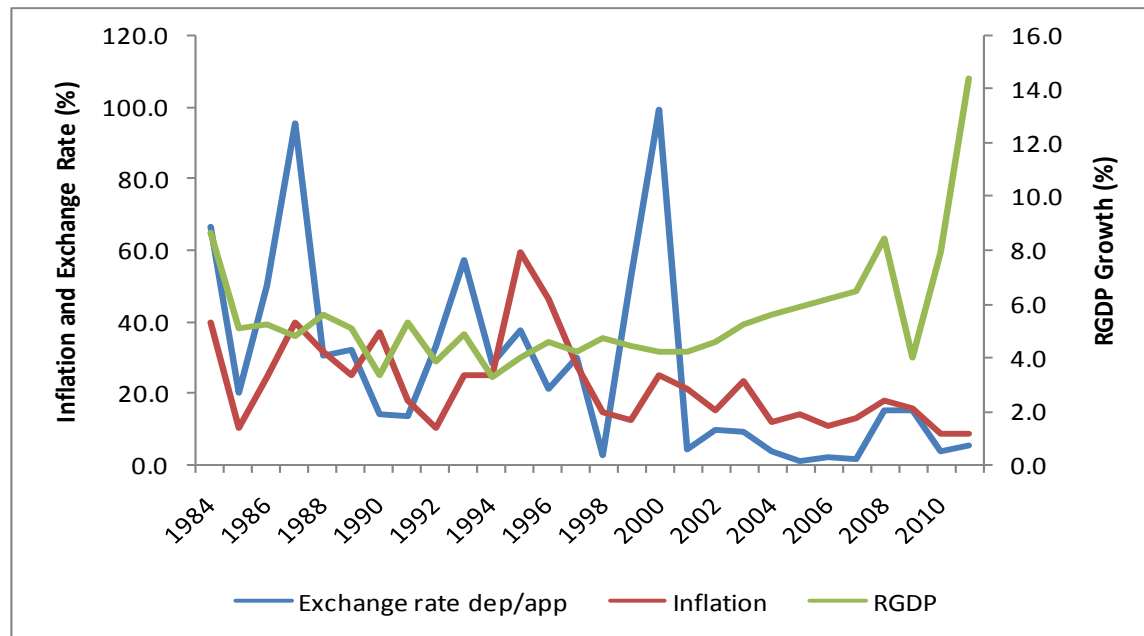
Sources: WAMZ data base and IFS year Book, 2011

Ghana

The Ghanaian adopted a fixed exchange rate regime in the management of its exchange rate between 1970 and 1985. During this period, the Ghanaian cedi was pegged to the main convertible currencies, notably the British pound and the American dollar, respectively. Beginning 1986, the country adopted a managed floating exchange rate, and in September of the same year, the government adopted an auction market approach in order to accelerate the adjustment of the exchange rate and to achieve the object of trade liberalization, leaving it partially to market forces (demand and supply) to determine the cedi-dollar rates. Following the adoption of a floating exchange rate in 1986, the cedi depreciated by 95.6 percent in 1987, but the depreciation rate of the cedi eased off between 1988 and 1991. In 1988, the foreign exchange bureaux system was established in an attempt to absorb the parallel market into the legal foreign

exchange market. These foreign exchange bureaux were fully licensed entities operated by individuals, groups or institutions. In March 1990, the country introduced the wholesale auction to replace the weekly retail auction, which resulted in the operation of a composite exchange rate system, namely the inter-bank and a wholesale system. However, the wholesale auction system was abolished in April 1992 and replaced by the inter-bank market. Since then, both the commercial banks and the Foreign exchange Bureau have operated in a competitive environment. As shown in Figure 3, the rate of depreciation which stood at 57.4 percent in 1993, decline to 2.3 percent in 1998, before attaining its highest value of 99.4 percent in 2000. Between 2001 and 2007, the rate of depreciation of the cedi slowed down, but the value of the cedi fell sharply between 2008 and 2009, partly due to the redenomination of the domestic currency.

Figure 2: Exchange rate movement, real GDP and Inflation in Ghana



Sources: WAMZ data base and IFS year Book, 2011

Figure 3, revealed a positive relationship between exchange rate depreciation and inflation for most of the review period. Following the depreciation of the cedi in 1987, the inflation rate increased to 39.8 percent from 24.6 percent in 1986, but gradually declined from 31.4 percent in 1988 to 18.0 percent in 1991. These periods also coincided with an increase in the external value of the cedi. The country also experienced deceleration in the inflation rate from 32.9 percent in 2001 to 10.7 percent in 2007. However, inflationary pressure re-emerged between 2008 and 2009, before decelerating to 10.7 percent in 2010.

Following the Economic Recovery Programme (ERP) by Ghana in the mid 1980s that sought to minimize both external and internal imbalances and place the economy on a path of sustainable growth, the economy grew by 5.2 percent between 1985 and 1989. Furthermore, between 1990 and 2008, real GDP growth remained positive, averaging above 4.0 percent. Increased government expenditure on infrastructure, as well as increased economic activities in the agriculture, services, and mining sectors, among

others, contributed to the positive growth rate during the period.

Guinea

Following the attainment of independence in 1958, Guinea implemented a fixed exchange rate regime and adopted its own currency, the Guinean Syli (GS), which was pegged to the (Special Drawing Right (SDR) on June 11, 1975 at the rate of GS 24.68 per SDR. The currency became increasingly overvalued, and, by mid-1985, its rate exceeded GS 280 per SDR in the parallel market. In 1986, the Syli was replaced by the Guinean franc (GF) at GF 300 per U.S. dollar in the official market and GF 340 per U.S. dollar in the second tier market, in which the exchange rate was set at weekly auction for foreign exchange organized by the central bank. Following this policy action, the Guinean franc depreciated by 46.6 percent in 1987, but the rate of depreciation declined gradually to 0.88 percent in 1994. In October 1994, the authorities adopted a flexible exchange rate regime and introduced an interbank market for foreign exchange. This led to series of depreciation

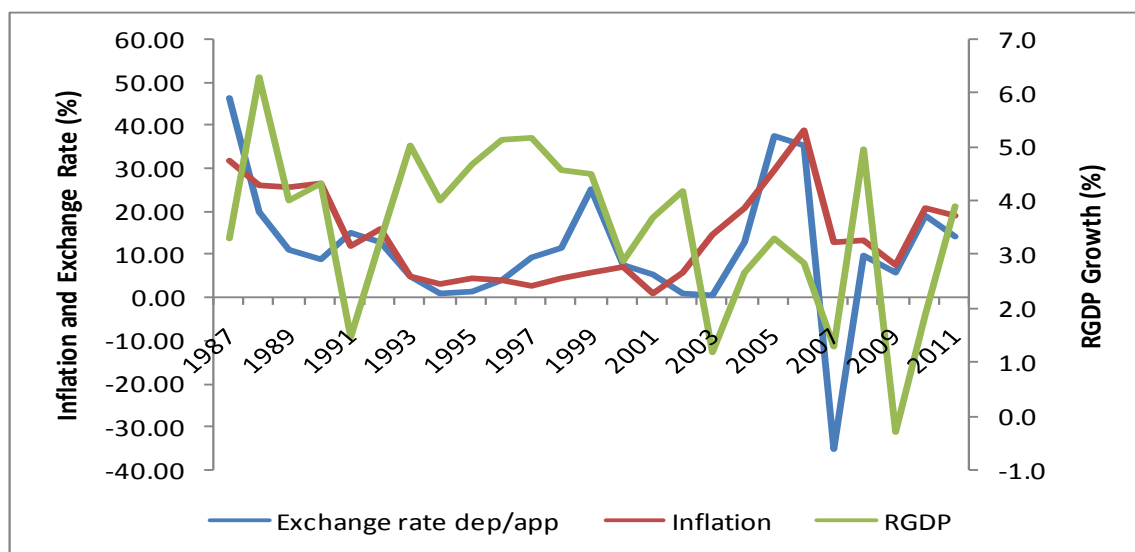
episodes of the Guinean franc were experienced between 1997 and 1999. Between late 2002 and mid-July 2004, the authorities pegged the official exchange rate against the U.S. dollar, which resulted to an appreciation of the domestic currency by 0.6 percent. The authorities increasingly used the auction mechanism as an administrative vehicle to allocate foreign exchange. However, in 2005, the central bank abandoned the official foreign exchange auction and liberalized the foreign exchange market, where the official exchange rate was determined weekly by a reference rate calculated as an arithmetic average of rates quoted by deposit banks and authorized foreign exchange bureaux. The currency experienced an average depreciation rate of 28.4 percent between 2004 and 2006, but appreciated in 2007 and 2009. In 2010, the currency also experienced a decline in its external value with a depreciation rate of 19.1 percent.

The relationship between inflation and exchange rate movement is presented in Figure 4. The figure indicates a positive relationship between exchange rate depreciation and inflation in

Guinea. Inflation in Guinea decelerated gradually from 31.8 percent in 1987 to 3.0 percent in 1997. However inflationary pressure re-emerged from 4.5 percent in 1998 to 7.2 percent in 2000, before declining to 1.1 percent in 2001. Between 2001 and 2006, the country experienced a surge in the price level from 1.1 percent to 39.1 percent during this period, but decelerated significantly to 12.9 percent in 2007 following the appreciation of the Guinean franc. In addition, the appreciation of the Guinean franc in 2009 partly resulted to a 7.9 percent decline in the inflation rate from 13.5 percent in 2008.

Despite the series of depreciation episodes, the Guinean economy maintained positive growth during the review period, with real GDP growth accelerating from 3.3 percent in 1987 to 4.3 percent in 1990. Real GDP growth also increased from 1.5 percent in 1991 to 4.5 percent during 1999, and the positive growth momentum was sustained between 2000 and 2008. However, the country experienced a negative output growth rate of 0.3 percent in 2009, which also correspond to an appreciation of the Guinean franc.

Figure 3: Exchange rate movement, real GDP and Inflation in Guinea



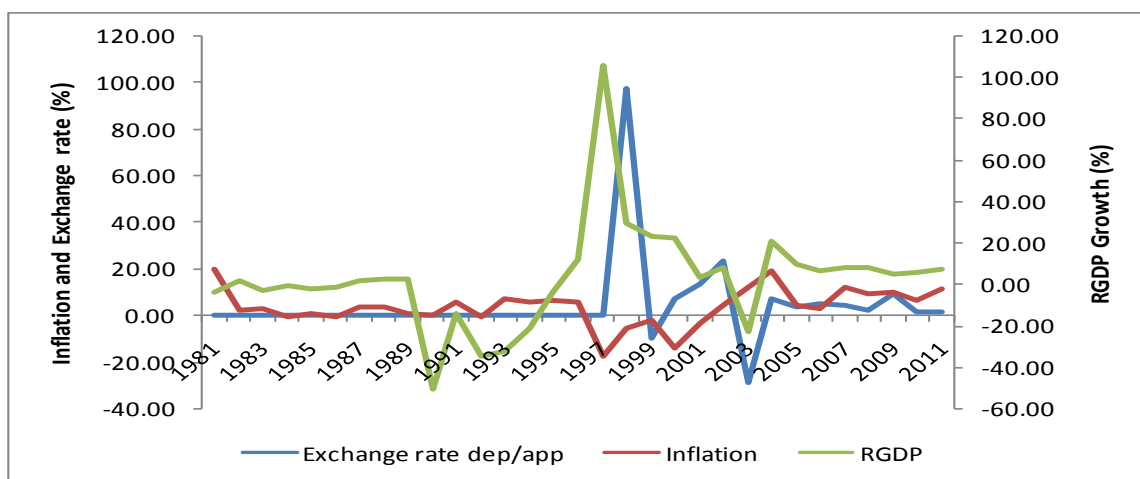
Sources: WAMZ data base and IFS year Book, 2011

Liberia

Liberia has a dual currency regime- the Liberian national currency (Liberian dollar) and the United States dollar. Liberia adopted a fixed exchange rate regime between 1981 and 1997, with the Liberian dollar pegged to the United States dollar at a fixed parity. Since 1998, the Liberian dollar has floated freely against other foreign currencies, especially the United States dollar. In 2000, the Central Bank of Liberia

adopted a managed float exchange rate regime. Following this transformation, the exchange rate which remained stable under the fixed exchange rate regime, witnessed a significant depreciation rate of 97.7 percent in 1998, but appreciates thereafter. The currency further depreciated from 7.6 percent in 2000 to 23.9 percent in 2002. The value of the domestic currency however remained relatively stable between 2005 and 2010.

Figure 4: Exchange rate movement, real GDP and Inflation in Liberia



Sources: WAMZ data base and IFS year Book, 2011

Figure 5 indicates a positive relationship between inflation and exchange rate movement. The Liberian economy witnessed low inflationary trend with inflation rate decelerating from 1.9 percent in 1982 to 0.6 percent in 1985. The disinflation continued in the mid-1980s, with a deceleration in the inflation rate from 3.2 percent in 1987 to 0.3 in 1988, and further to 0.2 percent in 1990. However, the country witnessed a general increase in the price level as the inflation rate surged from 3.8 percent in 2002 to 18.6 percent in 2004, but declined significantly to 0.6 percent in 2008 before plummeting to -0.2 percent.

The real GDP growth rate had been in the negative since 1980, improving from negative 3.8 percent in 1981 to negative 1.2 percent in 1986. The economy however bounced back with an increase in economic activity, resulting to

surge in real GDP growth rate from 1.8 percent in 1987 to 2.8 percent in 1989. Since the 1990s, economic activities declined significantly as the economy entered into recession by recording negative real GDP growth between 1990 and 1995. Following the end of the civil war in 1996, growth momentum emerged in 1996, with real GDP increasing from 12.1 percent to 22.4 percent in 2000. Growth declined to 2.9 percent in 2001 and increased marginally to 3.7 percent in 2002 before plummeting to -31.3 percent in 2003. Furthermore, real GDP growth increased from 2.6 percent in 2004 to 5.2 percent in 2010.

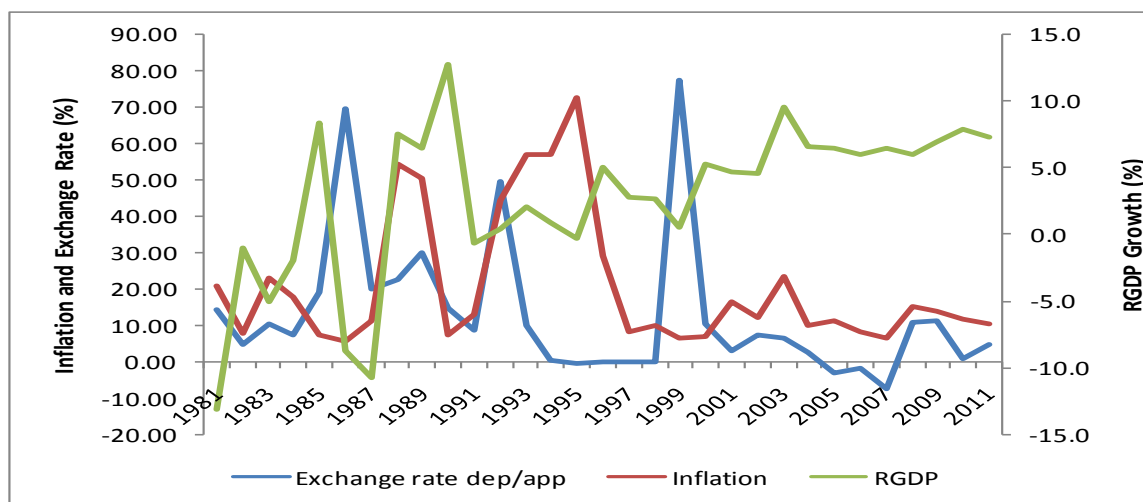
Nigeria

Prior to the introduction of Structural Adjustment Programme (SAP) in 1986, Nigeria operated a fixed exchange rate regime in which the naira was pegged to major international currencies. Following the adoption of SAP in

1986, the country introduced a Second-Tier Foreign Exchange Market (SPEM), with the adoption of dual system for the allocation of foreign exchange, resulting to a 69.9 percent depreciation of the domestic currency in 1987. However, in 1994 there was a policy reversal with the introduction of a fixed exchange rate that saw the naira pegged against international currencies. In 1995, the country introduced a more liberalized Autonomous Foreign Exchange Market (AFEM) during which period; the central bank sold foreign exchange to end-users through selected authorized dealers at market-determined exchange rate. In 1999, the country also moved to an Inter-Bank Foreign Exchange Market

(IFEM), which was designed as a two-way quote system, and intended to diversify the supply of foreign exchange in the economy by encouraging the funding of the inter-bank operations from privately-earned foreign exchange. , The naira remained relatively stable between 1994 and 1998, but experienced its worst depreciation of 77.7 percent in 1999. In 2002, the central bank re-introduced the Dutch Auction System (DAS) to replace the IFEM and in 2006, the Wholesale Dutch Auction System (WDAS) was introduced to deepen the market, hence the naira appreciated between 2004 and 2007. In 2008, the naira experienced a decline in the rate of depreciation from 11.0 percent in 2008 to 0.7 percent in 2010.

Figure 5: Exchange rate movement, real GDP and Inflation in Nigeria



Sources: WAMZ data base and IFS year Book, 2011

A cursory perusal of Figure 6 indicates a positive relationship between inflation and exchange rate movements. The Nigerian economy experienced episodes of inflationary pressures in the 1980s, as the inflation rate increased from 7.4 percent in 1985 to 54.5 percent in 1988, and thereafter decline steadily to 7.4 percent in 1990. However, in the early 1990s, the country also witnessed increase in the general price level, with inflation rate rising from 13.0 percent in 1991 to reach a peak of 72.8 percent in 1995, before decelerating to 6.9 percent in 2000. Inflationary pressure also eased off with a decline in the inflation rate from 18.9 percent in 2001 to 5.4 percent in 2007, and

thereafter increased gradually to 13.7 percent in 2010.

Real GDP growth which remained negative in the most part of the 1980s increased from negative 13.1 percent in 1981 to 8.3 percent in 1985 and thereafter the country went back into recession recording negative growths between 1986 and 1987. However, growth momentum picked up, with real GDP growth increasing from 7.5 percent in 1988 to 12.8 percent in 1990, but remained sluggish between 1991 and 1995. The country however experienced increase in economic activity with an increase in output

growth from 0.5 percent in 1999 to 6.6 percent in 2004, and further to 7.0 percent in 2009.

Sierra Leone

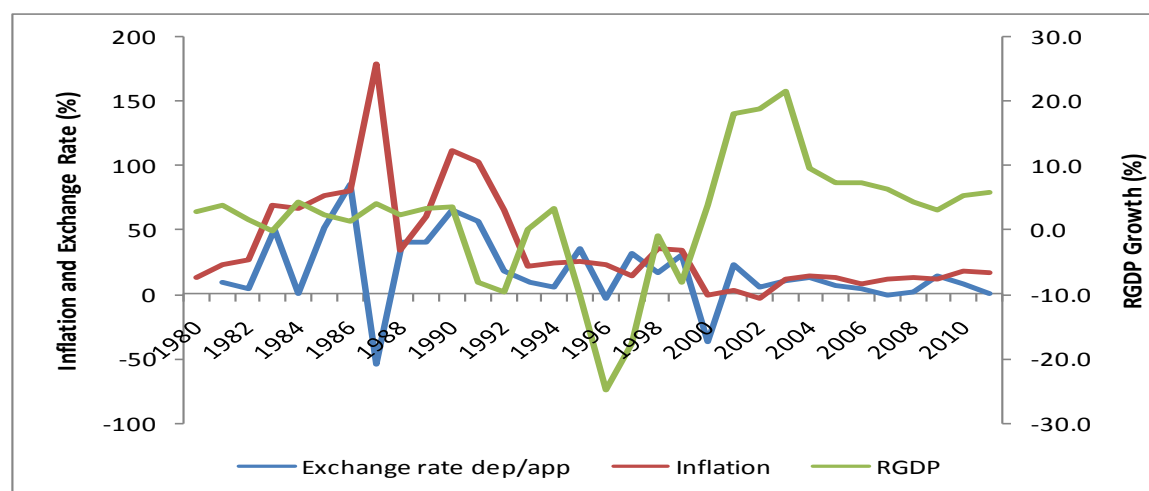
Sierra Leone, like many other countries adopted a fixed exchange rate regime following the collapse of the Bretton Woods System in the early 1970s. However, with the introduction of the Structural Adjustment Programme (SAP) in 1986, the country adopted the floating exchange rate regime, during which the government revalued the leone from Le53=\$1 to Le23=\$1. The adoption of the floating exchange rate was aimed at increasing the competitiveness of the country's export, while maintaining a stable exchange rate with minimal volatility. Thus, in April 1991, a "managed float" was introduced and the exchange rate was determined by market forces but was modified by intervention of the authorities from time to time to regulate the exchange rate so as to avoid excessive depreciation of the domestic currency. This was done through a weekly foreign exchange auction by the central bank. Given these developments, the domestic currency depreciated significantly from 9.8 percent in 1981 to 85.4 percent in 1986, but appreciated by 54.5 percent in 1987. The rate of depreciation increased from 41.0 percent in 1988 to 65.4 percent in 1990. However, the external value of the domestic currency strengthened as the rate of depreciated declined significantly from 56.6 percent in 1991 to 5.8

percent in 1994. The currency however appreciated in 1996 and 2000, and remained stable with the rate of depreciation declining from 14.5 percent in 2003 to 2.1 percent in 2008.

Sierra Leone experienced increase in the general price level as the rate of inflation increased from 23.4 percent in 1981 to 178.7 percent in 1987. Despite being high, inflationary pressure eased in the 1990s, as the inflation rate decelerated from 110.9 percent in 1990 to 34.1 percent in 1999. The country experienced deflation in 2000 and 2003. The inflation rate further declined from 14.2 percent in 2004 to 4.8 percent in 2008, but increased sharply to 16.6 percent in 2010. Thus, for most of the period under review, Figure 7 indicates a positive relationship between exchange rate movement and inflation.

The country witnessed positive growth in the early 1980s as real GDP growth rate increased from 2.9 percent in 1980 to 4.4 percent in 1984, and further increased from 1.5 percent in 1986 to 3.6 percent in 1990. However, real GDP growth remained negative in the 1990s, but economic activities picked up in 2000 resulting to an increase in real GDP growth from 3.8 percent to 18.2 percent in 2002. However, despite remaining positive, real GDP growth decline from 10.9 percent in 2003 to 4.9 percent in 2010.

Figure 6: Exchange rate movement, real GDP and Inflation in Sierra Leone



Sources: WAMZ data base and IFS year Book, 2011

3.0 LITERATURE REVIEW

3.1 Theoretical Literature

The impact of exchange rate movements on inflation and growth has been widely discussed and numerous channels through which the effects of currency fluctuations are transmitted onto the domestic price level and output have been identified in the literature.

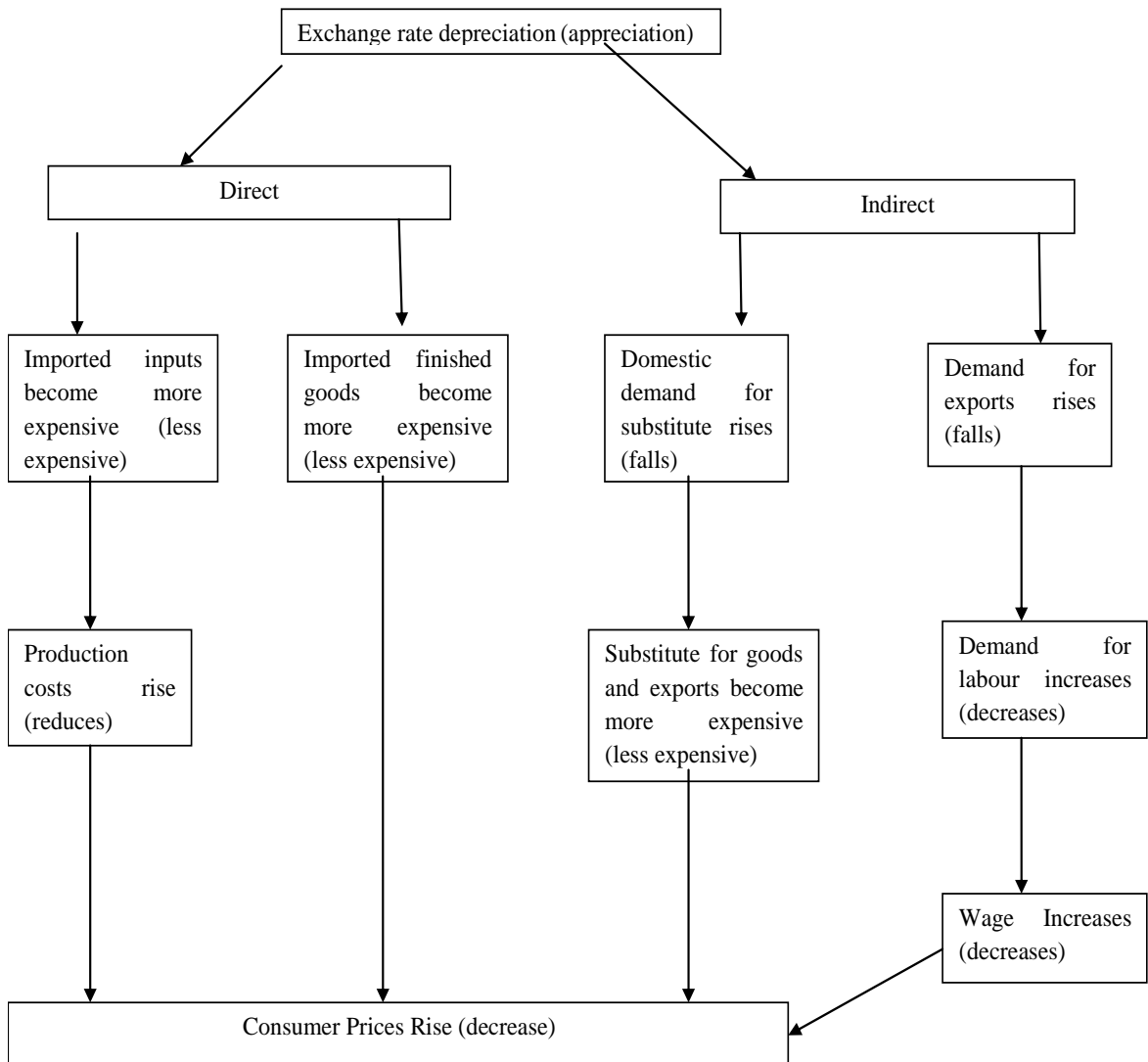
(i) Impact of Exchange Rate on Inflation

Exchange rate movements can impact on domestic prices through direct and indirect channels, via their effect on aggregate supply and demand. The direct channel is due to operation of law of one price based on purchasing power parity theory (PPP). It is postulated that exchange rate between two currencies is determined by relative movements in the price levels in the two countries. PPP states that price levels between two countries are equal when expressed in the same currency at any period of time. Therefore, if PPP holds, exchange rate fluctuations translate into proportional movements in the domestic price level; i.e. pass-through is equal to one. In a small

open economy (an international price taker), a depreciation of the domestic currency will result in higher import prices (both for finished goods and intermediate inputs), which will ultimately be transmitted to higher domestic prices (See Hyder and Shah, 2004).

Exchange rate variations can also affect domestic prices through its indirect effect on aggregate demand. Depreciation of the domestic exchange rate reduces the foreign price of domestic goods and services, and thereby increases foreign demand, resulting to an increase in net exports and hence aggregate demand and real output. The increase in domestic demand and real income may bid up input prices and hence causing workers to agitate for higher wages to maintain a real wage. The nominal wage increase may result to further price increases (See Hyder and Shah, 2004). Furthermore, depreciation may increase the domestic price of imported goods and services and thereby lead to expenditure switching in favour of domestic goods and services, which will increase their demands and raising domestic prices.

Figure 7: Transmission Mechanism of Exchange Rate Pass-Through



Source: Adapted from McFarlane (2006)

(ii) Impact of Exchange Rate on Output

The literature on the impact of exchange rate fluctuations on output has produced mixed results. The traditional views such as the elasticity, absorption and the Keynesian approaches assert that devaluation have positive effect on output. The elasticity approach states

that devaluation will improve the trade balance and hence output growth, assuming the Marshall-Lerner condition holds. In other words, if the sum of the price elasticity of exports and imports exceeds unity, the devaluation will lead to an improvement in the current account. Hence, devaluations lead to an increase in aggregate demand. In this approach, devaluation will increase the domestic price of foreign imports

and reduce the foreign price of domestic exports. This will result to a decrease in imports and an increase in exports, thereby increasing net export, trade balance and output. According to the absorption approach, a depreciation of domestic currency makes the country's exports relatively cheaper for foreigners and makes foreign goods relatively more expensive for domestic consumers. This helps to increase the country's exports and switches demand towards domestically produced goods, thereby increasing their demands and hence generate an increase in real output (Dornbusch, 1988). The expansionary effect of devaluation¹ on aggregate demand is thus believed to increase output and reduce unemployment (Krugman and Obstfeld, 2003). In the short-run when the economy is operating at a positively sloped aggregate supply curve, a depreciation of the domestic currency will cause both output and price level to increase.

In recent years, a growing literature argues that a depreciation of the domestic currency would have a contractionary impact on output. Depreciation increases the domestic currency cost of imported inputs and reduces the volume of imported inputs. Reduction in imports implies insufficient inputs necessary for production. Thus, because of the lack of enough inputs and higher cost relative to the prices of their domestic final products, firms tend to produce less, which leads to a reduction in aggregate supply. In addition, increased prices of tradable goods caused by depreciation would ultimately result in an increase in the general price level, which will impact negatively on the real wage. As real wages decrease, the workers will demand higher nominal wages to protect their purchasing power. If wages are flexible or there exists a wage indexation mechanism, the nominal wages will adjust proportionately to the general price level. Such increase in wages increases the cost of production and could produce adverse supply effects. Furthermore, if a country has a large external debt position, devaluation will negatively affect both residents and government, as it may reduce the net worth of both residents and government and therefore aggregate expenditure. Devaluation increases the domestic currency costs of servicing debt. Government

can finance increased debt service payments by reducing its expenditures, increasing taxes or domestic borrowing. All these modes of financing have contractionary effect on aggregate demand.

3.2 Empirical Literature

Numerous researchers have studied the impact of exchange rate on output and inflation and have produced mix results, based on methodological or geographical differences as well as the type of data used. In terms of methodology, Copelman and Werner (1996), by using a VAR model for Mexico with five variables—output, the real exchange rate, rate of depreciation of the nominal exchange rate, the real interest rate, and a measure for real money balances—showed that declines in output are observed after a devaluation. During the same period, Kamin (1996) showed that the level of the real exchange rate was a primary determinant of the rate of inflation in Mexico during the 1980s and 1990. In a related study, Kamin and Roger (2000) examined the impact of depreciation on output and inflation in Mexico employing VAR model with four variables; real exchange rate, output, price index and US interest rate using quarterly data for the period 1981-1995. The result revealed depreciation shock leads to reduction in output and an increase in inflation. Sheeley (1986) also found that devaluations have a negative impact on output for 16 Latin American countries, while the study by Calva, Reinhart and Vegh (1994) identified correlation between inflation and the real exchange rate in Brazil, Chile and Colombia

Using pooled time-series/cross-country analysis on the other hand, Edwards (1989) found that devaluations reduce output in developing countries in a where the real GDP is explained by the real exchange rate, government spending, terms of trade, and money growth. Morley (1992) also regressed capacity utilization to the real exchange rate, measures of fiscal and monetary policy, and terms of trade, export growth and import growth in a pooled time-series/cross M country analysis and found that

real devaluations tended to reduce output and it took at least two years for the full effects to show

Using nonlinear three-stage least squares estimation, Domaç (1997), based on Turkish data for 1960–90, showed that unanticipated devaluations have positive effects on output but anticipated devaluations do not exert any significant effect on output. In a similar analysis, Mills and Pentecost (2000) used a conditional error correction model for four European Accession countries: Hungary, Poland, Slovakia, and the Czech Republic. They found that real exchange rate depreciation had positive effects in Poland, no significant effect in Hungary and the Czech Republic, and negative effects in Slovakia. Grigorian, et al (2004) analyzes the dynamic effects of the exchange rate on prices in Armenia. By studying three inter-related markets (foreign exchange, money and labour), their estimation shows higher responsiveness of inflation to the exchange rate rather than to the other determinants (money supply and nominal wages). Their study revealed a negative correlation between inflation and exchange rate both in the short- and long-run.

The empirical literature has also produce conflicting results based on geographical classification. For instance, Bahmani- Oskooee *et al.* (2002) investigated the effect of currency depreciation on output in Asian countries. He found that in many Asian countries depreciation is contractionary. Also, Bahmani-Oskooee and Rhee (1997) using Korean quarterly data over the period 1971-1974 applied Johansen's cointegration and error-correction technique. Their error-correction model confirmed that there exists a long-run relationship between output, money and the real exchange rate variables. They concluded that real depreciations were expansionary in the long-run and the most important expansionary impact of real depreciations appeared with a lag of three quarters. Christopoluos (2004) on the other hand, investigated the effect of currency devaluation on output expansion in 11 Asian countries over the period 1968-1999. He found that, in the long run, the depreciation exerts a negative impact on output growth for five

countries while for three countries depreciation improves growth prospects. De Silva and Zhu, (2004) considered the case of Sri Lanka and applied the VAR technique. Using quarterly data over the period 1976-1998, they concluded that devaluation improved the trade balance but had a contractionary impact on the Sri Lankan economy.

Gylfason and Risager (1984) studied the effects of devaluation for 8 developing and 7 developed countries. They concluded that devaluation was expansionary in developed countries and contractionary in developing countries. Solimano (1986) constructed a macroeconomic model for Chile and concluded that devaluation was contractionary in the short to medium run. In a related development, the study by Loungani and Swagel (2001) using a panel of 53 developing countries: African countries – 16, Asian – 11, South American – 19, and Mediterranean – 7 revealed that in developing countries with the floating exchange rate, the impact of exchange rate depreciation on the price changes is positive and statistically significant. The same results are obtained in the studies estimating the relationship between the exchange rate and inflation separately for individual developing countries.

Other researchers have found mixed results in investigating the impact of devaluation on output growth and inflation in sub- Saharan countries. For instance, Khan (1998) investigated the impact of changes in real exchange rate on both output and inflation for twenty-two Sub- Saharan countries for the period 1980-1996. The result showed that, devaluation increases both output and inflation. In a related study, Ubok-Udom (1999) used annual data to examine the relationship between exchange rate variations and the growth of domestic output in Nigeria between 1971 and 1995. He used ordinary least squares (OLS) and found that depreciation is contractionary on output. Furthermore, Odusola and Akinlo (2001) investigated the impact of exchange rate depreciation on output and inflation in Nigeria. Using quarterly data for the period 1970-1995, with an impulse response function, they found expansionary impact of exchange rate depreciation on output in both the

medium and long term, but a contractionary effect in the short run. Canetti and Greene (1991) used a VAR framework to investigate the relative strength of exchange rate and monetary expansion in propagating inflation in Ten African countries (including Sierra Leone) during 1978-1989. Granger causality tests were conducted to determine the direction and significance levels of key variables. The study shows that inflation is driven by money supply and exchange rate depreciation. The study by Elbadawi (1990) also shows that depreciation of the parallel exchange rate exerted a significant effect on inflation in Uganda

In a separate study on the inflation dynamics in the WAMZ Member States, Kitcher, *et al* (2007) examined the main determinants of inflation in The Gambia using single equation error-correction model. Their findings are that inflation is driven mainly by inflation inertia and external factors in the short run and mainly by monetary factors in the long run. Real output, however, appear not to have any significant effect on inflation in the Gambia. In a related study conducted for Ghana, Abradu-Otoo and Donyina-Ameyaw (2007) find that the main determinants of prices in the long run are the exchange rate, base money, retail prices of petroleum products and the general level of economic activity. Concerning the impact of inflation and economic growth in Ghana over the period 1987(3)-2007(4), Adenutsi reveals that inflation has a marginal short-run positive impact

on growth but this impact turns negative in the long run. Furthermore, Onwioduokit *et al* (2007) establish that the key factors influencing inflation in Guinea are inflation inertia, exchange rate, fiscal deficit and output. Essien, Onwioduokit *et al* (2007) find that the key factors influencing inflation in Nigeria are past levels of inflation, monetary aggregates, fiscal deficit and exchange rate. Using vector error-correction model, Essien, Adamgbe and Sesay (2007) identify key determinants of inflation in Sierra Leone as inflation inertia, money supply and exchange rate.

Despite the plethora of empirical literature on the impact of exchange rate on output and inflation, there does not seem to be any study with exclusive focus on the WAMZ countries that has taken a simultaneous look at inflation, exchange rate and economic growth. While a few have analyzed the relationship between exchange rate and inflation by looking at exchange rate pass-through to domestic prices, others have rather chosen to examine the relationship between exchange rate and trade balance. Thus, studies on the WAMZ economies are limited in scope and coverage. For instance, the studies on inflation dynamics in the WAMZ Member States, however, did not consider interrelationships between output, inflation, exchange rate and money supply. Thus, looking at the variables in a simultaneous equation setting demonstrates originality of the current study.

4.0 THEORETICAL FRAMEWORK AND METHODOLOGY

The theoretical framework of the study draws heavily on the flexible price Mundell-Fleming Model couched in linear logarithmic stochastic form following Clarida and Gali (1994) and Adenutsi and Ahortor (2008). In formulating the open-economy model, the study follows Kandil and Mirzaie (2003) and Ahortor *et al* (2011) to model both the demand and supply sides of the economy. This is done from a general equilibrium perspective in order to establish interdependencies among the system variables. The standard Aggregate Demand side of the economy is modelled as follows:

Aggregate Demand: $y_t^d = d_t + \eta q_t - \sigma r_t$ (1)

where y_t^d = Aggregate Demand in period t , d_t = exogenous demand component in period t , q_t = real exchange rate in period t , r_t = domestic real rate of interest in period t , while η and σ are positive elasticities. Equation (1) states that aggregate demand is positively related to the exogenous demand shock which encapsulates external, fiscal expansion and other internal shocks. In addition, the aggregate demand is positively impacted by the real exchange rate through the stimulation of ‘exportables’ and domestic production of ‘importables’ but negatively impacted by the real interest rate which discourages investment and consumption. The following real variables are derived from the nominal variables:

Real Exchange Rate: $q_t = s_t + p_t^* - p_t$ (2)

Real Domestic Interest Rate: $r_t = i_t - E_t(p_{t+1} - p_t)$ (3)

where s_t = the spot exchange rate (the domestic value of foreign currency), p_t^* = the foreign price level which is assumed to be constant, p_t = domestic price level, r_t = domestic real interest rate, i_t = domestic nominal interest rate, all at time t ; and p_{t+1} = domestic price level at time $t+1$. Equation (2) states that the real exchange rate is the nominal domestic exchange rate divided by domestic and foreign relative prices expressed in logs. According to equation (3), the real domestic interest rate is given by nominal domestic interest rate less expected inflation (today’s expectation of tomorrow’s inflation)

which is defined as the expectation of domestic price level tomorrow deflated by domestic price level today in a logarithmic form.

Money Market Equilibrium Condition is given as follows:

$$m_t^s - p_t = y_t - \lambda i_t \quad (4)$$

Where m_t^s is the money supply at time t , and $(\lambda > 0)$ is the interest semi-elasticity of demand for money. The domestic nominal rate of interest (i_t) has a negative effect on the demand for money, while domestic output (y_t) has a positive effect. It is assumed that the output demand elasticity is unity. Equation (4) states that money market equilibrium is attained when real money supply is equal to real money demand which can be decomposed into two – transactions demand and speculative demand.

In an open economy, real money balances for transaction purposes may be held partly in domestic currency and partly in foreign currency. Thus, exchange rate expectations may influence the amount of transaction balances held in foreign currency. The money market equilibrium in an open economy can, therefore, be specified, using equation (3) to restate equation (4), as

Open-economy Money Market Equilibrium Condition:

$$m_t^s - p = \phi y_t + (1 - \phi) E_t(s_{t+1} - s_t) - \lambda [r_t + E_t(p_{t+1} - p_t)] \quad (5)$$

Supply-Side Framework

The supply-side of the economy is modelled with a view that the labour market developments give rise to wage and price settings. These in turn determine the short-run aggregate supply in the product market. The key assumption here is that in the long-run, the aggregate supply function is perfectly inelastic.

Labour Cost Function:

$$w = E_t(p_{t+1} - p_t) - \alpha_1(u - u^*) + \alpha_2\gamma, \quad \alpha_1 > 0, 0 \leq \alpha_2 \quad (6)$$

Mark-up Price Function:

$$p_{t+1} - p_t = w - \gamma \quad (7)$$

From equations 6 and 7, the Phillips Curve can be derived as follows:

Phillips Curve:

$$p_{t+1} - p_t = E_t(p_{t+1} - p_t) - \alpha_1(u - u^*) - (1 - \alpha_2)\gamma \quad (8)$$

Okun's Law:

$$u - u^* = -\beta(y - y^*), \quad \beta > 0 \quad (9)$$

Where w = wage rate, u = actual rate of unemployment, u^* = natural rate of unemployment, γ = growth rate of labour productivity, y = growth rate of output, and y^* = potential (optimal) growth rate of output.

From the Phillips Curve and Okun's Law, the short-run aggregate supply function, given that labour productivity growth is zero, can be specified as

Aggregate Supply Function:

$$p_{t+1} - p_t = E_t(p_{t+1} - p_t) + \alpha_1\beta(y - y^*) \quad (10)$$

According to equation (10), the general price level in the domestic economy is given by the level of inflation expectation, the output gap and labour productivity.

Uncovered Interest Parity (UIP) Condition: Interest parity prevails in the presence of free capital mobility. Given risk neutrality, the uncovered interest parity can be stated as:

$$i_t = i_t^* + E_t(s_{t+1} - s_t) \quad (11)$$

Where i^* is the world rate of interest, assumed for simplicity to be constant over time. Through costless arbitrage, the return on investing one unit of domestic currency in domestic security, i_t , is made equal to the expected value of the domestic currency return on investing the same amount in foreign security, which yields a foreign currency return, i^* , plus expected depreciation of domestic currency, $E_t(s_{t+1} - s_t)$.

Balance of Payments Equilibrium Condition:

External sector is in equilibrium when the current and the capital accounts of the balance of payments (BOP) balance each other. In other words, a deficit in the current account must be compensated for by a surplus in the capital account, and vice versa. The BOP can be stated as

$$BOP = \theta_0 + \theta_1 y_t + \theta_2 q_t + \theta_3 (r - i^*) \quad (12)$$

Where $\theta_1 y_t + \theta_2 q_t$ is the current account component of the BOP, which is a function of domestic aggregate demand and the exchange rate. Thus, equation (2.7) states that the BOP is made up of the current account which is a function of aggregate demand and exchange rate; the capital account which depends on the interest rate differential; and aggregate autonomous component (θ_0) made up of autonomous elements of the current and capital accounts. In equilibrium, the BOP must be equal to zero.

Equations 1, 5, 10 and 12 constitute the equilibrium of the system at each point in time. The shock (stochastic) processes that drive the dynamics of this equilibrium system are:

$$y_t^s = g_y + y_{t-s}^s + \varepsilon_{yt} \quad (13)$$

$$d_t = g_y + d_{t-1} + \varepsilon_{dt} \quad (14)$$

$$m_t^s = g_m + m_{t-1}^s + \varepsilon_{mt} \quad (15)$$

$$s_t^s = g_m + g_y + s_{t-1}^s + \varepsilon_{st} \quad (16)$$

Where g_y and g_m are the deterministic growth rates of output and money, and ε_{yt} , ε_{dt} , ε_{mt} , ε_{st} , are independently and identically distributed (*i.i.d.*) supply, demand, money and exchange rate shocks with zero means and constant variances. Thus, according to equations (13-16), it is assumed that the system is bombarded by permanent shocks (in a random walk fashion). It must be noted that this stochastic framework is both forward- and backward-looking; hence, a systematic procedure is required to obtain a solution. The following set of solutions can be obtained:

$$y_t^e = y_t^s \quad (17)$$

$$\pi_t^e (\equiv E_t p_{t+1}^e - p_t^e) = g_m - g_y \quad (18)$$

$$r_t^e = i^* \quad (19)$$

$$i_t^e = i^* + g_m - g_y \quad (20)$$

$$q_t^e = \frac{1}{\eta} (y_t^s - d_t + \sigma i_t^*) \quad (21)$$

$$p_t^e = m_t^s - y_t^s + \lambda (i_t^* + g_m - g_y) \quad (22)$$

$$s_t^e = m_t^s + \left(\frac{1}{\eta} - 1\right) y_t^s - \frac{1}{\eta} d_t + \left(\frac{\sigma}{\eta} + \lambda\right) i^* - p^* + \lambda(g_m - g_y) \quad (23)$$

The flexible-price equilibrium is economically intuitive. According to equation (17), when prices are flexible and the supply of output is exogenous, output must be supply-determined. Equation (18) states that with constant money demand elasticities, the expected rate of inflation (which turns out also to be the actual inflation rate) must be equal to the difference between money growth and output growth. Since world prices are constant in the foreign country (hence, zero world inflation), the world real and nominal rates of interest must be equal to i^* . The domestic real rate of interest must be equal to i^* as well under the assumption of free capital mobility. These facts are captured by equation (19).

According to equation (20), the equilibrium domestic nominal interest rate is given by the nominal international interest rate plus the differential of domestic money and output growth. Equation (21) states that the equilibrium real exchange is positively related to output supply and international interest rate while negatively impacted by aggregate demand. Equilibrium domestic price level is given by equation (22) where nominal money supply, nominal international interest rate and money supply-output growth differential have positive influence on the price level with output supply impacting on it negatively. In equation (23), the equilibrium nominal exchange rate is a positive

function of money and output supply, nominal international interest rate, and money-output supply differential but negatively related to domestic aggregate demand and foreign price level.

One can verify that the real and nominal exchange rates will appreciate under expansionary fiscal policy (indicated by Δd_t) as implied by equations (21) and (23), without any effects on output, prices, and interest rates. This is consistent with the notion that under a flexible exchange rate system with perfect capital mobility, fiscal policies are neutral. With expansionary monetary policy (indicated by Δm_t^s), the domestic price level will go up as implied by equation (22) and the domestic nominal exchange rate will depreciate as implied by equation (23). Output, interest rates, and the real domestic exchange rate will not be affected. This is obviously consistent with the classical dichotomy between real and nominal magnitudes associated with monetary policy under flexible prices.

Expanding equation (22) further using international interest rate definition from equations (20, 19 and 1), we have a price relationship as

$$p_t^e = m_t - \delta y_t + \mu q \quad (24)$$

According to equation (24), the price level is related to money supply/demand, output and exchange rate. Equation (24) can be thought of as a system of interdependencies: the price level is influenced by money supply (monetarist view), output (structuralist view) and exchange rate (traditional view). From the demand side of the money market, the price level, income (output) and exchange rate may explain demand

for real balances. Further, output may be dependent upon money supply, price level and exchange rate, while the real exchange rate may be a function of money supply, the price level and output. These interdependencies call for the construction of a simultaneous equations model to avoid the problem of endogeneity or a vector autoregressive (VAR) model that can handle not only the endogeneity problem but also

stationarity and cointegration properties imposed by the data generation process (DGP).

Empirical Model Specification

Based on the foregoing theoretical framework, a four-variable vector autoregressive (VAR) model is formulated in order to establish the interdependencies among the model variables. The empirical model is in two parts: 1) a specification using level variables involving the general price level proxied by the consumer price index, money supply proxied by broad money (M2), real output representing gross domestic product (GDP) at constant prices and the real exchange rate represented by bilateral real exchange rate of the local currency per US dollar; and 2) a specification employing the growth rates of model variables such as inflation as measured by percentage changes in the consumer price index, broad money supply growth rate, real GDP growth and exchange rate depreciation/ appreciation.

The choice of a VAR model for this study is informed by the fact that a VAR modelling sidesteps structural modelling to make a

The general VAR model for this study is specified as

$$X_t = A_1 X_{t-1} + A_2 X_{t-2} + \dots + A_p X_{t-p} + \epsilon_t \quad (25)$$

where, $X_t \equiv (4 \times 1)$ vector of system

endogenous variables at time (t) such as inflation, M2 growth, GDP growth and exchange rate depreciation

$X_{t-i} \equiv$ Lagged values of the system's

endogenous variables, and $i = 1, 2, \dots, p$

$A_i \equiv (4 \times 4)$ matrices of predetermined

variable coefficients to be estimated, and

$i = 1, 2, \dots, p$

$\epsilon_t \equiv (4 \times 1)$ vector of innovations at time t

X is the variable to be tested for a unit root, while variable t is a deterministic trend. Equation (26) models a data generating process (DGP) containing a drift term and a deterministic trend. It has been observed by Banerjee *et al*

simultaneous equation system, at least, exactly identified for estimation and analysis. Thus, identification requirements and their associated challenges under simultaneous equation estimation are unnecessary under a VAR modelling. There is also a consensus in the literature that autoregressive models tend to outperform structural models in terms of forecasting and simulation. Moreover, a VAR framework is a powerful tool for analysing impulse responses to systemic shocks and decomposing variations in variables due to these shocks. Another advantage of using a VAR technique over a simultaneous equation estimation technique, according to Mukherjee *et al* (2003), is that a set of cointegrating equations within a VAR framework does not suffer from simultaneity bias even if the equations constitute a simultaneous equations model. Although a VAR modelling has been criticised as being *atheoretic*, when efforts are made to give a sound theoretical background as has been established in this paper, it can provide deeper and clearer understanding of these interdependencies.

Unit root tests are conducted to determine the stationarity status of all variables. The study employs the popular Augmented Dickey-Fuller (ADF) test, complemented by Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test. The following model is used in the ADF Unit Root Test.

$$\Delta X_t = \alpha_1 + \rho X_{t-1} + \alpha_2 t + \sum_{i=1}^l \beta_i \Delta X_{t-i} + \epsilon_t t$$

$$= 1, 2, \dots, T \quad (26)$$

where Δ denotes the first-differenced operator (that is, $\Delta X_t = X_t - X_{t-1}$), ϵ_t is the error term at time t ,

(1993) that the results provided by the ADF test are more robust than those provided by any other unit root tests in the presence of autoregressive errors, since the autoregressive terms are captured precisely.

Rejecting the null hypothesis at the 5 percent level of significance implies accepting the alternative hypothesis that the series has no unit root and, for that matter, is stationary in level. When the null hypothesis is accepted the series has a unit root and is therefore not stationary at levels. A series is required to pass at least one of the tests at 5 percent or better to be considered as stationary.

If X_t is non-stationary, model (25) cannot be estimated at levels in that any such estimation will produce spurious results. Estimating model (25) in differences will result in loss of long-run information. However, according to Sims (1980),

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-p} + \epsilon_t \quad (27)$$

where Δ is as defined above

$$\Gamma_i = \sum_{j=i+1}^p A_j - I$$

$$\Pi = \sum_{i=1}^p A_i - I$$

Equation (27) is the error-correction representation of the VAR process in model (25). The vector error-correction model (VECM) differs from the usual VAR in that it allows for the existence of long-run “equilibrium” relationships among the system’s variables in the short run.

The rank of the matrix Π in model (27) determines the number of cointegrating vectors. If the Π matrix is of full rank in which case,

model (25) can be estimated with the non-stationary variables in levels for the analysis of not the coefficients but the dynamic interrelationships of the system (Enders, 1995). Several empirical studies also recommend that to overcome both problems of spurious results and loss of long-run information, cointegration tests must be conducted to unearth any long-run relationship between the system variables. Thus, this study proceeds to find out whether or not the system variables are cointegrated. In the presence of cointegration, with the assumption that $X_t \sim I(1)$, $Z_t \sim I(1)$ model (25) is transformed as

$r = n$, the VECM reduces to the usual VAR in levels of stationary variables. Hence, model (27) will be estimated in levels. If Π is a null matrix, such that $r = 0$, the VECM represents a VAR in first differences, provided $X_t \sim I(1)$ (Enders, 1995, Harris, 1995). In other words, if the rank is zero, there is no cointegrating vector. This implies the variables are non-stationary and not cointegrated.. However, if the rank is one or more, $0 < r < n$, we have one or multiple cointegrating vector(s).

Data Type and Sources

The study makes use of secondary quarterly series for the period 1981Q1 to 2010Q4 for all countries except Ghana (1983Q2 – 2010Q4) and Guinea (1989Q1 to 2010Q4). Data were obtained from United Nations database and IMF CD Rom, 2011. All the variables are in annual growth rates and the quarterly GDP data were obtained through interpolation of annual time series data using Eviews 7.0. This was done using the low frequency to high frequency method and the

quadratic match sum for each observation of the low frequency series.

Data were obtained on real GDP growth, money supply, nominal exchange rate, consumer price index (CPI) and US producer price index (PPI). Inflation was computed as a percentage change in the general price level as measured by the CPI. Real money supply growth was obtained after deflating nominal money stock by consumer price index. Bilateral real exchange

rate was obtained by deflating the product of the nominal exchange rate and US PPI by the domestic CPI. Thus, a rise in the bilateral real exchange rate implies depreciation, while a decrease indicates appreciation. The bilateral real exchange rate is preferred to the real effective exchange rate in this study because almost all the Member States' external reserves are denominated in US dollars and fluctuations in local currency – dollar exchange rate create a lot of apprehensions in policy arena and business circles.

One of the key limitations of this study arises from the quarterly interpolation of the annual series of GDP. Although, quarterly real money supply, inflation and real exchange rates were generated naturally as per statistical releases, combining these with “artificially” generated quarterly GDP may produce a distorted relationship between GDP and these other variables. However, efforts were made to ensure that the trend in the annual series as per the data generating process is maintained in the quarterly series.

5.0 PRESENTATION AND ANALYSIS OF RESULTS

The results of the WAMZ member countries' model estimations are presented in this section. These include the unit root test results, unrestricted VAR model results, impulse response functions and variance decomposition results.

5.1 Results for The Gambia

5.1.1 VAR Model Results for The Gambia

The results of the general unrestricted VAR model are presented in Table 1. Considering the inflation equation (3rd Column of Table 1), broad money supply growth has a long-run dynamic positive effect on inflation rate in the Gambia. A cumulative one percent growth of money supply over the past six quarters will induce an increase of 0.1 percent in inflation. Thus, inflation can be described, to some extent, as a monetary phenomenon in the Gambia. Inflation also has a dynamic long-run positive impact on itself. That is, inflation inertia exists in the Gambia, where a cumulative one-percentage point increase in inflation rate over the past six quarters will cause same proportionate increase (one percent) in the current level of inflation. This could be explained by inflationary expectation formation in the Gambia. Real depreciation of the dalasi impacts positively on inflation. One percent real depreciation induces 0.05 percent increase in inflation. However, Real GDP growth does not statistically explain inflation dynamics in the Gambia.

The unit root test results (see Appendix I) show that the four model variables are stationary at level for all the six countries. This implies an unrestricted VAR estimation can be carried out to establish long-run relationship among the variables. The lag length test (see Appendix II) shows that the optimum lag to be included in the model is six.

From the exchange rate equation (4th Column of Table 1), money supply growth has a dynamic positive impact on real exchange rate. A cumulative one percent growth in money supply in the past first and fifth quarters will cause 0.3 percent real depreciation of the dalasi. This is theoretically consistent as money supply growth tends to depreciate the exchange rate either through the interest rate channel or the consumption-import channel. Real exchange rate generates a positive inertia as its own past values over the previous six quarters tend to have a cumulative positive impact of 0.5 percent. That is, a cumulative one percent depreciation over the past six quarters will cause the current exchange rate to depreciate by 0.5 percent. Real GDP growth impacts dynamically positively on real exchange rate. Cumulative one percent increases in real GDP growth over the past four to six quarters will cause the dalasi to depreciate in real terms by 0.1 percent. This could be explained by the fact that real GDP growth implies an increase in income which induces a rise in imports which consequently affects demand for foreign currency, leading to depreciation of the currency.

Table 1: Parsimonious VAR Model Results for The Gambia

Dependent Variable Independent Variable	GAMM2G	GAMINF	GAMDEP	GAMGDPG
GAMM2G(-1)	1.345691 (0.0000)	0.057296 (0.0193)	0.162126 (0.0021)	
GAMM2G(-2)	-0.450655 (0.0000)			
GAMM2G(-3)				
GAMM2G(-4)	-1.107880 (0.0000)	0.172317 (0.0016)		0.061859 (0.0008)
GAMM2G(-5)	1.487846 (0.0000)	-0.249076 (0.0022)	0.152530 (0.0058)	-0.057054 (0.0018)
GAMM2G(-6)	-0.565000 (0.0000)	0.088830 (0.0828)		
GAMINF(-1)		1.551420 (0.0000)		-0.021555 (0.1176)
GAMINF(-2)		-0.438147(0.0001)		
GAMINF(-3)				
GAMINF(-4)	-0.919459 (0.0000)	-0.509527(0.0001)		0.118763 (0.0036)
GAMINF(-5)	1.307231 (0.0003)	0.585595(0.0006)		-0.097574 (0.0068)
GAMINF(-6)	-0.479713 (0.0262)	-0.224801(0.0192)		
GAMDEP(-1)	0.073102 (0.0266)	0.049709(0.0005)	1.210721 (0.0000)	
GAMDEP(-2)			-0.413468 (0.0000)	
GAMDEP(-3)				
GAMDEP(-4)	0.127198 (0.0129)		-0.846903 (0.0000)	
GAMDEP(-5)	-0.129047 (0.1065)		0.994229 (0.0000)	
GAMDEP(-6)	0.072199 (0.1226)		-0.403774 (0.0000)	
GAMGDPG(-1)				1.286334 (0.1738)
GAMGDPG(-2)				-0.354679 (0.0000)
GAMGDPG(-3)				
GAMGDPG(-4)			-2.042719 (0.0002)	-0.538623 (0.0013)
GAMGDPG(-5)	0.457832 (0.1411)		2.986715 (0.0007)	0.682029 (0.0000)
GAMGDPG(-6)	-0.377989 (0.1738)		-0.836271 (0.0977)	-0.324262 (0.0001)
CONSTANT	3.091385 (0.0059)	(0.6642)	-2.853248 (0.0098)	0.842032 (0.0002)
R-Squared	0.926370	0.965978	0.902911	0.903151
R-Squared adjusted	0.915957	0.962675	0.893485	0.892707
F-statistic & prob	88.96798 (0.0000)	292.4422 (0.0000)	95.78802 (0.0000)	86.47188 (0.0000)

Source: WAMI staff computations

The growth equation results (5th Column of Table 1) show that real money supply growth has a dynamic positive long-run impact on real GDP growth in the Gambia. A cumulative one percent growth in money supply over the past four to fifth quarters will cause real GDP growth to increase by 0.005 percent. Although this figure is significant, it is very negligible. Thus, money supply neutrality or super neutrality hypothesis may hold in the Gambia. Inflation has an overall positive dynamic effect on real GDP growth. One percent increases in inflation rate over the past fourth and fifth quarters will induce 0.02 percent net increase in real GDP growth in the current period. This inflation growth relationship

may be explained by the fact that inflation is historically low in the Gambia. Real exchange rate is not significant in explaining real GDP growth in the Gambia. Real GDP growth exerts positive inertia on itself with overall dynamic positive impact of 0.8 percent. This implies, cumulative one percent increases in real GDP growth over the past one to six quarters will induce 0.8 percent increase in current real GDP growth.

The results in Table 1 also indicate that real money supply growth (GAMM2G) is explained by its own past values and lags values of inflation and exchange rate. The long-run

dynamic effect of money supply growth on itself is positive, implying that money supply growth has an inherent inertia that perpetuates its growth rate overtime.

Overall, a cumulative one percentage point growth in broad money supply over six quarters will cause 0.7 percentage point increase in current money supply growth. Inflation rate tends to have a dynamic negative impact of 0.1 percentage point on money supply growth. This suggests that money supply tends to respond to inflationary pressures in the Gambia. More specifically, a cumulative one percent inflation rate over the past four to sixth quarters will cause broad money supply growth to decline by 0.1 percent. Real depreciation of the Gambian dalasi impacts positively on money supply growth. The long-run dynamic effect of real depreciation is 0.2, implying that cumulative one percent real depreciation over the first and fourth quarters will cause 0.2 percent growth in money supply. Real GDP growth, however, does not have any long-run dynamic effect on broad money supply growth in the Gambia.

5.1.2 Impulse Response Function Analysis for the Gambia

The impulse response graphs (see Appendix IV) show that the accumulated responses of inflation to one standard deviation shocks in money supply growth, exchange rate and real GDP growth are negligible. Inflation responds to only its own standard deviation shock by increasing initially to a point above its equilibrium level from the first to the fifth quarter, after which it remains constant through the rest of the forecast horizon.

Cumulatively, real GDP growth is irresponsive to shocks emanating from money supply growth, inflation and real exchange rate depreciation. This suggests that the dynamic effects of money supply growth and inflation on real GDP growth observed from the coefficient estimates are very weak. The response of real GDP growth to its own shock is to increase initially during the first-six quarters and thereafter declines albeit above its equilibrium level over the twenty-four-quarter forecast horizon.

Real exchange rate does not respond to any shock emanating from money supply growth, inflation and real GDP growth. Thus, the impacts of money supply growth and real GDP growth on the real exchange rate as observed from the coefficient estimates are not very strong. Its response to its own shock is to increase within the first four quarters after which it assumes a wave like trend above equilibrium path over the rest of the forecast horizon.

Responses of money supply growth to its own one percent standard deviation shock is to increase and remain above its equilibrium level throughout the 12-quarter forecast horizon. To an inflationary shock, money supply growth tends to decline, from the eight to eighteenth quarters during the forecast horizon. The responses of money supply growth to shocks emanating from real exchange rate and real GDP growth are not significant.

5.1.3 Variance Decomposition Analysis for The Gambia

Results tabulated in the variance decomposition tables (Appendix V) reveal that inflation is explained by its own shock and money supply, with inflation and money supply growth explaining 75.4 percent and 24.6 percent, respectively. However, the influence of money supply wanes through to the fifth quarter when it becomes less than 10.0 percent. From the sixth to 12th quarter, real exchange rate changes emerge as a significant driver. Real GDP growth's explanation for variations in inflation is less than 1.0 percent throughout the forecast period. Thus, inflation remains its own principal driver over the 12-quarter forecast period.

Variations in Real GDP growth are due to own shock, explaining about 90.0 percent of the variations in the first quarter and maintains this influence till the 12th quarter of the forecast horizon when it accounts for 75.1 percent of its own variations. The other variable that has appreciable influence on variations in real GDP growth in the Gambia is inflation with 10.3 percent influence in the 3rd quarter and 13.5 percent influence in the 12th quarter of the forecast period.

Variations in real exchange rate depreciation/appreciation are mainly driven by itself (85.3 percent) and inflation (12.1 percent) during the first quarter of the forecast horizon. The two remain the key drivers until the 6th quarter when money supply growth also begins to exert significant influence (14.0 percent) on variations in real exchange rate changes. Real GDP growth becomes an appreciable propeller of variations in real exchange rate depreciation/appreciation during the 11th quarter of the forecast period.

Past values of money supply growth constitute the key driver of its variations up to the fourth quarter when they explain over 90.0 percent of the total variations from the fifth quarter of the forecast horizon, real exchange rate emerges as a significant driver, while inflation becomes a significant driver during the eight quarter of the forecast horizon. By the end of the 12-quarter forecast horizon, inflation and real exchange rates collectively explain just about 37.5 percent of total variations in money supply growth.

5.2 Results for Ghana

5.2.1 VAR Model Results for Ghana

The parsimonious results are presented in Tables 2. In the money supply equation, the adjusted coefficient of determination explains about 90.7 percent of total variations in money supply (2nd Column of Table 2). The model passes all the diagnostic tests conducted. The results show that real money supply growth (GHAM2G) is explained by its own past values. Other variables that explain real money supply growth in Ghana are inflation and real GDP growth. Real exchange rate depreciation or appreciation does not have any significant impact on real money supply growth.

In the inflation model (3rd Column of Table 2), 97.3 percent of the variation in the parsimonious VAR model is explained by the model variables. The estimated model also passes all the key diagnostic tests and thus proves reasonable for discussion. Broad money supply growth has an overall long-run dynamic positive impact on inflation rate in Ghana. The cumulative

coefficient estimate of 0.2 implies cumulative one percent increases in growth of money supply over the past first-two quarters will induce an increase of 0.2 percent in inflation. Inflation also has a dynamic long-run positive impact on itself. This means inflation inertia exists in Ghana, where a cumulative one-percentage point increase in inflation rate over the past six quarters will cause 0.9 percent increase in the current level of inflation. Adaptive inflationary expectation formation in Ghana could explain this inflation inertia. Real depreciation of the cedi has a positive dynamic long-run effect on inflation. Cumulative one-percent increases in real depreciation in the previous fifth and sixth quarters induce 0.01 percent rise in inflation. Real GDP growth impacts significantly on inflation in Ghana. The overall dynamic long-run effect of -0.2 indicates that cumulative one percent increases in real GDP growth over the past fourth-six quarters will cause current inflation rate to reduce by 0.2 percent. Thus, inflation in Ghana can also be described as a structural phenomenon. This is particularly evident when bumper harvests induce a decline in food inflation leading to overall reduction in combined consumer price index.

In the real GDP growth model (5th Column of Table 2), all the model variables achieve explanatory power of 94.0 percent in the parsimonious model. All the key diagnostic tests results show that the results are worth discussing. The result revealed that money supply growth and real depreciation do not impact on real GDP growth. This may suggest the existence of money neutrality in Ghana. Inflation has a dynamic negative long-run effect on real GDP growth. Cumulatively, one percent increases in past six quarters of inflation will bring about 0.01 percent decline in real GDP growth. The dynamic impact of real GDP growth on itself is positive. Cumulative one percent increase in real GDP growth over the past six quarters will induce an increase of 0.8 percent in current real GDP growth.

Table 2: Parsimonious VAR Model Results for Ghana

Dependent Variable	GHAM2G	GHAINF	GHADEP	GHAGDPG
Independent Variable				
GHAM2G(-1)	1.112542 (0.0000)	-0.124214 (0.0470)		
GHAM2G(-2)		0.279390 (0.0000)		
GHAM2G(-3)	-0.290876 (0.0017)			
GHAM2G(-4)	-0.701581 (0.0000)		-0.547645 (0.0003)	
GHAM2G(-5)	0.809974 (0.0000)		0.828768 (0.0001)	
GHAM2G(-6)	-0.225388 (0.0011)		-0.317111 (0.0151)	
GHAINF(-1)		1.104226 (0.0000)	-0.090244 (0.0583)	-0.012409 (0.0176)
GHAINF(-2)				
GHAINF(-3)	-0.111275 (0.0034)			
GHAINF(-4)		-0.651762 (0.0000)	-0.571348 (0.0000)	0.056360 (0.0000)
GHAINF(-5)		0.745596 (0.0000)	0.799929 (0.0000)	-0.084606 (0.0000)
GHAINF(-6)		-0.272567 (0.0000)	-0.295369 (0.0102)	0.033903 (0.0000)
GHADEP(-1)			1.262066 (0.0000)	
GHADEP(-2)			-0.277259 (0.0080)	
GHADEP(-3)				
GHADEP(-4)			-0.337219 (0.0041)	
GHADEP(-5)		-0.100877 (0.0384)	0.215762 (0.0249)	
GHADEP(-6)		0.109199 (0.0179)		
GHAGDPG(-1)				1.442564 (0.0000)
GHAGDPG(-2)				-0.539927 (0.0000)
GHAGDPG(-3)				
GHAGDPG(-4)	2.031249 (0.0001)	-2.505873 (0.0000)	-1.020378 (0.0124)	-0.398389 (0.0000)
GHAGDPG(-5)	-2.189601 (0.0000)	3.265292 (0.0000)		0.460683 (0.0001)
GHAGDPG(-6)		-0.992676 (0.0405)		-0.168387 (0.0185)
CONSTANT	7.357786 (0.0003)	0.645953 (0.7720)	9.551611 (0.0040)	1.203331 (0.0011)
R-Squared	0.913724	0.975348	0.937524	0.940090
R-Squared adjusted	0.906958	0.972609	0.929874	0.934751
F-statistic & prob	135.0320 (0.0000)	356.0886 (0.0000)	122.5504 (0.0000)	176.0954 (0.0000)

Source: WAMI Staff Computations

In the exchange rate model, the coefficient of determination is 0.9298 (4th Column of Table 2). The model passes all the key diagnostic tests and

is worthy of discussion. The results show that money supply growth has a dynamic negative long-run effect on real exchange rate

depreciation. Cumulative one percent increases in money supply in the past fourth to six quarters will cause 0.4 percent real appreciation of the local currency. This relationship violates the a priori expectation of the study that real money supply growth should induce real exchange rate depreciation. However, this relationship can be explained, that in the case of Ghana, domestic inflation rate is higher than that of the rest of the world proxied by the US producer price index. Further, the domestic inflation rate for the past one decade has been greater than the nominal rate of depreciation. Thus, while real money supply growth has been increasing, the rate of nominal depreciation and the rate of inflation in the rest of the world have been lagging behind, thereby, causing real appreciation of the local currency, the cedi. This explanation is buttressed by the overall dynamic negative net effect of inflation on real exchange rate depreciation. The cumulative net coefficient estimate of -0.157 implies that cumulative one percent increases in inflation over the past six quarters will cause the current real exchange rate to appreciate by 0.2 percent.

Real exchange rate has a dynamic positive effect on itself in Ghana. The cumulative coefficient estimate of 0.863 implies one percent increases in real exchange rate depreciation over the past six quarters will induce 0.9 percent increase in the current real exchange rate depreciation. Turning to real GDP growth, its impacts on real exchange rate depreciation negative as indicated by the coefficient estimate of -1.02 of the fourth lag of real GDP growth. This means a one percent increase in the fourth lag of real GDP growth will induce 1.0 percent appreciation of the real exchange rate. Although this finding tends to be at variance with established economic theory, it can be rationalised in the case of Ghana. High real GDP growth rates tend to coincide with relatively high inflation rates in Ghana, thus, real GDP growth tends to appreciate real exchange rate in Ghana, overruling the consumption-import effect of increasing income on real exchange rate.

The dynamic cumulative long-run impact of money supply growth on itself is 0.7, implying

that cumulative one percent increases in growth in broad money supply over the third-to-sixth quarters will cause 0.7 percentage point increase in current money supply growth. Thus, in Ghana, money supply growth generates a positive inertia. The third lag of inflation rate impacts negatively on money supply growth. The coefficient of 0.1113 indicates that a one-percent rise in inflation will induce 0.1 percent decline in money supply growth. This suggests that monetary authorities in Ghana react to inflationary dynamics. A rising inflation implies a reduction in money supply growth to contain it. Real GDP growth has a dynamic long-run negative impact on money supply. The cumulative coefficient of -0.2 implies one percent increases in real GDP growth over the past fourth and fifth quarters induce a decline in current money supply growth of 0.2 percent. This relationship could be explained by the fiscal consolidation and monetary contraction that takes place to arrest inflationary pressures in a rapidly expanding economy.

5.2.2 Impulse Response Function Analysis for Ghana

The impulse response graphs for Ghana (see Appendix IV) indicate that response of inflation to one standard deviation shock in money supply growth is to decline initially during the first-three quarters before rising thereafter towards the equilibrium level in the fourth and fifth quarters of the forecast period. Although this result appears to be inconsistent with theoretical postulations, it can be rationalised as follows: increasing real money supply growth may partly suggest that the price level rises more slowly than nominal money stock, hence the decline in inflation as observed. To its own shock, inflation responds by increasing steadily through the first nine quarters. This may also be attributed to the lag in monetary policy transmission mechanism such that monetary policy intervention with regard to the general price level produces a delayed impact before becoming constant through the 12th forecast period. To shocks coming from real exchange rate depreciation and real GDP growth, inflation does not respond significantly.

Responses of real GDP growth to innovations in real money supply growth and real exchange rate depreciation are not significant. However, real GDP growth tends to decline in the presence of inflationary shocks throughout the forecast horizon. To its own innovations, real GDP growth responds positively by increasing initially during the first-six quarters before declining slightly but remaining above the equilibrium level through the rest of the forecast period.

Real exchange rate depreciation responds positively to shocks emanating from real money supply growth up to the eighth quarter, inflation up to sixth quarter, and itself throughout the forecast horizon. It, however, does not respond to innovations of real GDP growth.

The accumulated responses of money supply growth to its own one percent standard deviation shock is to increase over the first-five quarters of the forecast period and thereafter decline gently but remaining above the equilibrium line through the 12th quarter of the forecast horizon. Money supply growth declines in response to inflationary shock from sixth quarter and remain below the equilibrium level through to the 12th quarter of the forecast period. Money supply growth responses to shocks emanating from real exchange rate depreciation and real GDP growth are not significant throughout the forecast period.

5.2.3 Variance Decomposition Analysis for Ghana

Results of the variance decomposition of inflation show that its past values and money supply are the principal drivers with inflation and money supply growth explaining 62.5 percent and 37.5 percent, respectively, of the total variations in inflation. Again, as is the case of the Gambia, the influence of money supply wanes from the third quarter through to 12th quarter. Real GDP growth explains about 10.2 percent of variations in inflation at the 12th quarter of the forecast period. Inflation, however, remains its own principal driver over the forecast horizon.

With regard to variance decomposition of real GDP growth, inflation explains about 10.0 percent of variations during the sixth and ninth

quarters. Essentially, real GDP growth remains its own driver throughout the forecast horizon.

Turning to real exchange rate depreciation/appreciation, money supply growth and inflation in addition to itself, are significant drivers of variations in the real exchange rate depreciation. At the initial stage, variations are explained by real exchange rate itself (50.6 percent), money supply growth (23.2 percent) and inflation (26.2 percent). Real GDP growth emerges a significant contributor to the variations in real exchange rate depreciation/appreciation during the 9th quarter of the forecast period and grows in influence through the 12th quarter.

Real money supply growth remains the dominant driver of itself as it explains over 90.0 percent of variations in itself during the first-six quarters. Inflation only immerge at the 8th quarter of the forecast period as an influential factor (10.7 percent) driving variations in real money supply growth and maintain this influence through the 12th quarter of the forecast horizon. Real depreciation remains non-influential throughout the forecast period, while real GDP growth becomes influential only at the 12th quarter.

5.3 Results for Guinea

5.3.1 VAR Model Results for Guinea

The general VAR model results for Guinea are presented in Table 3 and the result shows an explanatory power of 95.1 percent. The model was tested for all the key assumptions underlying the estimation procedure and none of them was violated.

The inflation model has an explanatory power of 97.6 percent in the parsimonious VAR model (3rd Column of Table 3). The key diagnostic tests results indicate the model passes for discussion. Inflation inertia exists in Guinea and all the other three model variables have significant dynamic impact on inflation. The fifth lag of broad money supply growth has a long-run dynamic positive impact on inflation rate in Guinea. The magnitude of the coefficient estimate show that a one-percent increases in broad money supply growth will cause inflation to rise by 0.1 percent. Inflationary dynamics show that a cumulative one percent increases in inflation over the past six quarters will cause the current level of

inflation to increase by 0.9 percent. The fifth lag of real exchange rate depreciation carries a significant positive coefficient suggesting that a one-percent increase in exchange rate depreciation will induce 0.05 percent increase in inflation. Real GDP growth has a significant dynamic negative long-run impact on inflation. The coefficient of the first lag of real GDP growth indicates that a one percent rise in real GDP growth will cause inflation to decline by 0.3 percent. This suggests that inflation is also a structural phenomenon in Guinea

The real GDP growth model has an explanatory power of 90.2 percent as shown in the 5th Column of Table 3. The model passes all the key diagnostic tests and is, therefore, worthy of discussion. The significant variables in the real

GDP growth equation are money supply growth, inflation and past values of real GDP growth. The net dynamic effect of money supply growth on real GDP growth is negative. More specifically, one percent increases in money supply growth over the past six quarters will cause real GDP growth to decline by 0.01 percent in the current quarter. Inflation also had a negative impact on real GDP growth. Specifically, a one percent rise in inflation in the previous fourth quarter will induce 0.02 percent decline in real GDP growth in the current quarter. Real GDP growth has a positive inertia such that the overall net effect of one percent increase in its own past values will cause the current real GDP growth to increase by 0.9 percent.

Table 3: Parsimonious VAR Model Results for Guinea

Dependent Variable	GUIM2G	GUINF	GUIDEP	GUIGDPG
Independent Variable				
GUIM2G(-1)	1.713814 (0.0000)			
GUIM2G(-2)	-0.750053 (0.0000)			
GUIM2G(-3)				
GUIM2G(-4)	-0.922740 (0.0000)	-0.058823 (0.1468)	-0.595832 (0.0006)	-0.050836 (0.0001)
GUIM2G(-5)	1.562197 (0.0000)	0.083859 (0.0385)	0.808603 (0.0022)	0.068525 (0.0004)
GUIM2G(-6)	-0.758139 (0.0000)		-0.326158 (0.0751)	-0.024627 (0.0784)
GUINF(-1)		1.660775 (0.0000)		
GUINF(-2)		-0.586239 (0.0001)		
GUINF(-3)				
GUINF(-4)		-0.803756 (0.0000)	-0.975513 (0.0052)	-0.016295 (0.0371)
GUINF(-5)	-0.106172 (0.0530)	1.160161 (0.0000)	1.570554 (0.0090)	
GUINF(-6)		-0.493656 (0.0000)	-0.875392 (0.0125)	
GUIDEP(-1)			1.477276 (0.0000)	
GUIDEP(-2)			-0.548533 (0.0000)	
GUIDEP(-3)				
GUIDEP(-4)		0.035863 (0.1704)	-0.574555 (0.0001)	
GUIDEP(-5)	-0.039295 (0.1069)	0.049951 (0.0517)	0.794207 (0.0002)	
GUIDEP(-6)			-0.368758 (0.0044)	
GUIGDPG(-1)		-0.335236 (0.0227)	-1.448993 (0.0174)	1.318304 (0.0000)
GUIGDPG(-2)	-1.049269 (0.0326)			-0.386531 (0.0086)
GUIGDPG(-3)				
GUIGDPG(-4)	2.906705 (0.0000)		4.761507 (0.0011)	-0.520041 (0.0001)
GUIGDPG(-5)	-4.562393 (0.0000)		-8.780497 (0.0000)	0.508024 (0.0021)
GUIGDPG(-6)	1.636899 (0.0101)		3.693359 (0.0029)	-0.153481 (0.1407)
CONSTANT	6.790693 (0.0391)	1.838651 (0.0276)	11.10215 (0.0210)	1.078722 (0.0068)
R-Squared	0.957698	0.979109	0.929019	0.911979
R-Squared adjusted	0.951410	0.976323	0.913809	0.901556
F-statistic & prob	152.3033 (0.0000)	351.5055 (0.0000)	61.07875 (0.0000)	87.49274 (0.0000)

Source: WAMI Staff Computations

Real exchange rate depreciation model has an explanatory power of 91.4 percent in the parsimonious VAR framework (4th Column of Table 3). The model passes all the diagnostic tests, implying the results are worth analysing. The money supply growth variable has a cumulative dynamic impact of -0.113, suggesting that cumulative one percent growth in broad money supply will induce 0.1 percent real appreciation of the Guinean Franc. This relationship is explained by the fact that high money growth causes inflation to rise to a level higher than that of the rest of the world, thereby, causing real appreciation of the exchange rate. Inflationary impact on real exchange rate is

cumulative negative of 0.3, suggesting that one percent increases in inflation in the past six quarters will induce 0.3 percent appreciation of the real exchange rate. Real depreciation has a dynamic positive impact on itself as one percent increases in the past six quarters will cause the current level of depreciation to increase by 0.8 percent. Real GDP growth is another significant variable in the real depreciation equation. The cumulative impact of one percent increases in real GDP growth over the past six quarters is a 1.8 percent appreciation of the real exchange rate. This relationship is explained by the co-movement of inflation and growth in Guinea.

The results in 2nd column of Table 3 indicate that real money supply growth (GUIM2G) is impacted by its own past values. The dynamic cumulative long-run impact of money supply growth on itself is 0.8, implying that cumulative one percent increases in broad money supply growth over the first-two, fourth–six quarters will cumulatively induce 0.8 percent increase in current money supply growth. This means, in Guinea, previous money supply growth rates will perpetuate current growth rates. The fifth lag of inflation (GUIINF) rate has significant negative impact on money supply growth. The value of the coefficient estimate implies that a one-percent rise in inflation will induce 0.1 percent decline in money supply growth. This suggests that inflation enters the reaction function of the monetary authorities in Guinea such that money supply growth falls in the face of rising inflation. Another variable in the parsimonious money supply equation is real exchange rate depreciation (GUIDEP) but it is not statistically significant at the conventional levels. Real GDP growth (GUIGDPG) also has a dynamic long-run negative impact on money supply in Guinea. Cumulatively, one percent increases in real GDP growth over the past six quarters will cause money supply growth to shrink by 1.1 percent. As in Ghana, this relationship could be explained by the fact that measures are periodically taken to arrest inflationary pressures that coincide with expansion in the Guinean economy.

5.3.2 Impulse Response Function Analysis for Guinea

From the impulse response graphs for Guinea (see Appendix IV), response of inflation to one standard deviation shock in money supply growth is to increase above the equilibrium path throughout the forecast period. Inflation also responds to its own innovations by increasing steadily throughout the forecast period. Innovations of real exchange rate depreciation and real GDP growth do not elicit any response from inflation.

Real GDP growth responds negatively to shocks emanating from real money supply growth throughout the forecast period. Responses of real GDP growth to inflation and real exchange rate

depreciation are insignificant. To its own innovations, real GDP growth responds positively during the first-eight quarters.

Real exchange rate depreciation responds to shocks emanating from real money supply growth by increasing above its equilibrium path during the first-six quarters, and thereafter becomes insignificant. Real depreciation also responds positively to its own innovations during the first-nine quarters of the forecast horizon. It, however, does not respond to innovations of inflation and real GDP growth.

Accumulated response of money supply growth to its own one percent standard deviation shock is to increase over the first-six quarters of the forecast period and remain stable above the its equilibrium path thereafter. Money supply growth does not respond to inflationary shock throughout the 12-quarter forecast horizon. Money supply growth, however, responds to real exchange rate depreciation innovations by declining gently over the forecast period. Innovations of real GDP growth do not elicit any response from money supply growth.

5.3.3 Variance Decomposition Analysis for Guinea

Variance decomposition of real money supply growth (Appendix V) shows that past inflation is the dominant driver of itself in the first quarter. However, from the second quarter, money supply growth becomes influential in explaining variations in inflation. By the end of the 12th quarter of the forecast horizon, money supply growth becomes the dominant factor driving inflation, contributing 56.9 percent of total variations in inflation. Inflation becomes the second dominant driver of its own variations with a percentage contribution of 31.9 percent. Real exchange rate depreciation and real GDP growth do not exert any significant influence on variations in inflation.

Variance decomposition of real GDP growth is explained partly by itself (56.2 percent), real exchange rate depreciation (21.8 percent) and inflation (16.9 percent) during the first quarter of the forecast period. By the fifth quarter, money supply growth emerges as influential propeller of

variations in real exchange rate depreciation. By the end of the forecast period, money supply growth becomes the dominant factor driving real GDP growth.

At the initial stage, real exchange rate depreciation or appreciation is the dominant driver of its own variations (77.4 percent), followed by broad money supply growth (19.6 percent). By the end of the 7th quarter, real GDP growth emerges as an influential factor explaining (11.1 percent) variations in real depreciation. Inflation also assumes a significant role by the 9th quarter of the forecast period. At the 12th quarter, all the model variables become drivers of real exchange rate depreciation.

Money supply growth is its own driver during the first-six quarters of the forecast horizon. Real exchange rate depreciation becomes significant in the 7th quarter, while inflation emerges significant in the tenth quarter. At the 12th quarter, money supply remains the dominant propeller of its own variations followed by inflation and real exchange rate depreciation. Real GDP growth does not influence variations in real money supply growth.

5.4 Results for Liberia

5.4.1 VAR Model Results for Liberia

The parsimonious results are presented in Tables 4. The inflation model has explanatory power of 95.1 percent as indicated in the 3rd Column of Table 4. The parsimonious model passes all the key diagnostic tests and, therefore, can be analysed. All the model variables, real money supply growth (LIBM2G), real exchange rate depreciation (LIBDEP) and real GDP growth (LIBGDPG), have dynamic impacts on the current inflation rate (LIBINF). The cumulative net effect of broad money supply growth on inflation is 0.008; suggesting real money supply growth causes inflation to increase. Inflation exerts some positive inertia such that cumulative one-percent increases in inflation in the past six quarters will induce 0.9 percent increase in the current inflation rate. For real exchange rate depreciation, it has a dynamic positive net effect on inflation. Cumulatively, one-percent increases in real depreciation will cause the current inflation rate to increase by 0.003 percent. The

dynamic net effect of real GDP growth on inflation is negative, suggesting that cumulative one-percent increases in real GDP growth will cause inflation to decline by 0.02 percent. The dummy variable is not significant in the inflation equation, suggesting that the war period did not cause major structural change in inflationary trend in Liberia.

The real GDP growth model has explanatory power of 96.0 percent. All the key diagnostic tests results show that the results are worth discussing. Turning to the parsimonious model results in the 5th Column of Table 4, all the model variables affect real GDP growth in Liberia. Money supply growth has a dynamic positive impact on real GDP growth. Cumulatively, one-percent increases in real money supply growth over the past six quarters induces 0.03 percent rise in the current real GDP growth. Inflation also has a net positive dynamic effect on real GDP growth such that cumulative one-percent increases in inflation induces 0.05 percent rise in real GDP growth. Real exchange rate depreciation has a negative impact on real GDP growth. One-percent depreciation in the past induces 0.1 percent decline in real GDP growth. Real GDP growth generates positive inertia such that cumulative one-percent increases in real GDP growth in the past causes the current GDP growth rate to increase by 1.1 percent. Again the two dummy variables are not significant in the GDP growth equation.

The real exchange rate depreciation model has a coefficient of determination of 0.958 in the parsimonious VAR framework (4th Column of Table 4). The model passes all the diagnostic tests and the results are worth discussing. First of all, money supply growth has a positive impact on real exchange rate depreciation which is consistent with a priori expectation. A one-percent increase in broad money supply growth induces 0.1 percent depreciation of the real exchange rate. Inflation exerts dynamic net negative effect on real depreciation. Cumulative one-percent increases in inflation over the past six quarters will generate 0.4 percent appreciation in the current real exchange rate. Cumulative one-percent increases in the past levels of real exchange rate depreciation induce

0.6 percent depreciation of the current real exchange rate. Real GDP growth impacts negatively on real depreciation in the long run. A

one-percent increase in real GDP growth in the past brings about 0.3 percent appreciation in the current real exchange rate.

Table 4: Parsimonious VAR Model Results for Liberia

Dependent Variable	LIBM2G	LIBINF	LIBDEP	LIBGDPG
Independent Variable				
LIBM2G(-1)	1.549408 (0.0000)			
LIBM2G(-2)	-0.572773 (0.0000)			
LIBM2G(-3)				
LIBM2G(-4)	-0.660069 (0.0000)	0.124915 (0.0000)	0.112651 (0.0470)	-0.367459 (0.0000)
LIBM2G(-5)	0.994060 (0.0000)	0.204804 (0.0000)	-0.074236 (0.1827)	0.643407 (0.0000)
LIBM2G(-6)	-0.425825 (0.0000)	0.072119 (0.0028)		-0.248051 (0.0000)
LIBINF(-1)		1.539611 (0.0000)	-0.203251 (0.0326)	
LIBINF(-2)		-0.541302 (0.0000)		
LIBINF(-3)				
LIBINF(-4)	-2.120256 (0.0000)	-0.807672 (0.0000)	-0.882478 (0.0004)	0.688253 (0.0093)
LIBINF(-5)	3.310450 (0.0000)	1.157154 (0.0000)	1.228686 (0.0007)	-1.123321 (0.0063)
LIBINF(-6)	-1.447645 (0.0000)	-0.471876 (0.0000)	-0.544762 (0.0090)	0.480772 (0.0459)
LIBDEP(-1)	-0.077530 (0.0985)		1.369306 (0.0000)	-0.085399 (0.1259)
LIBDEP(-2)			-0.545822 (0.0000)	
LIBDEP(-3)				
LIBDEP(-4)		-0.068139 (0.0131)	-0.781160 (0.0000)	
LIBDEP(-5)		0.114866 (0.0050)	1.017648 (0.0000)	-0.134401 (0.0251)
LIBDEP(-6)		-0.043518 (0.0885)	-0.431858 (0.0000)	
LIBGDPG(-1)				1.629658 (0.0000)
LIBGDPG(-2)				-0.589315 (0.0000)
LIBGDPG(-3)				
LIBGDPG(-4)	0.286585 (0.0000)	-0.091937 (0.0000)	0.397047 (0.0000)	-0.785238 (0.0000)
LIBGDPG(-5)	-0.393480 (0.0001)	0.132809 (0.0000)	-0.530966 (0.0000)	1.261809 (0.0000)
LIBGDPG(-6)	0.115317 (0.0792)	-0.059191 (0.0038)	0.213509 (0.0019)	-0.462558 (0.0000)
CONSTANT	2.665201 (0.0171)	0.178925 (0.5850)	0.891653 (0.3381)	-0.329359 (0.7710)
DUM	-1.178680 (0.3152)	0.106256 (0.7839)	0.308356 (0.7882)	1.245119 (0.3987)
R-Squared	0.965330	0.957813	0.964112	0.965642
R-Squared adjusted	0.960427	0.950854	0.958193	0.960383
F-statistic & prob	196.8924 (0.0000)	137.6421 (0.0000)	162.8666 (0.0000)	183.6231 (0.0000)

Source: Author's Computations

The explanatory power of the money supply equation in the parsimonious VAR is 96.0 percent. The money supply model passes all the diagnostic tests conducted. Money supply growth generates net positive inertia. The cumulative dynamic long-run impact of past values of money supply growth on the current growth rate is 0.9. This means cumulative one percent increases in broad money supply growth over the past six quarters will cause the current broad money supply growth to increase by 0.9

percent. Inflation has a dynamic negative long-run effect on money supply growth. Cumulatively, one percent increases in inflation rate over the past quarters will induce a decline of 0.3 percent on broad money supply growth. Thus, inflation enters the reaction function of the monetary authorities in Liberia. The first lag of real exchange rate depreciation also has significant negative effect on money supply growth. The magnitude of the coefficient estimate indicates that a one-percent increase in

real depreciation in the previous quarter will bring about a reduction in money supply growth rate by 0.1 percent. This also suggests that real exchange rate depreciation enters the reaction function of monetary authorities in Liberia. Indeed, in Liberia, monetary policy framework focuses on exchange rate targeting. Real GDP growth in Liberia has a dynamic net positive effect on money supply. This probably points to a situation where monetary authorities adjust their monetary targets to accommodate GDP growth. The coefficient of the second dummy variable is statistically significant at 6.0 percent, implying that a shift to flexible exchange rate regime has caused a parallel upward shift in the money supply growth in Liberia. The war dummy has no significant effect on money supply growth in Liberia.

5.4.2 Impulse Response Function Analysis for Liberia

The impulse response graphs for Liberia (Appendix IV) shows that inflation responds to shocks emanating from money supply growth by increasing steadily during the first-eight quarters before turning insignificant towards the end of the forecast period. Thus, money supply growth causes inflation to rise in Liberia. Response of inflation to its own shock is positive throughout the forecast period. Inflation, however, does not respond to shocks emanating from real exchange rate depreciation and real GDP growth.

Real GDP growth responds negatively to innovations in real money supply growth and inflation up to at least the seventh quarter of the forecast period. It also responds positively to itself throughout the forecast period. It, however, does not respond to shocks emanating from real exchange rate depreciation.

Real exchange rate depreciation responds positively to innovations in real money supply growth up to the seventh quarter, real GDP growth and itself throughout the forecast horizon. It, however, responds negatively to innovations of inflation between the sixth and eleventh quarter.

The accumulated response of money supply growth to its own innovation is to increase over the first-five quarters of the forecast period and thereafter remains constant through the 12th quarter of the forecast horizon. No other shocks elicit response from money supply growth in Liberia.

5.4.3 Variance Decomposition Analysis for Liberia

The variance decomposition results (Appendix V) indicate that inflation is the principal driver of itself throughout the forecast period. The only variable that comes close to becoming influential is the real exchange rate depreciation.

Real GDP growth and inflation are the principal drivers of variations real GDP growth with initial contributions of 54.0 and 33.1 percent, respectively. Overtime money supply growth emerges as one of the key drivers of real GDP growth. However, by the close of the forecast period, real GDP growth strengthens itself as the principal driver, contributing about 68.0 percent of its own total variations.

In the case of real exchange rate depreciation/appreciation, money supply growth and itself are the dominant drivers. Inflation and real GDP growth emerge later to be drivers of variations in real exchange rate depreciation. By the end of the forecast period, inflation becomes the dominant driver (37.5 percent), followed by real GDP growth (28.4 percent), depreciation itself (17.2 percent) and money supply growth (16.8 percent).

Real money supply growth remains the dominant driver of itself at initial stages explaining over 90.0 percent of its own total variation on average. However, from the 7th quarter, inflation and real GDP growth emerge as influential factors explaining variation in money supply growth. This suggests that inflation and growth enter the reaction function of monetary authorities in Liberia.

5.5 Results for Nigeria

5.5.1 VAR Model Results for Nigeria

Table 5 presents the parsimonious results.

In the inflation equation, the coefficient of determination is 95.9 percent. All the key diagnostic tests show that the model is correctly specified and hence the results are worthy of discussion. The monetary variable is insignificant indicating that real money supply growth does not significantly explain inflation in Nigeria. Past inflation rates have dynamic positive effect on current inflation rate such that cumulative one-percent increases in inflation rates in the past will induce 1.1 percent increase in current rate of inflation in Nigeria. Real depreciation has dynamic positive net effect on inflation in Nigeria. Cumulatively, one percent depreciation of the real exchange rate will result in 0.03 percent rise in current rate of inflation. Real GDP growth does not explain inflation in Nigeria.

The explanatory power of the real GDP growth equation in the parsimonious VAR model is 91.8 percent. The model passes all the diagnostics tests and the results are worthwhile discussing (5th Column of Table 5). Money supply growth has a dynamic positive long-run impact on GDP growth. A percentage increase in money supply

growth in previous quarters will bring about 0.002 percent rise in real GDP growth in Nigeria. Inflation has a dampening dynamic long-run impact on growth with a percentage rise in inflation in the past producing 0.1 percent decline in real GDP growth in the current period. Real GDP growth itself exerts growth inertia such that cumulative one-percent rise in real GDP growth in the past induces 0.9 percent rise in the current growth rate of GDP.

The variables in the exchange rate equation explain about 93.6 percent of total variations in real exchange rate movement. The results of the diagnostic tests show that none of the underlying assumptions have been violated. The significant explanatory variables are money supply growth, inflation and depreciation itself. Real GDP growth does not explain real exchange rate depreciation in Nigeria. Cumulatively, a percentage increase in real money supply growth in the past will result in 0.1 percent appreciation of the real exchange rate. Similarly, a rise in inflation in past will cause real exchange rate to appreciate by 0.1 percent in the current period. For past rates of depreciation, Cumulative one percent increases in the past six quarters will induce 0.8 percent further depreciation in the current period.

Table 5: Parsimonious VAR Model Results for Nigeria

Dependent Variable	NIGM2G	NIGINF	NIGDEP	NIGGDPG
Independent Variable				
NIGM2G(-1)	1.495612 (0.0000)			
NIGM2G(-2)	-0.484736 (0.0000)			
NIGM2G(-3)				
NIGM2G(-4)	-0.650050 (0.0000)	0.136245 (0.1074)	-0.525894 (0.0002)	0.253178 (0.0000)
NIGM2G(-5)	0.929697 (0.0000)	-0.207252 (0.1385)	0.787549 (0.0005)	-0.451348 (0.0000)
NIGM2G(-6)	-0.403118 (0.0000)	0.095186 (0.2627)	-0.371113 (0.0068)	0.200022 (0.0005)
NIGINF(-1)		1.422727 (0.0000)		
NIGINF(-2)		-0.301348 (0.0612)	-0.118191 (0.0431)	
NIGINF(-3)		-0.104049 (0.5065)		
NIGINF(-4)	-0.357812 (0.0004)	-0.351921 (0.0387)		0.191203 (0.0032)
NIGINF(-5)	0.648526 (0.0002)	0.357029 (0.0584)		-0.294875 (0.0087)
NIGINF(-6)	-0.320996 (0.0023)	-0.064685 (0.5620)	-0.098269 (0.1600)	0.108027 (0.1039)
NIGDEP(-1)			1.464749 (0.0000)	
NIGDEP(-2)			-0.498881 (0.0000)	
NIGDEP(-3)				
NIGDEP(-4)	0.129224 (0.0006)	-0.072600 (0.0367)	-0.706021 (0.0000)	
NIGDEP(-5)	-0.200132 (0.0009)	0.100756 (0.0041)	0.955438 (0.0000)	
NIGDEP(-6)	0.063020 (0.1028)		-0.403303 (0.0000)	
NIGGDPG(-1)				1.543455 (0.0000)
NIGGDPG(-2)				-0.542724 (0.0000)
NIGGDPG(-3)				
NIGGDPG(-4)	-0.615371 (0.0000)			-0.804109 (0.0000)
NIGGDPG(-5)	1.036576 (0.0000)	-0.059196 (0.2134)		1.157564 (0.0000)
NIGGDPG(-6)	-0.325307 (0.0136)			-0.470717 (0.0000)
CONSTANT	1.061342 (0.1994)	1.026395 (0.2559)	4.854293 (0.0090)	0.324553 (0.5151)
R-Squared	0.969170	0.963598	0.941534	0.925919
R-Squared adjusted	0.964810	0.959273	0.935858	0.917930
F-statistic & prob	222.2961 (0.0000)	222.7979 (0.0000)	165.8715 (0.0000)	115.8980 (0.0000)

Source: Author's Computations

Considering the money supply equation, it has explanatory power of 96.5 percent. The model passes all the diagnostic tests conducted and the results are worth discussing. All the variables, inflation (NIGINF), real exchange rate depreciation (NIGDEP) and real GDP growth (NIGGDPG) have statistically significant impacts on broad money supply growth (NIGM2G) in Nigeria (2nd Column of Table 5).

Money supply growth has dynamic positive net effect on itself. Cumulative one percent increases in money supply growth in the past causes the current money supply growth to increase by 0.9 percent. The cumulative dynamic net effect of inflation on money supply growth is -0.03, implying that cumulative one-percent increases in inflation will bring about a reduction in money supply growth by 0.03 percent. This suggests that monetary authorities in Nigeria factor inflation into their monetary policy reaction function. The dynamic long-run impact of real exchange rate depreciation on money supply growth is negative. Specifically, one percent depreciation of the real exchange rate induces a contraction in real money supply growth by 0.07 percent. For real GDP growth, a one percent rise in its past values will cause real money supply growth to increase by 0.09 percent. This suggests that monetary authorities in Nigeria adjust their money stock in response to the level of real GDP growth.

5.5.2 Impulse Response Function Analysis for Nigeria

In Nigeria, response of inflation to one standard deviation shock in money supply growth is statistically significant but below its equilibrium path. This, as explained in the case of Ghana, may be due to the lag effect of monetary policy on the general price level and the fact that inflation might be more of a structural phenomenon. Further, the response of inflation to its own shock is statistically significant and positive. To shocks emanating from real exchange rate depreciation and real GDP growth, inflation does not respond.

Real GDP growth responds to only its own one standard deviation shocks by increasing above the equilibrium level. This also confirms the

growth inertia observed from the coefficient estimates. All other innovations do not elicit any response from real GDP growth.

For real exchange rate depreciation, it responds positively to shocks emanating from real money supply growth up to the 7th quarter, negatively to inflation throughout the forecast period, and positively to itself throughout the forecast horizon. It, however, does not respond to shocks coming from real GDP growth.

The impulse response of real money supply growth (see Appendix IV) to its own innovation is significantly positive throughout the forecast period, confirming the money supply growth inertia observed from the coefficient estimates. However, it does not respond to shocks emanating from other model variables such as inflation, depreciation and GDP growth.

5.5.3 Variance Decomposition Analysis for Nigeria

Results of the variance decomposition of inflation show that itself and money supply are the principal drivers throughout the forecast period. The initial contribution of inflation is 62.7 percent but this decline steadily to 61.0 percent by the end of the 12th quarter. Money supply growth contributes 37.3 percent to total variations in inflation during the first quarter of the forecast period but its contribution declines to 23.1 percent by the end of the forecast period. Depreciation and GDP growth do not have any appreciable explanation for inflation.

For real GDP growth, no other variable exerts significant influence on it except itself throughout the forecast period. It starts by explaining 92.9 percent and continue with marginal losses till the 12th quarter when it explains 84.4 percent of its own variations.

Real exchange rate depreciation or appreciation also remains its own principal driver throughout the forecast period, albeit shedding off some amount of its contribution from 88.1 percent in the first quarter to 59.0 percent in the 12th quarter. Money supply is the second dominant driver of real depreciation at the initial stage (11.1 percent) but it is overtaken by inflation as the second principal driver of real depreciation by the 9th quarter of the forecast horizon. By the

end of the forecast period, inflation explains 25.8 percent, while money supply growth explains 12.9 percent of variations in real depreciation.

Variance decomposition of real money supply growth (see Appendix V) indicates that its main driver is itself for the throughout the forecast period. In the initial quarter it explains 100 percent of its total variations. It is only in the 11th quarter that real GDP growth emerges as propeller of real money supply growth. This suggests that it is only growth that enters the monetary policy reaction function of the monetary authorities in Nigeria.

5.6 Results for Sierra Leone

The general model results which are presented in Table 6 indicate that the inflation model in the parsimonious VAR framework has a coefficient of determination of 0.960 (3rd Column of Table 6). The estimated model also passes all the key diagnostic tests and thus proves worthy of discussion. The key variables that affect inflation

in the long run are the past rates of inflation (SIEINF), real exchange rate depreciation (SIEDEP) and real GDP growth (SIEGDPG). Money supply growth (SIEM2G) does not significantly impact on inflation in Sierra Leone. The cumulative net dynamic effect of inflation on itself is 1.02, implying one percent increases in inflation over the past six quarters will result in 1.02 percent increase in the current rate of inflation. Real depreciation has a positive dynamic effect on inflation such that one-percent real depreciation of the Leone in the previous first and fourth quarters induces 0.15 percent increase in the current rate of inflation. For real GDP growth, its net dynamic impact on inflation is negative. That is, one percent increases in real GDP growth in the past fourth and fifth quarters will bring about 0.24 percent decline in current rate of inflation. This suggests that inflation is not a monetary phenomenon but a structural phenomenon in Sierra Leone.

5.6.1 VAR Model Results for Sierra Leone

Table 6: Parsimonious VAR Model Results for Sierra Leone

Dependent Variable	SIEM2G	SIEINF	SIEDEP	SIEGDPG
Independent Variable				
SIEM2G(-1)	1.255209 (0.0000)			
SIEM2G(-2)	-0.276206 (0.0293)			0.022121 (0.1345)
SIEM2G(-3)				
SIEM2G(-4)	-0.683352 (0.0000)			0.050584 (0.0966)
SIEM2G(-5)	0.687302 (0.0008)			0.106988 (0.0047)
SIEM2G(-6)	-0.201737 (0.0807)			0.055361 (0.0135)
SIEINF(-1)		1.337614 (0.0000)		
SIEINF(-2)		-0.291932 (0.0052)		
SIEINF(-3)				
SIEINF(-4)	-0.226124 (0.0130)	-0.548905 (0.0000)	-0.175170 (0.0124)	
SIEINF(-5)	0.299282 (0.0487)	0.773411 (0.0000)		
SIEINF(-6)	-0.149061 (0.1042)	-0.252098 (0.0016)		
SIEDEP(-1)		0.076228 (0.0000)	1.281324 (0.0000)	
SIEDEP(-2)	-0.028405 (0.0602)		-0.418884 (0.0001)	
SIEDEP(-3)				
SIEDEP(-4)	-0.088579 (0.0054)	0.071049 (0.0019)	-0.834288 (0.0000)	
SIEDEP(-5)	0.133155 (0.0031)		0.971660 (0.0000)	
SIEDEP(-6)	-0.079727 (0.0094)		-0.409028 (0.0000)	
SIEGDPG(-1)	0.191237 (0.1486)			1.464367 (0.0000)
SIEGDPG(-2)				-0.379280 (0.0047)
SIEGDPG(-3)				
SIEGDPG(-4)	-0.662600 (0.0703)	0.807861 (0.0228)		-0.341113 (0.0112)
SIEGDPG(-5)	0.647471 (0.0367)	-1.050174 (0.0038)		0.171720 (0.0718)
SIEGDPG(-6)				
CONSTANT	1.882155 (0.1956)	4.049805 (0.0157)	1.700088 (0.6450)	0.291325 (0.2464)
DUM	2.431624 (0.1290)	-7.971457 (0.0007)	3.950138 (0.3979)	-0.552365 (0.2136)
R-Squared	0.924748	0.963562	0.877384	0.971265
R-Squared adjusted	0.912336	0.960024	0.869287	0.968779
F-statistic & prob	74.50035(0.0000)	272.3691 (0.0000)	108.3554 (0.0000)	390.5926 (0.0000)

Source: Author's Computations

The real GDP growth model achieves explanatory power of 96.9 percent in the parsimonious VAR framework (5th Column of Table 6). The model passes all the diagnostic tests conducted, implying the results presented in Table 6 are not only consistent, efficient and unbiased but also non-spurious. Inflation and real exchange rate depreciation do not impact real GDP growth in Sierra Leone. Real money supply growth has net dynamic effect of 0.21, implying that cumulative one-percent increases in broad money supply growth over the past six quarters will cause real GDP growth to increase by 0.21 percent in the current period. Real GDP growth exerts positive inertia in Sierra Leone

such that one-percent increases in real GDP growth over the past six quarters cumulatively generate 0.92 percent increase in the current real GDP growth rate. Generally, growth appears to be driven by its own past values, probably by traditional supply side factors, and not demand-side variables.

In the parsimonious VAR framework, the real depreciation model has explanatory power of 86.9 percent (4th Column of Table 6). None of the underlying assumptions of the estimation technique is violated according to the diagnostic tests conducted. Thus, the results reported in Table 6 are consistent, efficient, unbiased and

non-spurious. Money supply growth and real GDP growth do not explain real exchange rate depreciation in Sierra Leone. The only variable that has an impact on real exchange rate depreciation, apart from itself, is inflation. The fourth lag of inflation carries a coefficient of -0.175, implying a one-percent rise in inflation in the previous fourth quarter will induce 0.18 percent appreciation of the real exchange rate in the current period. This is theoretically consistent as rising inflation implies high domestic price level which causes the real exchange rate to appreciate, holding other things constant. The dynamic net effect of real depreciation on itself is 0.591, which means that cumulative one-percent increases in real exchange rate depreciation over the past six quarters will produce 0.59 percent increase in the rate of depreciation of the local currency, the Leone.

The money supply growth model has explanatory power of 91.2 percent. The model passes all the relevant diagnostic tests and the results can, therefore, be relied upon. From Table 6, the results show that real money supply growth exerts positive inertia. Inflation, real exchange rate depreciation and real GDP growth have significant dynamic impacts on real money supply growth. The war dummy is not statistically significant, implying that the civil war has not affected the structure of money supply growth in Sierra Leone.

The dynamic cumulative long-run impact of money supply growth on itself is 0.8, implying that cumulative one percent increases in growth in broad money supply over six quarters induces 0.8 percent increase in money supply growth in the current period. The net dynamic effect of inflation is -0.08, implying one percent increases in inflation rate over the past six quarters will cause the current money supply growth to decline by 0.08 percent. This suggests that inflation enters the monetary policy reaction function of the Bank of Sierra Leone. Real exchange rate depreciation also has a net negative dynamic impact of 0.06 on real money supply growth, suggesting that real money supply growth in the current quarter shrinks by 0.06 percent for one percent increases in real depreciation of the Leone over the past six

quarters. The dynamic effect of real GDP growth is to dampen the current money supply growth in Sierra Leone by 0.02 percent for cumulative one-percent increases in real GDP growth over the past six quarters. This may be rationalised by the fact that real GDP growth coincides with high inflationary episodes; hence, an attempt to respond to high inflation by reducing money supply implies simultaneous response to high economic growth.

5.6.2 Impulse Response Function Analysis for Sierra Leone

The impulse response graphs for Sierra Leone (see Appendix IV) show that response of inflation to innovations of money supply growth is to increase initially during the first-four quarters before becoming insignificant through the rest of the forecast period. Inflation responds to its own innovations by increasing steadily throughout the forecast horizon, confirming the inflation inertia observed in the coefficient estimates analysis. Shocks emanating from real exchange rate depreciation also elicit significant positive response from inflation. However, real GDP growth shock fails to elicit significant response on inflation.

Real GDP growth responds positively to innovations in real money supply growth but negatively to shocks from real exchange rate depreciation throughout the forecast period. It also responds to its own shocks by rising steadily above the equilibrium path throughout the forecast period. Shocks to inflation, however, does not elicit response from real GDP growth.

Real exchange rate depreciation responds positively to shocks emanating from real money supply growth up to the fourth quarter, negatively to inflation up to fourth quarter, and positively to itself up to the eighth quarter of the forecast horizon. Again, real GDP growth does not elicit any response from real exchange rate depreciation.

The accumulated response of money supply growth to its own one percent standard deviation shock is positive throughout the 12-quarter forecast horizon. This confirms the positive money supply growth inertia observed under the coefficient estimate analysis. The response of

money supply growth to inflation shock is to decline during the first-six quarters and thereafter becomes insignificant, while money supply growth response to shock emanating from real exchange rate depreciation is to decline steadily over the forecast period. However, money supply growth does not respond to innovations of inflation and real GDP growth.

5.6.3 Variance Decomposition Analysis for Sierra Leone

Variance decomposition results for Sierra Leone (see Appendix V) show that past values of inflation constitute the principal driver of current inflation, explaining 53.1 percent in the first quarter. Inflation is the second dominant driver at the initial stage with a contribution of 43.9 percent. Overtime, during the 6th quarter precisely, however, real depreciation emerges as the dominant driver of inflation with a contribution of 45.5 percent. By the end of the forecast period, real depreciation explains 68.2 percent of total variations in inflation, while money supply growth and inflation itself contribute 12.4 and 17.7 percent, respectively.

Decomposition of real GDP growth shows that it is the sole driver of its own variation during the first-five quarters, with contributions ranging between 90.3 and 82.8 percent. From the 7th

quarter through the end, money supply growth and real depreciation become influential factors driving variations in real GDP growth. Inflation does not have any significant explanation for real GDP growth.

Real exchange rate depreciation or appreciation remains the principal driver of its own variations throughout the forecast period, beginning with a contribution of 47.6 percent and ending with 64.8 percent. Other dominant variables are money supply growth and inflation with contributions of 27.5 and 24.9 percent, respectively in the first quarter; and 17.0 and 17.9 percent, respectively, at the end of the forecast period.

Real money supply growth remains the sole propeller of itself during the first-five quarters as it explains 100 percent of its own variations during the first quarter and 82.8 percent in the fifth quarter. In the sixth quarter, however, real exchange rate depreciation emerge the second dominant driver of variations in real money supply growth with a contribution of 18.6 percent. By the end of the forecast period, money supply growth contributes 45.7 percent, while real depreciation contributes 44.2 percent of variations in money growth. Inflation and real GDP growth have contributions less than 10.0 percent each.

6.0 SUMMARY OF FINDINGS AND POLICY RECOMMENDATIONS

Summary of Findings

In **The Gambia**, real GDP growth is driven by its past values (real GDP inertia), money supply and inflation. The result revealed that money supply growth and inflation had a positive impact on real GDP. It is also evident from the result that exchange rate depreciation and money supply growth are key determinants of inflation in the Gambia as revealed by the coefficient estimates, impulse response function and variance decomposition analyses. Real exchange rate depreciation is explained by itself (exchange rate inertia) and inflation, while money supply growth and real GDP growth have a very long lag effects on it. The results also suggest that the key variables that influence money supply growth for The Gambia are inflation and real exchange rate depreciation or appreciation.

The results for **Ghana** indicate that real GDP growth is driven by its values (probably, the traditional factors from the supply side of the economy) and inflation. Inflation had a negative impact on real GDP growth. Inflation is both a monetary and structural phenomenon in Ghana as observed from coefficient estimates and variance decomposition analyses. Inflation is positively related to both money supply growth and exchange rate depreciation but the inflationary impact may be with some lags. The existence of inflation inertia was also established. Variations in real exchange rate depreciation are explained by all the model variables, albeit with some lags. It is also clear from the results that money supply growth in Ghana is influenced by inflation and real GDP growth.

In **Guinea**, real GDP growth is driven by its past values, inflation and money supply growth. Both money supply growth and inflation had a negative impact on real GDP growth. Inflation is positively influenced by both money supply growth and exchange rate depreciation, but negatively related to real GDP growth as observed from the coefficient estimates, impulse response and variance decomposition analyses. As in Ghana, variations in real exchange rate

depreciation are explained by all the model variables, albeit with some lags. Further, inflation and real exchange rate depreciation influence money supply growth in Guinea.

The key drivers of growth in **Liberia** are its past values, inflation, money supply growth and exchange rate depreciation. The result revealed that money supply and inflation are positively related to real GDP growth, while a negative impact was established for exchange rate depreciation. Inflation is positively driven by money supply growth and exchange rate depreciation. Real exchange rate depreciation is influenced by all the four model variables. Moreover, both inflation and real GDP growth appears to have influenced money supply growth in Liberia.

Real GDP growth in **Nigeria** is positively related to money supply growth and negatively related to inflation. It is also driven by its past values (probably, the traditional factors from the supply side of the economy). Inflation is found to be a monetary phenomenon in Nigeria. The key drivers of real exchange rate depreciation in Nigeria are its past values, inflation and money supply growth. The coefficient estimates suggest both inflation and exchange rate influence money supply growth in Nigeria, while the variance decomposition analysis showed that money stock appears to be adjusted only to accommodate GDP growth, albeit with significant lags.

In **Sierra Leone**, real GDP growth is explained by its past values (probably, the traditional factors from the supply side of the economy), money supply growth and real exchange rate depreciation. Inflation in Sierra Leone is positively related to money supply growth and real exchange rate depreciation, but negatively related to real GDP growth as observed from the coefficient estimates, impulse response functions and variance decomposition analyses. The result also revealed the existence of inflation inertia. Real exchange rate depreciation is explained by its own past values, money supply growth and

inflation. The key variables that influence money supply growth in Sierra Leone are inflation and exchange rate.

Recommendations

To achieve sustainable growth in the mist of low inflation (non inflationary growth) in the WAMZ economies the authorities should implement policies aimed at resolving supply-side challenges in a view to increasing domestic production and achieving sustainable economic growth. This can be achieved through continued increase in infrastructure, energy and power supply, among others. In addition, .the authorities are encouraged to maintain price stability, through the implementation of prudent monetary policy and maintaining exchange rate stability. The authorities should note that increasing money supply in the short run to enhance real GDP growth, may lead to dynamic inconsistency, causing long run inflation without

increase in real GDP. In this regard, policies aimed at achieving low inflation are desirable. Another policy implication arising from the study is that the authorities should provide a more favourable environment that would increase both traditional and non-traditional exports, increase domestic production of non-tradables and boost economic activities in the tourism sector. These activities might lead to increase in foreign exchange inflows and help stabilize the domestic currency.

Limitations of the Study

A caution is hereby given that a cross-country comparison of the results of this study has to be carefully done bearing in mind that it is real GDP growth rather than real GDP per capita growth that was used in the analysis. Besides, a consistent study period was not used, as those of Ghana and Guinea differ from the general coverage of 1981Q1-2010Q4.

REFERENCES

- Abradu-Otoo, Philip and Donyina-Ameyaw, Samuel (2007). "Inflation Dynamics in Ghana". In West African Monetary Institute (ed.), *West African Monetary Zone Studies in Inflation Dynamics*, Accra: 46-105.
- Adenutsi, Deodat E. (2011). "Financial Development, International Migrant Remittances and Endogenous Growth in Ghana", *Studies in Economics and Finance*, 28(1): 68-89.
- Adenutsi, Deodat E. (2011). "Financial Development, Bank Savings Mobilisation and Economic Performance in Ghana: Evidence from a Multivariate Structural VAR", *International Journal of Development Research and Quantitative Techniques*, 1(2): 3-24.
- Adenutsi, Deodat E. and Ahortor, Christian R.K. (2008). "Remittances, Exchange Rate, and Monetary Policy in Ghana", *West African Journal of Monetary and Economic Integration*, 8(2): 1-42.
- Agénor, Pierre-Richard (1991). "Output, Devaluation and the Real Exchange Rate in Developing Countries," *Weltwirtschaftliches Archiv*, 127(1): 18-41.
- Ahortor, Christian R.K., Adenekan, A. and Ohemeng, W. (2011). "An Estimate of Inflation Threshold in the WAMZ: The Case of Ghana and Nigeria", *West African Journal of Monetary and Economic Integration*, 11(2): 158-201.
- Bahmani-Oskooee, M. and Rhee, H-J. (1997). "Response of Domestic Production to Depreciation in Korea: An application of Johansen's Cointegration Methodology," *International Economic Journal*, 11: 103-112.
- Banerjee, A., Dolado, J.J., Galbraith, J.W., and Hendry, D.F. (1993). *Cointegration, Error Correction, and the Econometric Analysis of Non-Stationary Data*. Oxford: Oxford University Press.
- Canetti, Elie and Greene, Joshua (1991). "Monetary Growth and Exchange Rate Depreciation as Causes of Inflation in African Countries: An empirical Analysis," IMF Working Paper 91/67. Washington, D.C.
- Christopolos, D.K. (2004). "Currency Devaluation and Output Growth: New Evidence from Panel Data Analysis", *Applied Economics Letters*, 11: 809-813.
- Connolly, M. (1983). "Exchange Rates, Real Economic Activity and the Balance of Payments: Evidence from the 1960s." In E. Classen and P. Salin (eds.), *Recent Issues in the Theory of the Flexible Exchange Rates*. Amsterdam: North-Holland.
- Copelman, M. and Werner, A.M. (1996). "The Monetary Transaction Mechanism in Mexico" Federal Reserve Working Paper 25. Washington, D.C.
- De Silva, D. and Zhu, Z. (2004). "Sri Lanka's Experiment with Devaluation: VAR and ECM Analysis of the Exchange Rate Effects on Trade Balance and GDP," *International Trade Journal*, 18(4): 269-301.
- Domaç, Ilker (1997). "Are Devaluations Contractionary?" *Journal of Economic Development* 22(2): 145-63.
- Dornbusch, R. (1988). *Open Economy Macroeconomics*, 2nd Edition. New York: Basic Books.
- Edwards, S. (1989). *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policy in Developing Countries*. Cambridge, Mass: MIT Press.
- Elbadawi, I.A. (1990). "Inflationary Process, Stabilization and the Role of Public Expenditure in Uganda," Mimeo, Washington D.C.: World Bank.
- Enders, Walter (1995). *Applied Econometric Time Series*. New York: John Wiley & Sons.
- Essien, A. Essien, Onwioduokit, E., Adamgbe, E. and Obiora, K.I. (2007). "Inflation Dynamics in Nigeria," ". In West African Monetary Institute (ed.), *West*

- African Monetary Zone Studies in Inflation Dynamics*, Accra: 180-263.
- Essien, A. Essien, Adamgbe, Emmanuel and Sesay, Allieu (2007). "Inflation Dynamics in Sierra Leone". In West African Monetary Institute (ed.), *West African Monetary Zone Studies in Inflation Dynamics*, Accra: 264-336.
- Grigorian, D., Khachatryan, A. and Sargsyan, G. (2004). "Exchange Rate, Money, and Wages: What Is Driving Prices In Armenia?" IMF Working Paper, WP/04/229. Washington, DC.
- Gylfason, T. and Risager, O. (1984). "Does Devaluation improve the Current Account?" *European Economic Review*, 25: 37-64.
- Gylfason, T. and Schmid, M. (1983). "Does Devaluation cause Stagflation?" *The Canadian Journal of Economics*, 25: 37-64.
- Hanson, J.A. (1983). "Contractionary Devaluation, Substitution in Production and Consumption and the Role of the Labour Market", *Journal of International Economics*, 14: 179-189.
- Kamin, Steven B. (1996). "Exchange Rates and Inflation in Exchange Rate based Stabilisation: an Empirical Examination", *International Finance Discussion Paper*, 554, Board of Governors of the Federal Reserve System, Washington, D.C.
- Kamin, Steven B., and Rogers, John H. (2000). "Output and the Real Exchange Rate in Developing Countries: An Application to Mexico," *Journal of Development Economics*, 61(1): 85-109.
- Kitcher, John T., Sissoho, M. and Jarju, L. (2007). "Inflation Dynamics in the Gambia". In West African Monetary Institute (ed.), *West African Monetary Zone Studies in Inflation Dynamics*, Accra: 1-45.
- Klau, M. (1998). "Exchange Rate Regime and Inflation and Output in Sub-Saharan Countries". *Working Paper*, 53, Bank for International Settlements (BIS).
- Krugman, Paul R. and Taylor, Lance (1978). "Contractionary Effects of Devaluation," *Journal of International Economics*, 8(3): 445-56.
- Loungani, P., and Swagel, P. (2001). "Sources of Inflation in Developing Countries", IMF Working Paper 01/198. Washington, D.C.
- Mills, Terence C., and Pentecost, Eric J. (2000). "Real Exchange Rate and the Output Response in Four EU Accession Countries," Business Cycle and Economics Growth Research Paper No. 00-4. Loughborough: Department of Economics, Loughborough University.
- Morley, Samuel A. (1992). "On the Effects of Devaluation during Stabilization Programs in LDCs," *Review of Economics and Statistics*, 74(1): 21-27.
- Mukherjee, Chandan, Howard White and Marc Wuyts (2003), *Econometrics and Data Analysis for Developing Countries*, London: Routledge.
- Mwase, N. (2006). "An Empirical Investigation of the Exchange Rate Pass-Through to Inflation in Tanzania", IMF Working Paper 06/150. Washington, D.C.
- Odusola, A.F. and Akinlo, A.E. (2001). "Output, Inflation and Exchange Rate in Developing Countries: An Application to Nigeria", *The Development Economics*, 39(2): 199-222.
- Onwioduokit, Emmanuel A., Sylla, F., Obiora, K.I. and Conte, M. (2007). "Inflation Dynamics in Guinea". In West African Monetary Institute (ed.), *West African Monetary Zone Studies in Inflation Dynamics*, Accra: 106-179.
- Sheeley, E.J. (1986). "Unanticipated Inflation, Devaluation and Output in Latin America," *World Development*, 14: 665-671.
- Sim, C.A. (1980). "Macroeconomic and Reality", *Econometrica*, 48:1-49
- Solimano, A. (1986). "Contractionary Devaluation in the Southern Cone: The Case of Chile," *Journal of Development Economics*, 23: 135-151.

APPENDIX I: UNIT ROOT TESTS RESULTS

Table A1.1: Unit Root Test Results for The Gambia

VARIABLE	ADF TEST Null: not stationary (*)	KPSS Null: Stationary (**)	REMARK ON ORDER OF INTEGRATION
GAMDEP	-3.034201 (0.0039)	0.081804 (0.739000)	I (0)
GAMGDPG	-6.772445 (0.0000)	0.127948 (0.739000)	I (0)
GAMINF	-2.064068 (0.0393)	0.341958 (0.739000)	I (0)
GAMM2G	-7.416934 (0.0000)	0.380737 (0.739000)	I (0)

(*) Figures in brackets are MacKinnon (1996) one-sided p-values. (**) Figures in brackets are asymptotic critical values at 1%.

Table A1.2: Unit Root Test Results for Ghana

VARIABLE	ADF TEST Null: not stationary (*)	KPSS Null: Stationary (**)	REMARK ON ORDER OF INTEGRATION
GHADEP	-3.309498 (0.0011)	0.064884 (0.739000)	I (0)
GHAGDPG	-5.415561 (0.0000)	0.111292 (0.216000)	I (0)
GHAINF	--5.172245 (0.0002)	0.120979 (0.216000)	I (0)
GHAM2G	-3.943639 (0.0025)	0.363920 (0.739000)	I (0)

(*) Figures in brackets are MacKinnon (1996) one-sided p-values. (**) Figures in brackets are asymptotic critical values at 1%.

Table A1.3: Unit Root Test Results for Guinea

VARIABLE	ADF TEST Null: not stationary (*)	KPSS Null: Stationary (**)	REMARK ON ORDER OF INTEGRATION
GUIDEP	-4.388686 (0.0000)	0.090202 (0.739000)	I (0)
GUIGDPG	-5.017073 (0.0005)	0.111982 (0.216000)	I (0)
GUIINF	-2.153588 (0.0248)	0.207659 (0.739000)	I (0)
GUIM2G	-3.219902 (0.0872)	0.078412 (0.216000)	I (0)

(*) Figures in brackets are MacKinnon (1996) one-sided p-values. (**) Figures in brackets are asymptotic critical values at 1%.

Table A1.4: Unit Root Test Results for Liberia

VARIABLE	ADF TEST Null: not stationary (*)	KPSS Null: Stationary (**)	REMARK ON ORDER OF INTEGRATION
LIBDEP	-2.150426 (0.0309)	0.175321 (0.739000)	I (0)
LIBGDPG	-2.655868 (0.0082)	0.177722 (0.739000)	I (0)
LIBINF	-2.810655 (0.0053)	0.100342 (0.739000)	I (0)
LIBM2G	-3.943639 (0.0388)	0.417319 (0.739000)	I (0)

(*) Figures in brackets are MacKinnon (1996) one-sided p-values. (**) Figures in brackets are asymptotic critical values at 1%.

Table A1.5: Unit Root Test Results for Nigeria

VARIABLE	ADF TEST Null: not stationary (*)	KPSS Null: Stationary (**)	REMARK ON ORDER OF INTEGRATION
NIGDEP	-3.075194 (0.0024)	0.105326 (0.739000)	I (0)
NIGGDPG	-3.490889 (0.0456)	0.083592 (0.216000)	I (0)
NIGINF	-2.962606 (0.0416)	0.241154 (0.739000)	I (0)
NIGM2G	-4.081572 (0.0090)	0.041485 (0.216000)	I (0)

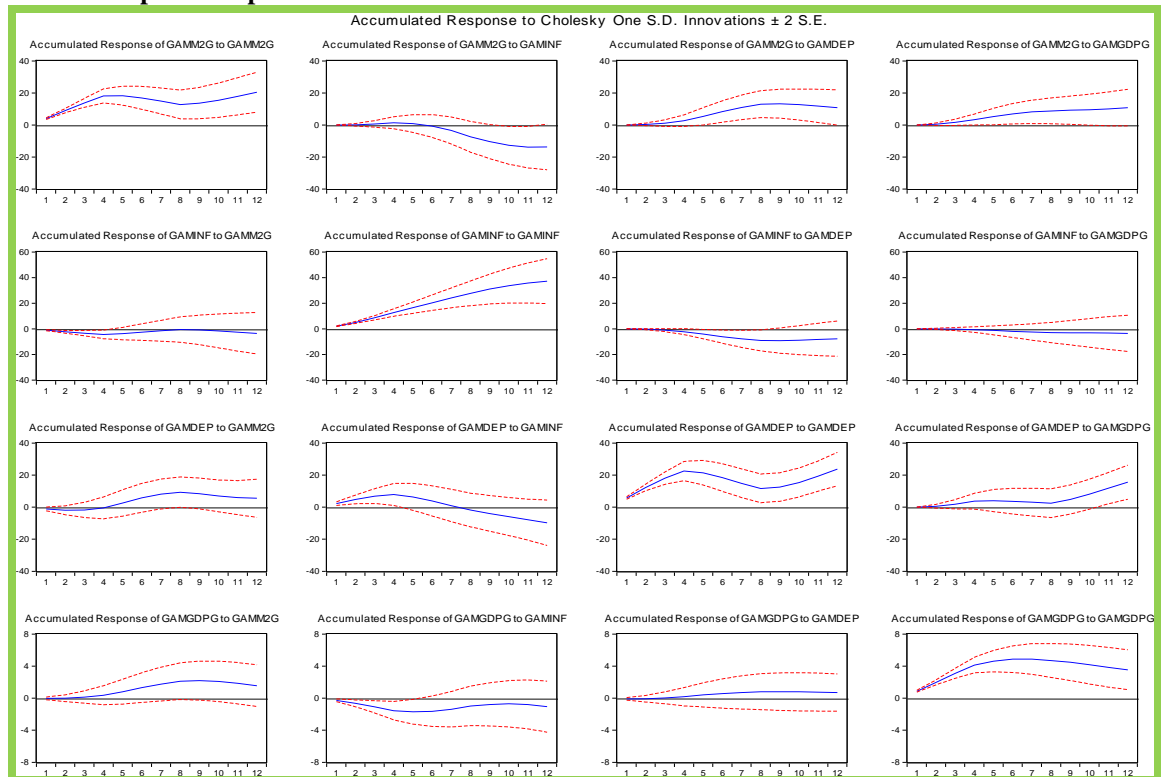
(*) Figures in brackets are MacKinnon (1996) one-sided p -values. (**) Figures in brackets are asymptotic critical values at 1%.

Table A1.6: Unit Root Test Results for Sierra Leone

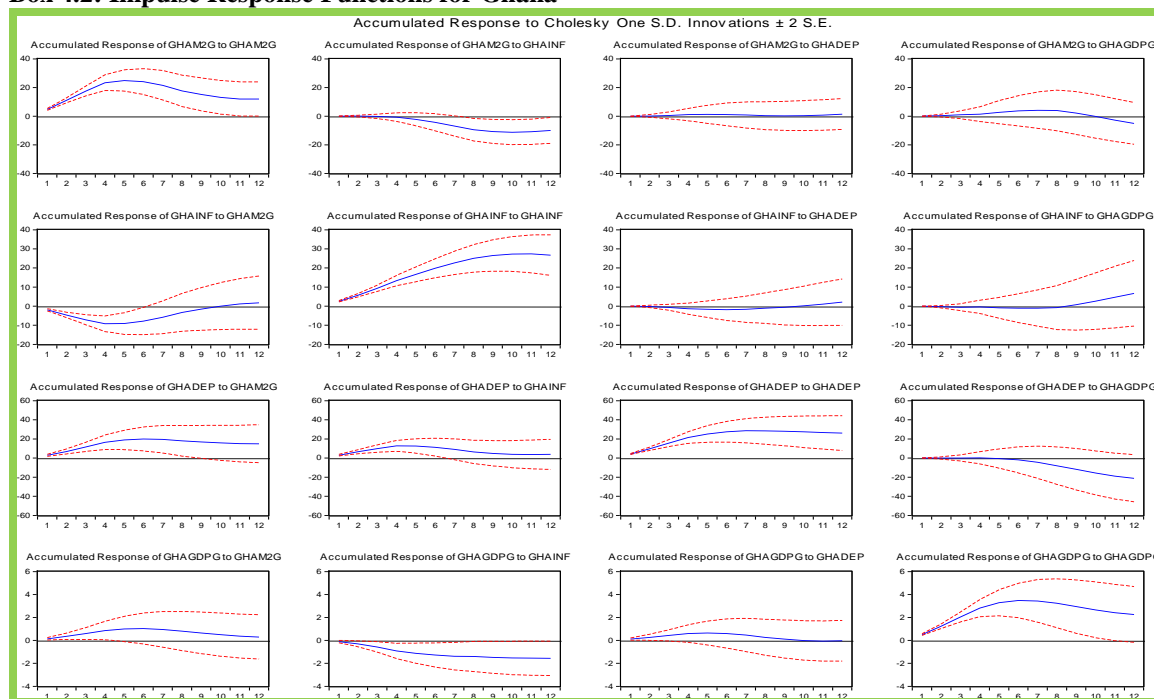
VARIABLE	ADF TEST Null: not stationary (*)	KPSS Null: Stationary (**)	REMARK ON ORDER OF INTEGRATION
SIEDEP	-4.163590 (0.0070)	0.034636 (0.216000)	I (0)
SIEGDPG	-2.463027 (0.0140)	0.227499 (0.739000)	I (0)
SIEINF	-4.465525 (0.0026)	0.123359 (0.216000)	I (0)
SIEM2G	-6.318682 (0.0000)	0.061508 (0.216000)	I (0)

(*) Figures in brackets are MacKinnon (1996) one-sided p -values. (**) Figures in brackets are asymptotic critical values at 1%.

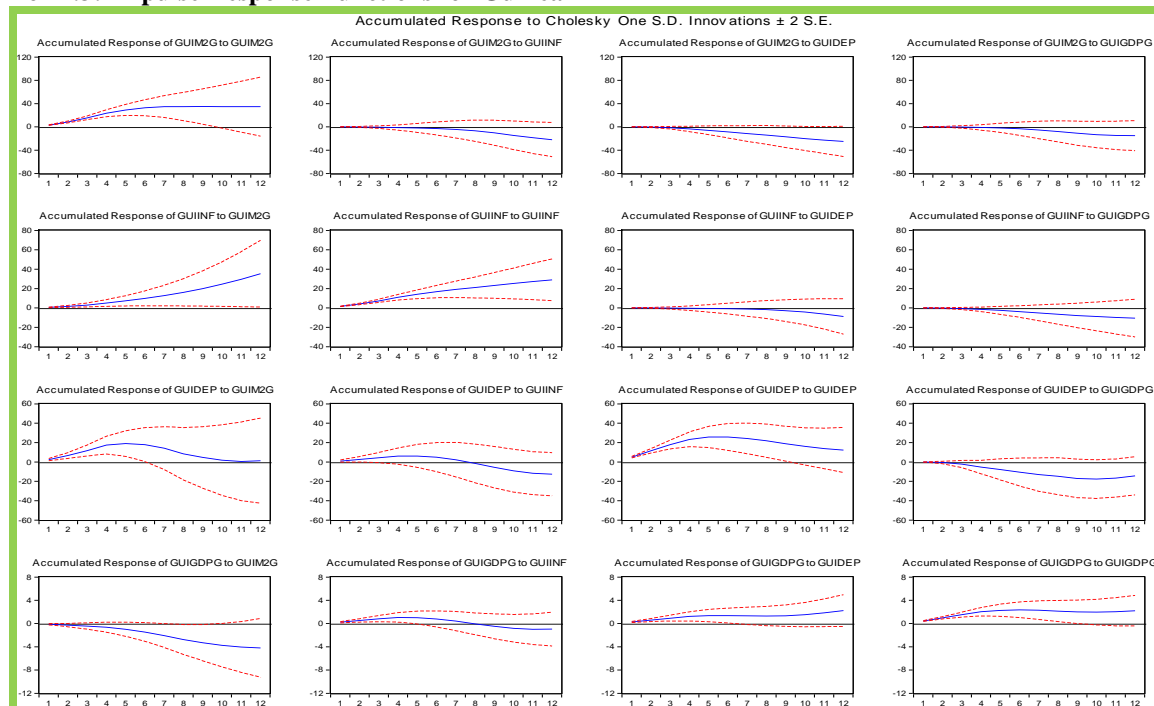
APPENDIX IV: IMPULSE RESPONSE FUNCTIONS

Box 4.1: Impulse Response Functions for The Gambia

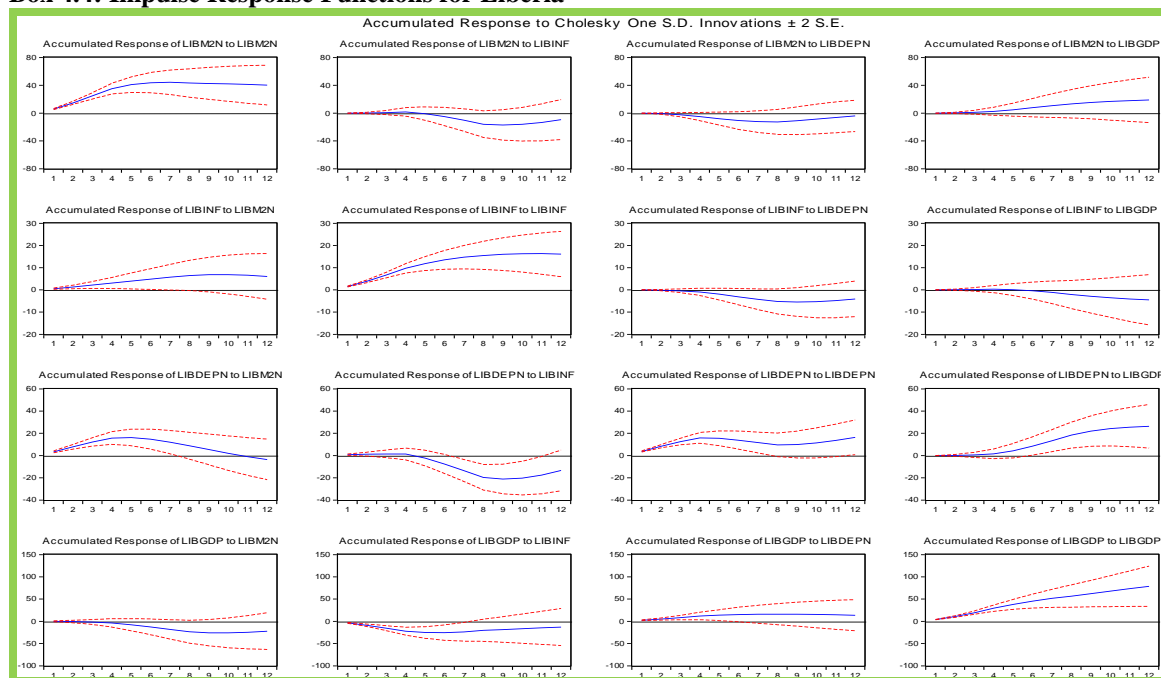
Box 4.2: Impulse Response Functions for Ghana



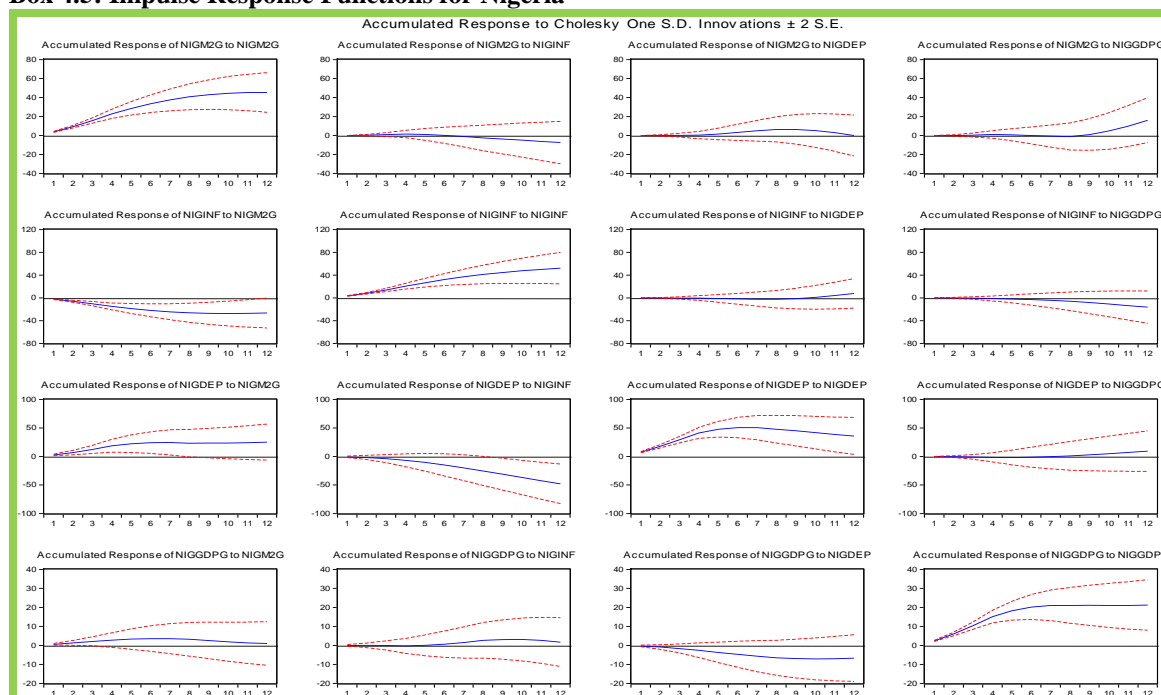
Box 4.3: Impulse Response Functions for Guinea



Box 4.4: Impulse Response Functions for Liberia

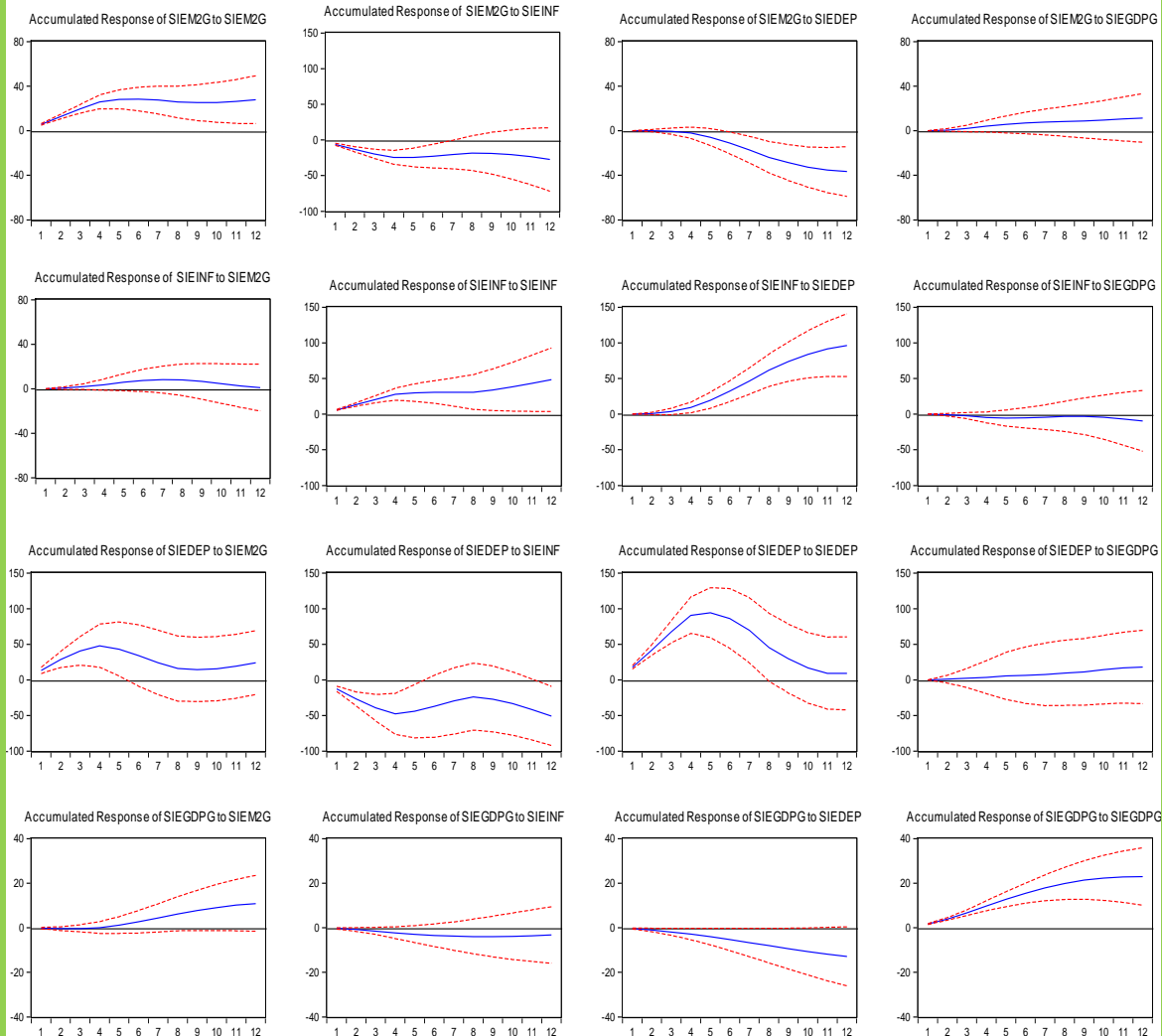


Box 4.5: Impulse Response Functions for Nigeria



Box 4.6: Impulse Response Functions for Sierra Leone

Accumulated Response to Cholesky One S.D. Innovations ± 2 S.E.



APPENDIX V: VARIANCE DECOMPOSITIONS

Table A5.1: Variance Decompositions for The Gambia

Variance Decomposition of GAMM2G:					
Period	S.E.	GAMM2G	GAMINF	GAMDEP	GAMGDPG
1	3.909873	100.0000	0.000000	0.000000	0.000000
2	6.479744	99.22406	0.036050	0.346919	0.392974
3	8.402016	96.65077	0.291383	1.616724	1.441118
4	9.865884	92.41184	0.838595	3.699691	3.049872
5	10.37564	83.88640	1.041474	10.40121	4.670911
6	11.00928	75.46383	2.907587	16.04804	5.580535
7	11.79595	68.08866	7.972670	18.48844	5.450225
8	12.76007	60.76960	16.37527	18.11506	4.740068
9	13.10539	57.92703	20.37099	17.18856	4.513416
10	13.41302	56.951521	22.18641	16.54872	4.309663
11	13.66908	57.46552	22.02804	16.35017	4.156265
12	13.92681	58.34995	21.23708	16.30502	4.107953

Variance Decomposition of GAMINF:					
Period	S.E.	GAMM2G	GAMINF	GAMDEP	GAMGDPG
1	2.222813	24.58981	75.41019	0.000000	0.000000
2	3.936393	19.91467	79.30451	0.754590	0.026226
3	5.539896	15.13660	82.15486	2.624289	0.084252
4	7.066496	11.29650	83.71604	4.833354	0.154102
5	8.267000	8.486921	82.27105	8.836834	0.405199
6	9.361348	7.497358	80.66210	11.25229	0.588255
7	10.26977	7.125624	80.28846	11.92672	0.659203
8	10.98191	6.885520	80.85815	11.59381	0.662527
9	11.44570	6.422470	82.27157	10.69569	0.610270
10	11.77639	6.466051	82.76978	10.18306	0.581102
11	11.99552	6.796721	82.60274	10.03936	0.561172
12	12.12319	7.220765	82.14111	10.08564	0.552486

Variance Decomposition of GAMDEP:					
Period	S.E.	GAMM2G	GAMINF	GAMDEP	GAMGDPG
1	6.138374	2.638687	12.08893	85.27238	0.000000
2	9.439306	1.614632	12.64420	85.50397	0.237207
3	11.32998	1.256852	11.91389	85.75615	1.073104
4	12.45607	2.729336	10.50249	83.94014	2.828032
5	13.03274	9.184554	10.92443	77.30736	2.583660
6	14.05798	14.02347	12.58878	70.91972	2.468031
7	15.01730	15.26007	14.61054	67.57947	2.549925
8	15.69627	14.68279	16.51462	66.05263	2.749960
9	15.99706	14.46161	17.51539	63.83428	4.188731
10	16.68336	14.22094	17.44155	61.14510	7.192412
11	17.62163	13.37256	16.78910	59.30896	10.52938
12	18.60139	12.15695	16.10677	58.35722	13.37906

Variance Decomposition of GAMGDPG:					
Period	S.E.	GAMM2G	GAMINF	GAMDEP	GAMGDPG
1	0.909471	0.458086	8.521046	1.466904	89.55396
2	1.500571	0.230785	9.321636	0.616132	89.83145
3	1.967280	0.161496	10.30748	0.390333	89.14069
4	2.326306	0.348769	11.50907	0.445492	87.69667
5	2.437944	2.226271	10.68627	1.072823	86.01464
6	2.504888	4.919602	10.19687	1.536943	83.34659
7	2.557925	7.411956	10.70577	1.844826	80.03745
8	2.622912	9.036262	12.61087	1.954297	76.39857
9	2.636853	9.178911	12.86387	1.958264	75.99895
10	2.651604	9.081697	12.78836	1.938228	76.19172
11	2.672051	9.174116	12.72479	1.915878	76.18522
12	2.707948	9.527230	13.50869	1.882840	75.08124
Cholesky Ordering: GAMM2G GAMINF GAMDEP GAMGDPG					

Table A5.2: Variance Decompositions for Ghana

Variance Decomposition of GHAM2G:					
Period	S.E.	GHAM2G	GHAINF	GHADEP	GHAGDPG
1	4.705224	100.0000	0.000000	0.000000	0.000000
2	7.893186	99.74715	0.000253	0.026554	0.226045
3	10.23728	99.40827	0.036999	0.128254	0.426473
4	11.81706	98.96981	0.236523	0.321952	0.471716
5	12.08199	96.31110	1.749372	0.337435	1.602088
6	12.33780	92.75784	4.728199	0.330331	2.183627
7	12.86489	89.35333	8.143062	0.382872	2.120741
8	13.70743	86.92271	10.71913	0.472783	1.885379
9	14.09664	85.20092	10.96188	0.454482	3.382722
10	14.44727	83.08011	10.55298	0.447292	5.919622
11	14.72147	80.61609	10.19946	0.520633	8.663821
12	14.94851	78.18592	10.29523	0.670257	10.84860
Variance Decomposition of GHAINF:					
Period	S.E.	GHAM2G	GHAINF	GHADEP	GHAGDPG
1	3.183744	37.49526	62.50474	0.000000	0.000000
2	5.267178	39.61304	59.82247	0.124462	0.440025
3	6.930913	36.56884	62.51338	0.539597	0.378180
4	8.274748	31.65561	66.82689	1.205100	0.312401
5	8.919714	27.24796	71.02292	1.136457	0.592666
6	9.546947	25.53440	72.88829	1.020867	0.556444
7	10.16637	26.55274	72.01779	0.933731	0.495742
8	10.77598	29.32803	69.04617	1.121442	0.504351
9	11.12780	29.98452	66.54697	1.216809	2.251700
10	11.44581	30.13657	63.36122	1.643529	4.858675
11	11.72313	29.68318	60.40083	2.183440	7.732550

12	11.96520	28.74893	58.24566	2.781234	10.22418
Variance Decomposition of GHADEP:					
Period	S.E.	GHAM2G	GHAINF	GHADEP	GHAGDPG
1	5.823930	23.21070	26.21280	50.57650	0.000000
2	9.644971	26.02002	22.84278	51.13277	0.004434
3	12.71842	28.64230	20.13408	51.21882	0.004797
4	15.07742	31.04182	17.88904	51.05762	0.011519
5	15.73199	30.83446	16.43708	52.48352	0.244941
6	16.06028	29.99570	16.45579	52.55767	0.990827
7	16.43358	28.69864	17.49831	50.62953	3.173527
8	17.09837	27.43678	18.54903	46.77006	7.244131
9	17.60190	26.20223	18.24141	44.19710	11.35926
10	18.08863	25.15979	17.56191	41.98936	15.28894
11	18.41889	24.43451	16.97363	40.65013	17.94173
12	18.57823	24.03240	16.69674	40.06901	19.20185
Variance Decomposition of GHAGDPG:					
Period	S.E.	GHAM2G	GHAINF	GHADEP	GHAGDPG
1	0.548021	6.238174	3.626520	4.740905	85.39440
2	0.971828	6.748237	5.260671	3.800985	84.19011
3	1.326097	7.180100	7.152717	3.565935	82.10125
4	1.598018	7.441532	9.520581	3.528607	79.50928
5	1.683669	7.411584	9.982997	3.255495	79.34992
6	1.702634	7.286361	10.60114	3.237992	78.87450
7	1.712392	7.358338	10.82299	3.795505	78.02316
8	1.743699	7.879213	10.47040	5.023115	76.62727
9	1.782382	8.303905	10.21276	5.522890	75.96045
10	1.815717	8.691114	9.900919	5.782529	75.62544
11	1.836409	8.954242	9.694337	5.730939	75.62048
12	1.845857	9.030961	9.599701	5.697483	75.67185
Cholesky Ordering: GHAM2G GHAINF GHADEP GHAGDPG					

Table A5.3: Variance Decompositions for Guinea

Variance Decomposition of GUIM2G:					
Period	S.E.	GUIM2G	GUIINF	GUIDEP	GUIGDPG
1	3.136280	100.0000	0.000000	0.000000	0.000000
2	6.183112	99.69002	0.020662	0.268925	0.020396
3	9.375042	98.32400	0.158542	1.462594	0.054868
4	12.59482	95.33161	0.545006	3.679770	0.443611
5	14.03758	93.06804	0.617635	5.672429	0.641898
6	14.93268	88.89840	0.988667	8.419328	1.693609
7	15.54972	83.48135	1.928681	11.07196	3.518003

8	16.06061	78.25649	3.419653	12.83816	5.485694
9	17.07667	69.23046	7.997049	14.65918	8.113317
10	18.00162	62.30396	12.77544	15.85621	9.064392
11	18.69894	57.75130	16.49534	16.74486	9.008510
12	19.14916	55.06822	18.83859	17.46036	8.632837
Variance Decomposition of GUIINF:					
Period	S.E.	GUIM2G	GUIINF	GUIDEP	GUIGDPG
1	1.655893	9.855244	90.14476	0.000000	0.000000
2	3.151798	12.30368	87.09663	0.012212	0.587484
3	4.751175	15.19948	83.32707	0.060817	1.412626
4	6.445847	18.70486	78.94189	0.164318	2.188939
5	7.540879	22.43735	73.89779	0.147805	3.517058
6	8.510900	26.81156	68.14409	0.203054	4.841293
7	9.398881	31.62058	62.01581	0.335424	6.028187
8	10.23066	36.64671	55.85287	0.567631	6.932788
9	11.30407	42.18523	49.44209	1.440591	6.932086
10	12.49640	47.72470	43.21971	2.597497	6.458095
11	13.82427	52.77585	37.32974	4.165140	5.729267
12	15.27019	56.94297	31.93917	6.154267	4.963591
Variance Decomposition of GUIDEP:					
Period	S.E.	GUIM2G	GUIINF	GUIDEP	GUIGDPG
1	5.562142	19.61484	2.989279	77.39588	0.000000
2	9.677938	24.75543	3.879399	71.00966	0.355517
3	12.97691	29.57689	4.125652	64.38999	1.907464
4	15.55130	33.95420	3.939187	56.79963	5.306981
5	15.98500	33.00869	3.735438	56.01846	7.237413
6	16.31330	32.18729	4.199234	53.78945	9.824020
7	17.17504	33.40100	6.154400	49.31707	11.12753
8	18.72876	37.72566	9.143163	43.01023	10.12095
9	19.88934	36.95413	12.14756	40.56946	10.32886
10	20.61832	36.27421	14.44835	39.56509	9.712361
11	20.95203	35.50005	15.45643	39.40768	9.635841
12	21.17812	34.85315	15.36094	39.10376	10.68215
Variance Decomposition of GUIGDPG:					
Period	S.E.	GUIM2G	GUIINF	GUIDEP	GUIGDPG
1	0.565871	5.061055	16.92158	21.79528	56.22209
2	0.914340	4.658167	17.35118	21.20808	56.78257
3	1.169700	5.008249	16.72188	21.02350	57.24638
4	1.340555	5.925000	15.55811	21.04992	57.46697
5	1.413379	11.47133	14.06224	19.67263	54.79380
6	1.510974	20.14634	14.45719	17.21844	48.17804
7	1.668267	29.14981	16.98146	14.19159	39.67714
8	1.873221	36.75501	19.95401	11.27666	32.01431

9	2.001270	39.56890	21.98993	9.951803	28.48936
10	2.083634	40.89314	22.76193	10.00557	26.33936
11	2.136569	40.93451	22.25070	11.67310	25.14169
12	2.185877	39.66288	21.26098	14.44984	24.62629
Cholesky Ordering: GUIM2G GUIINF GUIDEP GUIGDPG					

Table A5.4: Variance Decompositions for Liberia

Variance Decomposition of LIBM2G:					
Period	S.E.	LIBM2G	LIBINF	LIBDEP	LIBGDP
1	5.279336	100.0000	0.000000	0.000000	0.000000
2	9.683657	99.66519	0.015761	0.282561	0.036484
3	13.56757	98.72758	0.069043	1.003029	0.200348
4	16.82762	97.20217	0.188323	2.060281	0.549229
5	18.59915	90.68310	3.372324	3.193955	2.750626
6	20.17653	80.57965	9.671491	3.568240	6.180624
7	21.79331	69.83270	17.06029	3.292613	9.814393
8	23.49054	60.14265	24.13914	2.836183	12.88203
9	23.94363	57.91324	23.89519	3.021601	15.16997
10	24.23943	56.72331	23.37502	3.410238	16.49143
11	24.61217	55.50372	23.79347	3.701219	17.00159
12	25.18021	53.73831	25.66250	3.756621	16.84257
Variance Decomposition of LIBINF:					
Period	S.E.	LIBM2G	LIBINF	LIBDEP	LIBGDP
1	1.610608	0.005652	99.99435	0.000000	0.000000
2	2.957637	0.003763	99.80882	0.156489	0.030925
3	4.214659	0.007437	99.45130	0.471905	0.069356
4	5.343486	0.048579	99.04902	0.810860	0.091539
5	5.931132	0.147128	96.96940	2.648110	0.235367
6	6.335975	0.443615	94.24463	4.445724	0.866029
7	6.624083	0.942657	91.08714	5.749328	2.220879
8	6.846979	1.616810	87.36506	6.467177	4.550953
9	6.923415	1.712897	86.16593	6.328481	5.792693
10	6.977260	1.687262	84.87346	6.623026	6.816254
11	7.057777	1.745519	83.08950	7.629660	7.535318
12	7.187415	2.066474	80.79243	9.288786	7.852314
Variance Decomposition of LIBDEP:					
Period	S.E.	LIBM2G	LIBINF	LIBDEP	LIBGDP
1	4.500201	35.93378	0.163471	63.90275	0.000000
2	7.641637	37.97667	1.378419	60.58721	0.057702
3	9.872963	38.68412	3.460370	57.81253	0.042980
4	11.29086	38.39858	6.283757	55.21175	0.105906
5	12.74934	31.30777	21.66436	43.37326	3.654607

6	14.93832	22.80481	34.08889	32.37306	10.73324
7	17.45728	16.97649	39.69362	25.36591	17.96398
8	19.90124	13.53954	41.05860	21.32715	24.07470
9	20.77294	13.84896	38.59785	19.69185	27.86134
10	21.31580	15.00500	36.72901	18.70423	29.56176
11	21.87254	16.15827	36.29878	17.91460	29.62835
12	22.59910	16.84936	37.51120	17.22284	28.41660
Variance Decomposition of LIBGDP:					
Period	S.E.	LIBM2G	LIBINF	LIBDEP	LIBGDP
1	5.682579	4.128122	33.14938	8.681873	54.04063
2	10.69605	2.844944	32.93194	6.906607	57.31651
3	15.60914	1.902993	31.96011	5.539753	60.59715
4	20.30019	1.258920	30.37037	4.428400	63.94231
5	22.65568	2.348396	26.80551	3.708999	67.13710
6	24.45597	5.244404	23.34044	3.194178	68.22098
7	26.00698	9.079889	20.66123	2.835746	67.42314
8	27.41309	13.06180	19.11026	2.615830	65.21212
9	28.36054	13.07196	18.26800	2.528471	66.13157
10	29.24643	12.35585	17.81197	2.549800	67.28238
11	30.17498	11.68648	17.63282	2.616025	68.06468
12	31.18872	11.42874	17.65335	2.677779	68.24013
Cholesky Ordering: LIBM2G LIBINF LIBDEP LIBGDP					

Table A5.5: Variance Decompositions for Nigeria

Variance Decomposition of NIGM2G:					
Period	S.E.	NIGM2G	NIGINF	NIGDEP	NIGGDPG
1	3.742215	100.0000	0.000000	0.000000	0.000000
2	6.655883	99.73918	0.234391	0.019778	0.006652
3	9.324009	99.40371	0.449222	0.037492	0.109572
4	11.70080	98.83169	0.661450	0.035152	0.471711
5	13.10749	97.99670	0.655153	0.879640	0.468505
6	14.14183	96.30127	0.984810	2.096216	0.617704
7	14.88428	94.45606	1.595980	3.195028	0.752935
8	15.39612	92.72264	2.533203	3.938455	0.805704
9	15.75140	90.71671	2.913559	3.762792	2.606937
10	16.34201	85.12425	3.244078	4.005087	7.626583
11	17.33348	75.84335	3.406833	5.217765	15.53205
12	18.72938	64.95943	3.386237	7.276890	24.37744
Variance Decomposition of NIGINF:					
Period	S.E.	NIGM2G	NIGINF	NIGDEP	NIGGDPG
1	4.134903	37.28044	62.71956	0.000000	0.000000
2	7.229232	36.71037	63.21572	0.042702	0.031213

3	10.21849	35.84373	63.95858	0.060586	0.137105
4	13.03001	34.92332	64.68304	0.046833	0.346808
5	14.88002	33.23687	65.94267	0.243424	0.577042
6	16.27093	31.72419	66.93808	0.398380	0.939355
7	17.23612	30.38090	67.69577	0.449492	1.473840
8	17.87658	29.16430	68.22960	0.426327	2.179771
9	18.42096	27.78677	67.86459	0.807836	3.540808
10	18.95955	26.26258	66.48277	2.090659	5.163989
11	19.56369	24.68117	64.07993	4.455510	6.783394
12	20.23350	23.19866	60.99638	7.640828	8.164127
Variance Decomposition of NIGDEP:					
Period	S.E.	NIGM2G	NIGINF	NIGDEP	NIGGDPG
1	7.778664	11.09087	0.841503	88.06763	0.000000
2	13.72894	12.90081	0.992884	86.06134	0.044975
3	18.98720	15.13723	1.576250	83.17147	0.115045
4	23.49453	17.51929	2.623876	79.68602	0.170817
5	24.83736	17.67031	4.389535	77.77887	0.161282
6	25.47485	17.40313	7.152612	75.26426	0.179999
7	25.99475	16.72954	10.66856	72.28737	0.314520
8	26.82599	15.96927	14.44673	69.01116	0.572840
9	27.60243	15.08561	17.78499	66.08278	1.046613
10	28.45794	14.19521	20.88215	63.44230	1.480331
11	29.28903	13.43325	23.60728	61.05510	1.904371
12	30.00517	12.93445	25.75487	58.97016	2.340514
Variance Decomposition of NIGGDPG:					
Period	S.E.	NIGM2G	NIGINF	NIGDEP	NIGGDPG
1	2.464479	5.525692	4.40E-05	1.537654	92.93661
2	4.482259	4.519380	3.50E-05	2.026973	93.45361
3	6.357632	3.722508	0.014950	2.507327	93.75521
4	8.035912	3.016972	0.078532	3.000567	93.90393
5	8.683704	2.956665	0.186231	4.077728	92.77938
6	8.984941	2.843688	0.585453	5.176531	91.39433
7	9.126328	2.759608	1.499134	6.163593	89.57767
8	9.249545	2.801906	3.135307	6.852648	87.21014
9	9.286494	3.223917	3.284039	6.970520	86.52152
10	9.311775	3.721569	3.268048	6.955784	86.05460
11	9.339162	4.058254	3.467726	6.923009	85.55101
12	9.403524	4.160056	4.493562	6.922430	84.42395
Cholesky Ordering: NIGM2G NIGINF NIGDEP NIGGDPG					

Table A5.6: Variance Decompositions for Sierra Leone

Variance Decomposition of SIEM2G:					
Period	S.E.	SIEM2G	SIEINF	SIEDEP	SIEGDPG
1	5.625540	100.0000	0.000000	0.000000	0.000000
2	9.000308	99.10331	0.388184	0.001756	0.506746
3	11.53352	96.65069	1.404614	0.238194	1.706499
4	13.47217	92.41365	2.796799	1.330085	3.459463
5	14.44569	82.79780	4.549240	8.371496	4.281466
6	15.50343	71.94004	5.110845	18.60974	4.339372
7	16.72645	62.12842	4.610724	29.28749	3.973367
8	18.09974	53.96784	3.964859	38.57862	3.488689
9	18.81129	50.03756	4.227115	42.44053	3.294800
10	19.33901	47.34536	4.982082	44.39653	3.276026
11	19.67020	45.96301	5.840452	44.80155	3.394995
12	19.87688	45.74985	6.428763	44.24836	3.573027
Variance Decomposition of SIEINF:					
Period	S.E.	SIEM2G	SIEINF	SIEDEP	SIEGDPG
1	8.550152	53.06878	46.93122	0.000000	0.000000
2	13.39479	49.63450	49.64184	0.366993	0.356670
3	16.91088	45.03981	50.66787	3.107921	1.184396
4	19.88162	38.73628	49.12433	9.855724	2.283670
5	22.43978	30.40891	39.54994	28.12923	1.911923
6	25.87566	23.27433	29.81387	45.46698	1.444814
7	29.69778	18.27115	22.63405	57.90226	1.192541
8	33.40875	14.84234	17.88504	66.20582	1.066803
9	35.66002	13.03086	16.53882	69.49378	0.936548
10	37.37872	12.05282	16.33526	70.66179	0.950134
11	38.65002	11.87562	16.86618	70.03362	1.224571
12	39.62755	12.36453	17.67589	68.20534	1.754238
Variance Decomposition of SIEDEP:					
Period	S.E.	SIEM2G	SIEINF	SIEDEP	SIEGDPG
1	25.30113	27.49432	24.86412	47.64157	0.000000
2	40.91440	24.16354	21.81033	53.97796	0.048169
3	51.22828	21.00704	19.57718	59.31149	0.104296
4	57.41673	18.34055	17.93716	63.59387	0.128419
5	57.86845	18.75382	18.06586	62.92694	0.253378
6	59.50823	20.03069	18.47361	61.23441	0.261293
7	63.05130	20.24253	17.84007	61.66127	0.256134
8	68.24999	18.80473	16.00442	64.86524	0.325608
9	70.18004	17.82615	15.34753	66.47484	0.351467
10	71.72118	17.09894	15.46338	66.91892	0.518767
11	72.72265	16.85230	16.37050	66.12899	0.648202
12	73.47048	16.95732	17.59408	64.79118	0.657420
Variance Decomposition of SIEGDPG:					
Period	S.E.	SIEM2G	SIEINF	SIEDEP	SIEGDPG

1	1.701682	1.929092	2.895330	4.831320	90.34426
2	2.991537	0.988675	3.984217	6.242967	88.78414
3	4.239061	0.509361	4.591456	7.131533	87.76765
4	5.423984	0.785928	4.844451	7.736800	86.63282
5	6.399726	3.806361	4.474326	8.896043	82.82327
6	7.250932	7.176000	4.008211	9.966892	78.84890
7	7.958620	10.64941	3.529476	11.15867	74.66244
8	8.521870	13.94788	3.112386	12.40976	70.52997
9	8.890147	15.74420	2.862161	13.79617	67.59746
10	9.133616	17.07710	2.734197	15.03573	65.15297
11	9.282501	17.82204	2.730323	16.07729	63.37035
12	9.372223	18.09744	2.814044	16.90714	62.18137
Cholesky Ordering: SIEM2G SIEINF SIEDEP SIEGDPG					