RELATIVE EFFECTS OF MONETARY AND FISCAL POLICY ON OUTPUT: THE CASE OF LIBERIA

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DECLARATION

This research paper is my original work and has not been presented for the award of a degree in any other university.

Signed..... Date October 5, 2010

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This research paper has been submitted for examination with our approval as university supervisors.

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DEDICATION

For their unflinching love, support and confidence in me, this paper is dedicated to my mother, Mrs. Mary Conteh, the memories of my late father, Mr. Anthony T. Conteh, and the Conteh family in general. As a source of inspiration and for enduring two years without seeing his dad, this work is also dedicated to my son, Kemoh.

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LIST OF ACRONYMS/ ABBREVIATIONS

ACS	American Colonization Society
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
CBL	Central Bank of Liberia
CLEMAO	Clemente-Montanes-Reyes
DF	Dickey-Fuller
DF-GLS	Dickey-Fuller Generalized Least Squares
ECOWAS	Economic Community of West African States
FEVD	Forecast Error Variance Decomposition
FIML	Full Information Maximum Likelihood
FRC	Firestone Rubber Company
GDP	Gross Domestic Product
GEMAP	Governance and Economic Management Assistance Program
GOL	Government of Liberia
HIPC	Heavily Indebted Poor Countries
IDA	International Donor Assistance
IFS	International Financial Statistics
IGNU	Interim Government of National Unity
IMF	International Monetary Fund
IRF	Impulse Response Function

KPSS	Kwiatkowski-Philips-Schmidt-Shin
LD	Liberian Dollar
MoF	Ministry of Finance
NBL	National Bank of Liberia
NHDR	National Human Development Report
NPRAG	National Patriotic Reformation Alliance Government
ODP	Open Door Policy
OLS	Ordinary Least Squares
PRC	People's Redemption Council
PRS	Poverty Reduction Strategy
PP	Philip-Perron
QTM	Quantity Theory of Money
RFTF	Results Focused Transitional Framework
SBC	Schwartz-Baysian Criteria
SES	Senior Executive Service
SMP	Staff Monitoring Program
USD	United States Dollar
VAR	Vector Autoregression
VEC	Vector Error Correction
ZA	Zivot-Andrews

ABSTRACT

The objective of this paper is to determine the relative potency of monetary and fiscal policy on output in Liberia for the period 1960 to 2008. In order to establish evidence on the relative potency of monetary and fiscal policy on output in Liberia, this study employs the St. Louis model which is estimated in the context of an unrestricted vector autoregression (VAR) framework. We computed impulse response functions (IRFs) and forecast error variance decomposition (FEVDs) using 1000 Monte Carlo simulations. Additionally, we estimated Granger causality amongst the variables contained in the model.

The results based on the IRFs and FEVDs provide empirical evidence in support of the hypothesis that monetary policy has a positive statistically significant impact on output in Liberia while fiscal policy is of no significance in altering output in Liberia. The findings of this study support the conclusions reached by proponents of the St. Louis Model who believe that monetary policy is relatively more effective in altering output than fiscal policy. The study found no evidence of the impact of a policy mix in altering output in Liberia. However, evidence of a foreign influence in altering output in Liberia was detected.

On the basis of the results, the following recommendations were made: that monetary policy should be the primary stabilization policy which must be complemented with fiscal discipline so as to achieve the desired policy objectives; that the conduct of monetary policy must be exercised with caution as regards the interest rate and the exchange rate so as to avoid inflationary expectations and attract foreign domestic investment; that efforts should be made to ensure an independent CBL that is free of political interferences and capable of instilling financial discipline in the banking sector; that the CBL formulate policies that are capable of protecting the interest of depositors thus discouraging the hoarding of currency, curbing capital flight and encouraging the development of organized and formal money and capital markets.

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

A sustainable rate of economic growth with moderately low and steady rate of price growth (inflation) and relatively stable exchange rates is the primary objective of any macroeconomic stabilization policy. Realization of this objective is achieved via two main alternative policy options- monetary and fiscal policies. Dow and Saville (1988), define monetary policy as the adoption of a policy seeking to control the rate of growth of the monetary aggregates and announcing target rates of growth to control aggregate demand. In so doing, monetary policy is formulated to guarantee that the supply of money is optimal in order to curb inflation and promote meaningful and sustainable economic growth. Dwivedi (2005) defines fiscal policy as the discretionary changes made in the government spending and tax rates with the objective of achieving certain economic objectives (goals). In so doing, by means of varying government spending and/or taxes, fiscal policy can be used to stabilize autonomous expenditures, other macroeconomic variables and consequently the level of equilibrium output in the economy.

Economies are potentially unstable thus necessitating the formulation and implementation of these macroeconomic stabilization policies, either individually or jointly depending on the prevailing macroeconomic environment, for, according to Chingarande (1999, p.1), 'the achievement and maintenance of full employment, balance of payments equilibrium, and accelerated economic growth and development'. She argued that it is an acknowledged fact throughout the economics literature that both of these stabilization policies 'either individually or jointly affect the level of economic activity' but the extent and pace with which each one of these policies effect a significant change on the equilibrium level of income prevailing within the economy has been at the center of a protracted disagreement (ibid).

Economists who believe that monetary policy is more effective than fiscal policy in determining real output are referred to as *monetarists.* Modern monetarism has its roots in the classical monetary theory which held that monetary policy was the most powerful tool for achieving economic growth and full employment. The origin of this debate can be traced to the early

development of the Quantity Theory of Money (QTM) by Irving Fischer and later by the Cambridge economists. The QTM proposes a positive relationship between money supply and long-term prices of goods. It states that increasing the amount of money in the economy will eventually lead to an equal percentage rise in the prices of products and services, hence variations in the quantity of money circulating in the economy is the surest means of varying output. Since the classical economists believed that market economies self-regulate and that they guarantee low levels of unemployment if left on their own, hence the doctrine of *laissez faire*, they advocated for minimum government interference in the operations of the economy thus restricting the government's role, among other things, to that of issuing liquidity in the economy. This established the supremacy of monetary policy over fiscal policy.

The policy prescription of the QTM was called into question in the 1930s due to the failure of Classical economic theory to remedy the economic malaise caused by the Great Depression. It was in this vain that John Maynard Keynes in 1936 formulated his "*General Theory of Employment, Interest and Money*". Keynes path-breaking work dubbed the "*Keynesian Revolution*" was a challenge to the supremacy of monetary actions over fiscal measures. Hence believers in the relative supremacy of fiscal action over monetary action came to be referred to as *fiscalists*. The policy prescription of the Keynesian Revolution was more government intervention in the running of the economy, hence a choice of varying government spending and/or taxation in order to vary output. The Keynesian Revolution argued that fiscal policy was a relatively more potent and reliable policy instrument for economic stabilization.

Reassurance in the Keynesian theory began to diminish after Keynes publication due to stagflation. This meant that Keynesian policy prescription was only effective in the short-run. Thus the belief in the relative supremacy of fiscal policy over monetary policy was strongly criticized by Milton Friedman and other renowned economists. This opposition to Keynesian theory was carried out by a group called the *Monetarists* and their challenge to Keynesian theory is dubbed the *Monetarists Counter-Revolution*. Friedman and Schwartz (1963) carried out a monumental study of the monetary history of the United States. Using different measures of money supply, and in contrast to Keynesian views, they found a strong relationship between economic fluctuations and money supply. They argued that long-period changes in the quantity of money relative to output determine the secular behaviour of prices. Substantial expansions in

the quantity of money over short periods have been a major *proximate* source for the accompanying inflation in prices, (Friedman, 1969). The monetarists believe that monetary impulse is the most important factor accounting for variations in output, employment and prices. Further studies such as, Friedman and Meiselman (1963); Anderson and Jordan (1968) and Carlson (1978) using the St. Louis equation, provided empirical evidence in favour of the supremacy of monetary policy over fiscal policy. Hence the Monetarist Counter Revolution regarded monetary policy as relatively more effective than fiscal policy.

The arguments put forward by the Monetarist Counter Revolution met opposition from staunch Keynesians such as Kaldor (1970) and Tobin (1965). Using the same monetary data collected by Friedman and Schwartz, these two economists argued that money supply is practically endogenous to the system, that is it increases with a boom and decreases with a recession. They argued that this formed the basis for the high correlation in Friedman and Schwartz study and that correlation does not mean causation. These two studies established the relative supremacy of fiscal policy over monetary policy. The Neo-Keynesians believe that fiscal policy is more effective than monetary policy in altering output. They argued that the only circumstance for the ineffectiveness of fiscal policy is in the *classical case* where the Keynesian and Classical money demand functions are similar; that is, where money demand depends only on income.

The search for a superior stabilization policy over the other continues to lure economists as this debate seems to be unending. This debate is now centered on the opposing views to the question "does money matter" in determining output and prices. It is within this light that this study is being conducted.

1.1 Background of the Liberian Economy

1.1.1 Country Overview

Liberia, one of the poorest countries in the world, is located on the west coast of Africa. It was founded in 1822 by the *American Colonization Society (ACS)* as a refuge for freed slaves from the United States of America (USA) and declared itself independent on July 26, 1847. Liberia currently has a population of 3,489,078 with an unemployment rate[1] of 85% and an annual economic growth rate of 4.6 per cent (CBL, 2009). It covers a total surface area of 111,370

[1] National Human Development Report (NHDR) of Liberia 2006

square kilometers (NHDR, 2006). The country has substantial deposits of mineral resources such as gold, diamond and iron ore and a fertile land and tropical climate which support the production of such commodities as rubber, timber, rice, vegetables, cocoa, coffee, oil palm, amongst others.

1.1.2 Review of the Economy

Liberia is a small open economy that is export-oriented as a result of the Open Door Policy (ODP) of the 1940s. Exports are essentially primary commodities with little or no value addition while imports are mostly manufactured goods and rice - the nation's staple food. The economy is characterized by a dualistic production structure with the major economic sectors being subsistence agriculture, industrial production, and manufacturing, amongst others.

The macroeconomic performance of Liberia since independence can be broken down into the following periods: The period between 1847 and 1925; this period was characterized by both internal and external disequilibrium in key macroeconomic variables but the magnitudes of such imbalances cannot be established due to lack of data. This was the period of low productivity and economic activities were mostly subsistent in nature. There was an acute shortage of trained manpower and lack of economic incentives prevailed thus the country could not attract significant foreign investment. The Government of Liberia (GOL) had a narrow domestic taxes base which consisted of poll tax, duty fees paid by vessels docking at the ports of Liberia, loans, grants and aid from foreign countries. This was the first era of fiscal mismanagement in the history of Liberia as the minority ruling group; the *Congos*[2] misappropriated the minimal resources and contracted numerous loans with harsh conditions thus culminating into Liberia's current debt crisis. During this period, the GOL contracted loans in 1870, 1906 and 1911.

The period between 1926 and 1979; the hallmark of this period was the coming to Liberia in 1926 of the Firestone Rubber Company (FRC). The FRC obtained a concession agreement with the then GOL which gave the FRC the right to lease up to one million acres of land for a period of ninety-nine years. This concession established the world's largest rubber plantation thus serving as a major economic boom for Liberia; providing about 25,000 jobs and a loan of US$5 million for the GOL. This improvement in the performance of the Liberian economy was further

[2] This refers to freed slaves from the Americas and their descendents. They are also referred to as Americo-Liberians.

boosted by the adoption of the Open Door Policy (ODP) in the 1940s. The ODP was an export-oriented policy that attracted substantial foreign capital inflows in Liberia. From 1939 to 1945, Liberia registered a favorable balance of trade, which amounted to US$25.9 (about US$754 million in current dollars) million during the six year period while the GOL revenue rose from US$827,000 in 1939 to US$1.9 millions in 1945, an increase of 133.9 percent. This macroeconomic improvement attracted four multi-national iron ore companies to Liberia between 1951 and 1965 further boosting the growth potentials of the economy, (IMF, 1975).

The period between 1950 and 1970 is considered as the period of rapid economic boom in Liberia as the economy experienced an unprecedented growth rate during the years before 1961 that was second only to Japan in the world. From 1946 to 1960, the GOL attracted US$500 millions in foreign investment; exports rose from US$15.8 million in 1948 to US$82.6 million in 1960, an increase of 422.8 per cent; and the GOL revenue rose from US$32.4 millions in 1960 to US$69.9 millions in 1971, an increase of 115.7 percent. Worlobah (2006) indicated that between 1970 and 1980, the major sources of foreign exchange earnings were from iron ore mining and rubber exports; hence the contribution of iron ore mining to total mining output was about 90 per cent while its contribution to 'current price GDP at factor cost' increased gradually from '31.5 per cent in 1970 to 34.0 per cent in 1972', as compared to agricultural output whose contribution to GDP declined 'from about 12 per cent in 1970 to 10 per cent in 1972' before rising again to 14 per cent in 1973. Given these developments, during the years 1954 up to 1960, the economy experienced, on averaged, an annual growth rate of about 15 per cent, (Clower et al., 1966).

The rapid expansion of the Liberian economy was adversely affected by the "oil shocks" in 1974. Since Liberia was an export oriented economy, thanks to the ODP, the high prices of petroleum products caused a significant increase in the prices of the basic commodities needed for consumption and production thus having severe effects on the cost of living in the economy.

The rapid growth of the Liberian economy was not matched by any significant economic development. The gains from the expansion accrued to the minority ruling class thus leaving the masses to live in abject poverty. This prompted the formation of a Commission by the GOL and the Government of the United States which was led by Clower (ibid). The Clower Commission referred to this era in Liberia as the time of "growth without development." The commission blamed the lack of development on corruption and mismanagement of resources by the GOL.

Despite the fact that this era produced a significant boom in the Liberian economy judging by the increase in output, it is also remembered as the era that sowed the seeds for the civil crisis from 1980 to 2003 starting with the infamous "Rice Riots" in 1979.

The Period between 1980 and 2004; a major hallmark of this period was the continuous decline in economic activities within the Liberian economy, attributable to the military overthrow in 1980 of the "*Americo-Liberian (Congo)*" Government which had ruled Liberia from independence and the consequential civil crisis. This coup by the People's Redemption Council led by Samuel Doe resulted into the collapse of economic activities as most foreign investors liquidated their investments and pulled out of the country between the years 1980 to 1988; resulting into a continuous decline in major macroeconomic variables. Table 1 reports the macroeconomic performance of Liberia over the period 1974 to 2002.

Table 1: Selected Macroeconomic Indicators in Liberia (1974-2002)

Year	Fiscal Deficit to GDP in %	Public Debt to GDP in %	Annual Inflation in %	Real GDP Growth in %	Current Account Balance millions USD	Gross Official Reserves millions USD
1974	2.6	21.8	19.5	4.8	N/A	16.6
1979	-13.2	47.4	11.5	3.3	-155.6	55.0
1984	-10.5	114.6	1.3	-3.1	-26.5	7.8
1988	-94.5	157.5	9.6	-2.0	15.6	0.4
1993	N/A	321.7	11.2	-33.0	-28.3	N/A
1998	0.3	692.4	12.6	28.5	-42.0	N/A
2002	-1.3	476.8	15.0	3.3	-6.1	3.3

Sources: Adopted from Worlobah (2006)

Initially, the PRC government attracted massive foreign aid. The increased aid was used by the PRC government for the training of military personnel, the construction of barracks, and the purchase of military hardware. Aid levels rose from about US$20 million in 1979 to US$75 millions and then to US$95 millions, for a total of US$402 millions between 1981 and 1985, more than the country received during the entire previous century. The PRC government grew

corrupt and repressive thus causing the US government to stop aid. The military coup and the repressive regime of the PRC created an investor confidence crisis which led to a massive capital flight from the country over the period 1980-1989. As shown in Table 1, between 1980-1989 public debts rose, inflation increased, the current account balance worsened but improved in 1988, the real GDP growth showed a persistent downward trend while the gross level of official reserves dropped significantly due to the foreign aid squeeze.

The PRC government became insensitive to the general needs of the masses thus paving the way for the rebel invasion of Charles Taylor in 1989. The ensuing civil war resulted into a collapse of political, democratic, social and economic institutions. Physical infrastructure such as roads and bridges, water and sanitation, power and electricity, and telecommunication among others were severely damaged. This was accompanied with the loss of human lives approximated at 200,000 people, with approximately 60% of the then population either internally or externally displaced.

With the end of fighting in 2003 and the presidential elections in 2005, macroeconomic variables started to trend favorably. In 2004, external trade expanded but the trade balance registered a deficit of US$233.0 million, from US$60.3 million registered a year ago. This poor performance was attributable to reduced exports induced by the United Nations sanctions[3] on timber and diamond exports from the country. According to IMF estimates cited by the CBL, real Gross Domestic Product (GDP) grew by 9.8 percent during 2005 with unemployment at 80 percent. This depicts a slowdown in growth when viewed against the 21.2 percent growth recorded in 2004. The average rate of inflation stood at 11.1 percent while merchandise exports registered a 26.5 percent increase from its 2004 value. Import payments, on the other hand, declined by 8.0 percent, (CBL, 2005).

The period between 2005 to present; this is considered as the era of recovery as tremendous efforts have been exerted by the GOL and its development partners particularly, the United States of America, the United Nations, the World Bank, and the International Monetary Fund (IMF). In February 2006, the GOL agreed to an ambitious program of reforms, supported by the IMF Staff-Monitoring Program. The key objectives of this program included stabilizing the economy, rebuilding public institutions, and restoring credible financial management in the

[3] Sanctions were imposed by the UN on timber and diamonds because proceeds from their sale were believed to be use in financing the civil conflict in Liberia.

public sector, something which had been missing and the absence of which had earlier resulted in the civil war. Liberia's performance under this program was satisfactory thus enabling the country to enter a Poverty Reduction and Growth Facility Program in early 2008. The country also reached the Heavily Indebted Poor Countries (HIPC) decision point at the same time, which enabled the country to successfully clear its arrears with multilateral creditors. The GOL initiated Liberia's Poverty Reduction Strategy (PRS) that spans April 2008 to June 2011. It focuses on enhancing national security, revitalizing economic growth, strengthening governance and the rule of law and rehabilitating infrastructure to enable improved delivery of basic services. The performance of the economy during this period is depicted in Table 2:

Table 2: Selected Macroeconomic Indicators (2003-2008)

Economic Indicator	2003	2004	2005	2006	2007	2008
Real GDP Growth (%)	-31.3	2.6	9.8	7.8	9.4	7.1
Nominal GDP (US$ millions)	41.0	460	530	612	735	870
Inflation	10.4	7.8	11.1	7.4	11.7	17.5
Exports (US$ millions)	109	104	110	158	208	260
Imports (US$ millions)	140	268	294	401	499	760
External official Grants (US$ millions)	20	189	287	303	389	401
Exchange Rate LD/US$	50.5	54.5	56.5	59.5	62.5	63.5

Sources: Republic of Liberia CBL Annual Reports (2003-2008)

Between 2005 and 2008, the country recorded a real GDP growth rate of about 8 percent but due to the global financial crisis, the growth rate of real GDP dropped to 4.6 percent in 2009. Likewise, the average inflation from 2005 to 2008 was 11.925 percent but inflation reduced to 7.2 percent in 2009; as compared to the 2005-2008 period, the nominal exchange rate depreciated from the 2005-2008 average rate of L$60.5 per US$1 to L$67.81 per US$1 in 2009, (CBL Annual Reports, 2005-2008).

1.1.3 Monetary Policy Stance

Prior to the coming of the freed slaves to Liberia, barter trade prevailed. Over time due to interactions with the European merchants, salt, seashells, ivory, spices, amongst others, served as

money. The history of dollarization in Liberia dates back to 1847 when the British Pound Sterling was used as the official currency in Liberia. Between 1847 and 1944, there were many foreign currencies, such as the German Mark, the French Franc and the United States Dollar[4] in addition to the British Pound circulating in Liberia. This multiplicity of currencies greatly hindered transactions as the exchange rate between currencies had to be determined before transactions could take place. In January 1944, the GOL declared war on Germany, its major trading partner at the time, thus banning the circulation of the German Mark.

Between 1944 and 1962, in an attempt to reduce payment frictions in the country's financial system resulting from the multiplicity of foreign currencies, the GOL officially declared and enforced the use of the US dollar as the national currency on December 31, 1943 thus making Liberia wholly dollarized and dispossessing policy makers of the use of the basic monetary policy instruments. Due to the absence of a National or Central Bank, the fiscal activities of the GOL were implemented by the Bank of Monrovia, an auxiliary of the Citibank of New York. According to Reeves (2006), the Ministry of Finance (MoF), during the '1961-1962 fiscal year minted and issued coins with face values of L$1.00; L$0.50; L$0.25; L$0.10; L$0.05; L$0.01 to circulate alongside the US dollar thus moving Liberia from a pure US dollar standard to a dual currency system'. He claimed that Liberia became a member of the IMF on March 28, 1962 and on March 3, 1963, the GOL 'established the par value of the Liberian dollar with the US dollar at L$1 to US$1'; on May 1974, it enacted a legislation establishing the National Bank of Liberia (NBL) which started operations on July 15, 1974.

The NBL became the monetary authority and it was given the power to mint and issue Liberian coins and perform some quasi central bank functions, which included supervision of the operations of the clearing house, monitoring banking operations, setting reserve requirement ratios, and being the lender of last resort to the GOL and the banking system. 'The deposits of the NBL comprised of GOL securities for capital subscription, GOL promissory notes for coins in circulation, deposits of financial institutions, and public sector deposits, (ibid)'.

The military coup of 1980 created confidence crisis as the PRC government froze the bank accounts of some politicians and individuals who they considered to be corrupt. This led to

[4] The US dollar at this time was the dominant currency due to coming of the FRC.

massive capital outflow from the country thus reducing the GOL revenues. In 1982, the GOL decided to reverse the falling trend in its revenue base by minting and issuing the Liberian five-cornered dollar coin thus causing balance of payment crisis and moving the exchange rate away from the previous one to one parity that existed prior to the coup. Due to the movements in the exchange rate, major macroeconomic variables trended unfavorably. As the PRC government grew corrupt and tyrannical, the US government (its major donor) reduced aid to the country; as a result of this additional drop in its revenue base, and given its large military expenditures, the PRC government with the help of the NBL resulted into continuously printing money.

Because of the country's inability to accumulate sufficient foreign currencies to finance its operations due to a fall in production, the most attractive option was seigniorage hence the share of Liberian currency in total currencies in circulation increased. In 1989, the GOL through the NBL printed and issued a five dollar banknote. During the period up to 1989, the financial sector consisted of 12 commercial banks. Due to the widespread looting of banks during the civil war, the currency in circulation increased significantly; thus increasing prices. In an attempt to control the money stock, the Interim Government of National Unity (IGNU) in 1992 withdrew the five dollar note from circulation and reintroduced another five-dollar banknote called *Liberty*.

By this time, the civil war had divided the country into two parts: Liberia proper which consisted of Monrovia and its immediate environs protected by ECOWAS peace keepers and which served as the seat of the Interim Government and *Greater Liberia* which consisted of majority of the country occupied and ruled by rebels of Charles Taylor and which also served as the seat of the National Patriotic Reformation Alliance Government (NPRAG). During this time, the *Liberty* circulated in Liberia proper while the earlier one circulated in *Greater Liberia.* With the signing of the Peace Accord in Abuja in 1996, the country was re-unified and the two Liberian five dollar banknotes circulated side by side in addition to the US dollar. In 1999, the GOL enacted a legislation establishing the Central Bank of Liberia (CBL) which granted her the full powers of a modern central bank. In 1999, the CBL printed and issued new Liberian banknotes of face value L$100.00; L$50.00; L$20.00; L$10.00; L$5.00 to replace the *Liberty* and the earlier one. These new Liberian banknotes circulated side by side with the US dollar.

At present, there are eight commercial banks operating in Liberia: the Liberian Bank for Development and Investment (LBDI) since 1961, Ecobank Liberia Limited (EBLL) since 1999,

the International Bank Liberia Limited (IBLL) previously the International Trust Company (ITC) since 2000, the Global Bank Liberia Limited (GBLL) since 2005, the First International Bank Liberia Limited (FIBLL) since 2005, the United Bank for Africa Liberia Limited (UBALL) since 2008, the Access Bank Liberia since 2009 and finally the Guaranty and Trust Bank Liberia (GTBL) since 2009. The CBL serves as the apex financial institution in Liberia and the sole monetary policy formulator of the country.

Due to the massive bank failures occasioned by the civil conflict, there is a lack of confidence in the banking system as a result of which the Liberian economy is highly cash based. Besides, owing to the dual currency arrangement, political instability and conflict occasioned by the civil war, economic and financial instability and large donor inflows, the Liberian economy is highly dollarized. In addition, the country's financial system is undeveloped as there are no organized money and capital markets. Since the formation of Liberia, its economy has always been partly or fully dollarized. Foreign currencies, mostly the US dollar, have been used both as a store of value and a medium of exchange, (Lodewyk et al, 2009).

Due to the above problems, traditional monetary policy instruments available at the disposal of a full fledged Central Bank are lacking to the CBL. Reserve requirements ratio and discount rates are ineffective because the economy is cash based hence the currency in the hands of the non-banking public exceeds that of the banking public. Due to the absence of organized money and capital markets, open market operations are non-existent. Implementation of monetary policy is complicated by the large amount of U.S. dollars in circulation. The current monetary policy framework recognizes that in a highly dollarized and very open economy, the exchange rate is the main transmission mechanism through which monetary imbalances affect prices, (ibid).

In Liberia, the prices of all goods and services (both tradeable and non-tradeable) are tied to the exchange rate. Hence, the CBL targets relative nominal exchange rate stability by means of monthly foreign currency auction. The exchange rate regime used by the CBL is that of managed floating in which a bandwidth of the nominal exchange rate is set and foreign currency auctions are used to keep fluctuations in the value of the nominal exchange rate within the said bandwidth. Table 3 shows monetary aggregates in the Liberian economy while Table 4 reports macroeconomic consequences of changes in monetary aggregates for the period 2002 to 2008.

Table 3: Monetary Aggregates (2002-2008) in millions of LD

	2002	2003	2004	2005	2006	2007	2008
Money Supply (M1)	2363.1	2506.8	3,726.8	4,870.9	6,620.8	8,859.2	12,748.0
Demand Deposits	1,318.2	1,203.2	1,971.9	2,702	3,973.2	5,541.7	9,111.0
Currency	1,045	1,303.2	1,754.9	2,168.9	2,647.6	3,317.4	3,637.0
Quasi-Money	535.4	433.9	960.3	1,491	1,928	3,118	4,183.0
Savings Deposits	470.6	433.6	956	1,429.7	1,830.4	2,664.3	N/A
Time Deposits	64.8	0.3	4.2	61.4	97.6	453.6	N/A
Broad Money (M2)	2898.5	2,940.6	4687.1	6,361.9	8,548.8	11,977.1	16,931.0

Source: Republic of Liberia CBL Annual Reports, several issues. N/A means not available.

Table 3 shows a steady growth of monetary aggregates in the economy. As monetary aggregates change, macroeconomic indicators fluctuate. For example, in 2008, money supply increased by 41.4 percent thus causing inflation to increase to 17.5 percent, GDP growth rate to decline to 7.1 percent, interest rates to decline to 14.2 percent, the exchange rate to depreciate and the trade balance to worsen.

Table 4: Selected Macroeconomic Indicators (2002-2008)

	2002	2003	2004	2005	2006	2007	2008
Inflation (%)	15.5	10.4	7.8	11.1	7.4	11.7	17.5
GDP Growth (%)	3.3	-31.3	2.6	9.8	7.8	9.4	7.1
Interest Rate (%)	16.94	17.49	17.2	14	16.4	14.8	14.2
Exchange Rate	65	50.5	54.5	56.5	57	62.5	63.5
Trade Balance (mil US$)	-2.1	-60	-233	-178.6	-308.9	-314.6	-500

Source: Republic of Liberia CBL Annual Reports, several issues.

Analyses of Tables 3 and 4 show that changes in money supply are associated with fluctuations in the value of macroeconomic indicators in the economy, thus confirming the monetarists argument that money matters.

1.1.4 Fiscal Policy Stance

Liberia is a unitary country, with a complex structure of sub-national administrations. The country is sub-divided into 15 counties. Below each county, a multitude of districts, cities, townships, and towns exist with no clearly defined responsibilities. The territorial division into counties plays a central role in the structure of the state and the organization of the legislature.

From independence in 1847 to 1926, the GOL relied on loans and grants to finance its operations as the tax base was very narrow. One thing that is glaring and consistent in the history of Liberia is that from 1847 up to 2004, all governments have shown a high propensity to spend more than they can generate from revenue and the resultant gap has traditionally been financed by external borrowing and seigniorage. This is evident from the loans of 1870, 1906 and 1911 and many other subsequently smaller loans and the seigniorage of the 1980s.

As early as 1870, the GOL finances were constrained; the government of President Roye began a program of reconstruction of the nation. In order to raise funds for these projects, the GOL negotiated a loan with London banks. The terms of the loans were severe; among other things, the interest rate on the loan was 7 percent. Liberia actually received about $90,000, while bonds were issued for $400,000. Because of increasing world competition from Brazilian coffee, European sugar beets, and steamers, Liberia was unable to generate sufficient export revenues, and so defaulted on the loan negotiated by Roye. Recession forced Liberia into a series of ever larger loans.

By 1906 the GOL was bankrupt hence it could only pay its bills by borrowing from local German merchants. This forced President Arthur Barclay to negotiate for another $500,000 English loan, through Sir Harry Johnston, a British colonial agent, and his Liberia Development Company. The terms of the loan were severe as the GOL was to pay an annual interest of 30,000.00 British pounds until the entire loan was repaid. In an attempt to protect the interest of the British investors, Liberia had to surrender part of its sovereignty by allowing two Englishmen

to be placed in charge of the Nation's customs revenues. Due to the small nature of the revenue base and embezzlement of state funds, Liberia again defaulted on this loan.

The cumulative public debt as of 1911 was almost US$1.4 million and given the level of fiscal indiscipline by the GOL and the state of the economy, additional government spending proved distabilizing thus having adverse effects on the economy. In 1911, the U.S. Government arranged a 40-year international loan totaling $1.7 million, with the conditionality that four outsiders (American, British, French and German) be given control over customs receipts and taxes, which were earmarked for loan repayment. In this regard, a receivership was imposed on the GOL revenue, which lasted until 1926, (Van der Kraaij, 1981).

During this period, Liberia's primary exports were coffee, palm oil, palm kernels, and piassava while the GOL's primary sources of revenue were hut tax, and revenue from customs. A major fraction of public revenue was given to the General Receiver who paid the debt service, the salaries earned and expenses incurred by the receivership, the custom service and the army. About 40 per cent of the GOL revenue, representing about US$100,000.00 went into servicing the loan, (ibid). Liberia defaulted again and in 1918 sought another loan of US$5 millions from the US government which was rejected at least until the coming of the Firestone Rubber Company (FRC) in 1926 at which time a loan of US$5 millions was arranged through the Finance Corporation of America, a Firestone subsidiary.

From 1926 up to 1976, public finances in Liberia showed a remarkable improvement thanks to the coming of the FRC in 1926, the signing of the Defense Pact with the US government in 1942, and the Open Door policy (ODP) of President Tubman in the early 1940s which attracted four multinational iron companies between 1951 to 1965, (IMF, 1975). From 1939 to 1945, Liberia registered a favorable balance of trade, which amounted to $25.9 million during the six-year period; that equates to $754 millions in current dollars. The GOL revenues rose from $827,000 in 1939 to $1.9 million in 1945, an increase of 133.9 percent. From 1946 to 1960, the Tubman Administration attracted $500 millions in foreign investment; exports rose from $15.8 million in 1948 to $82.6 million in 1960, an increase of 422.8 percent; and Government revenue rose from $32.4 million in 1960 to $69.9 million in 1971, an increase of 115.7 percent. From 1962 to 1980, Liberia received $280 million in aid from the U.S., the greatest level of U.S. aid to any African country on a per capita basis at the time.

Aid levels rose from about $20 millions in 1979 to $75 million and then $95 million, for a total of $402 million between 1981 and 1985, more than the country received during the entire previous century but aid to the PRC government was stopped because of its corrupt and repressive activities. As a result of the military coup of 1980 and the subsequent fiscal indiscipline exhibited by the PRC government, there was a disequilibrium in both domestic and external macroeconomic indicators which Worlobah (2006, p.13) attributed 'to political instability, accentuated by depressed world demand and declining reserves of iron ore, stagnating rubber production, and a significant decline in the terms of trade'. The combined effect of these factors was a dis-incentive to foreign investment which translated into capital outflow from the economy thus causing a balance of payment disequilibrium, reducing investment, and increasing the fiscal deficits (ibid). The PRC government failed to implement policies that could reverse the ensuing deteriorating macroeconomic environment. As its revenue base declined, instead of reducing its unproductive expenditures, the PRC government resorted in excessive deficit financing. Table 5 summarizes the GOL fiscal activities in the 1980s.

Table 5: Liberia Fiscal Balances between 1981 and 1987 (in millions of LD).

Year	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Total Revenues (including grants)	279.3	256.4	260.1	217.0	205.6	234.6
Total Expenditures	370.6	390.4	344.1	382.6	310.5	366.3
Overall Balance	-91.3	-133.0	-84.0	-165.6	-104.9	-131.7
Financing	91.3	133.0	84.0	165.6	104.9	131.7
Changes in arrears	-6.0	8.0	3.3	68.7	41.1	29.7
Borrowing from the NBL	50.7	81.6	53.0	57.3	42.1	24.0
Others	46.6	43.4	27.7	39.6	21.7	24.0

Sources: Adopted from Worlobah (2006, p.14)

Analysis of Table 5 indicates that from 1981 to 1987, the GOL spent more than it generated as revenues thereby incurring an overall deficit balance. These deficits were severe from fiscal year 1984-85 to 1986-87. Financing these deficits was mainly done by excessive borrowing from the NBL, external borrowings and other sources.

The civil war in Liberia lasted from 1989 to 2003, causing untold destruction to lives and properties. The unstable political environment severely hindered economic activities leading to the outflow of capital. Moreover, a significant number of the population was either killed or forced to flee the country thus reducing the labour force. As the political environment improved in 1997 due to the disarmament of the fighting forces, the re-unification of the country and the subsequent 1997 presidential elections, the economy experienced some improvements as activities in the timber, agricultural and rubber sectors resumed. According to IMF (2005) real GDP increased by about 20 to 30 per cent per annum during the period between 1998-2000 but the external account was in disequilibrium. In 2003 the country relapsed into another bloodshed which greatly affected the economy.

With the cessation of hostilities in December 2003, the World Bank and the UNDP jointly undertook a needs assessment for Liberia. The findings confirmed an already known fact in Liberia: that Liberia's political instability was strongly tied to its fiscal indiscipline. Following this, a "Results Focused Transitional Framework" (RFTF) was prepared which defined the most urgent needs. The transitional GOL at the time was to use the RFTF as a strategic plan. However, economic governance remained a major challenge; little was done to address the problems of the civil service, arrears of pay accumulated and patronage appointments continued. With the encouragement of its development partners, the transitional GOL adopted the Governance and Economic Management Assistance Program (GEMAP) which was backed by a resolution of the United Nations Security Council in June 2005.

GEMAP's objective was to improve economic governance and financial management by putting in place the basic systems of public financial management, and providing, on a temporary basis, the specialized financial management staff to oversee them. GEMAP's key components include revenue improvement, budgeting and expenditure management and adopted measures to strengthen fiscal administration, transparency and accountability. GEMAP laid the foundations for the commencement of government functioning and in turn the normalization of relations with international financial institutions. In 2006, with the inauguration of President Sirleaf, the GOL endorsed GEMAP as a right step in enhancing governance and strengthening economic management. In order to reduce its expenditures, the GOL embarked on a down-sizing program of the civil service. The GOL also instituted the Senior Executive Services (SES) which is

composed of experts and technocrats whose sole responsibility is to monitor the day to day activities of government ministries and agencies and recommend expert advice. In 2007, the GOL reached an understanding with the IMF on a Staff Monitoring Program (SMP). The aim of the IMF-SMP was to further improve economic governance, public financial management, tax and customs administration and the health of the banking sector.

Liberia runs a fiscal year that starts on July 1 of one year and ends in June 30 the following year. The fiscal system of Liberia is totally centralized and includes all government activities because the country is a unitary state. The Bureau of the Budget prepares the annual fiscal budget of the GOL which is divided into revenues and expenditures. Revenues include taxes on income, general sales tax, license fees and fines, revenue from maritime, loans and grants while expenditures include all expenses incurred in general administration (civil service), the maintenance of law and order, expenditures on national defense, the provision of community and social services and direct economic activities, the purchase of capital assets and goods for the GOL's use and transfers to para-statals. Since Liberia is currently on the HIPC initiatives, the country is currently operating a cash-based budgetary policy where borrowing to finance the budget deficit is not permitted. Fiscal policy has therefore remained anchored on the need to maintain a balanced cash-based budget. The GOL has committed to spend only as revenues permit; consequently, a statement that "there shall be no deficit financing" is included in the preface to recent budgets.

For the Fiscal year 2009/2010, the GOL is operating on a budget of US$347, 035, 687 million. The external debt as of 2009, stands at US$ 1782 million and it is composed of: multilateral US$1070.7 millions; bilateral US$ 690.8 million; and commercial US$ 20.5 million. In April 2009, the GOL by means of the IDA Debt Reduction Facility bought back US$1.2 billion of its commercial debt at a discount of nearly 97 percent off the face value. However, due to the prolonged nature of the civil conflict and the process by which some loans were contracted, most of the outstanding commercial debt was deemed barely discernible thus unenforceable. Total domestic debt at end-June, 2009 was about US$913.8 million, of which US$303.9 million was deemed valid; US$317.0 million, contestable; and US$292.5 million rejected. Of the total valid claims, US$263.8 million is owed to financial institutions (FIs), of which 97 per cent is due to the Central Bank of Liberia, (CBL, 2009).

1.2 Statement of the Problem

Analysis of Liberia's macroeconomic performance indicates that most of Liberia's macroeconomic problems are self-inflicted arising from mismanagement characterized by unsustainable levels of government expenditures, dual currency arrangement, corruption and bad governance. We argue that this could be the consequence of lack of information about the appropriate dose of monetary and fiscal policies necessary for stimulating meaningful and sustainable economic growth and stability. Over the years, the country's monetary policy has been tailored to meet the financial requirements of the government while the fiscal policy has been used for political patronage. The level of macroeconomic mismanagement has led to political and macroeconomic instability which has hindered the growth potentials of the economy.

In an attempt to restore basic financial management and to address long standing governance problems, the GOL embraced GEMAP and took significant steps to improve financial management. To improve the distribution of the national income and alleviate poverty, the GOL formulated a poverty reduction strategy called *Lift Liberia*. In the context of *Lift Liberia,* fiscal policy has been identified as the key driver for economic growth while monetary policy has been assigned the role of maintaining low inflation via stability in the nominal exchange rate.

The formulation of an optimal macroeconomic stabilization policy to achieve the economic objectives of *Lift Liberia* would be easy and uncomplicated if policy makers knew completely and precisely how monetary and fiscal aggregates are related to economic activities in Liberia. An understanding of these behavioural features is crucial in the formulation and implementation of result-focused macroeconomic stabilization policies. As it is, the assignment of macroeconomic stabilization policies in *Lift Liberia* lacks empirical foundation. Previous macroeconomic stabilization policies have been formulated without any empirical backing to establish the nature of the link between fiscal and monetary aggregates on one hand and economic activities on the other. It therefore follows that it is necessary to probe into the responsiveness of output to macroeconomic variables employed so that greater emphasis is placed on the policy that could have the greatest impact in altering output. This study aims at filling this gap.

1.3 Research Questions

Given the need to foster meaningful economic growth and development in Liberia, this study asks the following questions:

i. what is the impact of monetary policy on output in Liberia over the years?
ii. what is the impact of fiscal policy on output in Liberia over the years?
iii. has there been a policy mix over the years and if so, how has it impacted on output?

1.4 Objectives of the Study

The broad objective of this study is to determine the policy measure that has been more effective in altering real output growth in the Liberian economy in line with the desired objective of macroeconomic stability.

The specific objectives are to:

i. determine the impact monetary policy has had on economic growth in Liberia over the years
ii. determine the impact fiscal policy has had on economic growth in Liberia over the years
iii. determine the impact, if any, of a policy mix on economic growth in Liberia over the years

1.5 Research Hypotheses

This study will test the following research hypotheses:

i. monetary policy has been more effective than fiscal policy in promoting and sustaining meaningful economic growth in Liberia over the years
ii. fiscal policy has been more effective than monetary policy in promoting and sustaining meaningful economic growth in Liberia over the years
iii. a policy mix, if any, has been more effective in promoting and sustaining meaningful economic growth in Liberia over the years

1.6 Justification of the Study

Liberia faces a challenge of reconstructing its economy after the devastation caused by the 14-year civil war. This can only be realized via appropriate macroeconomic stabilization policies.

Empirical evidence establishing the nature of the link between macroeconomic policy variables and economic activities could prove indispensable to policy makers in that such information is likely to reduce the likelihood of policy mistakes. This study therefore attempts to establish the empirical evidence on the macroeconomic stabilization policy that has had the greatest impact on output so that that policy could be given more attention.

1.7 Organization of the Study

The rest of the study is organized as follows: Chapter 2 gives the theoretical and empirical review of literature on the relative potency of monetary and fiscal policies. Chapter 3 outlines the econometric methodology to be adopted in investigating the relative potency of fiscal and monetary policies on output in Liberia, definition and justification of variables together with the estimation procedures to be conducted. Chapter 4 presents the empirical results and gives an economic interpretation of the findings. Chapter 5 gives a summary of the study, policy implications and recommendations and conclusion.

CHAPTER TWO:

LITERATURE REVIEW

2.0 Introduction

The relative potency of monetary and fiscal policies is determined by the comparative swiftness with which each policy effects a desirable change in the policy maker's objectives. Macroeconomic stabilization policies are formulated to optimize the policy maker's objective function wherein the policy objective is determined by the prevailing macroeconomic environment. It is an incontrovertible fact that both fiscal and monetary policies affect the equilibrium level of income and interest rate in the economy what matters is the extent and pace with which each one affects output. This chapter provides the theoretical literature surrounding this debate. In addition, it provides the empirical literature and a synthesis of the debate.

2.1 Review of Theoretical Literature

The theoretical literature regarding the relative potency of fiscal and monetary policy, though prolonged, has now zeroed in on the question "does money matter" in bringing about a significant and desired change in the equilibrium level of output and interest rate prevailing in the economy. The fiscalists hold that *money does not matter* thus inferring that fiscal policy is more effective in impacting on the equilibrium level of income and interest rate while the monetarists argue that *only money matters* hence inferring that fiscal policy is ineffective. The theoretical literature review intends to trace the determinants of the equilibrium level of output and interest rates through the schools of macroeconomic thought as used by Chingarande (1999).

2.1.1 Classical School of Thought

The Classical theory of output determination is explained by *Say's Law* so named after the French economists *Jean Baptiste' Say*. The classical economists by means of Say's law argued that "supply creates its own demand," hence the act of producing something creates the equivalent demand for it and that what is produced is consumed. Since the classical economists believed that the economy was always at full employment, the key determinant of output in the economy was via the *invisible hand*, that is, supply and demand conditions, hence the labor market was assumed to always be in equilibrium. Similarly, the classical economists argued that the equilibrium interest rate is determined by the demand for loanable funds (investment) which

is an inverse function of the interest rate and the supply of loanable funds (savings) which is a positive function of the interest rate, hence the factor market was assumed to be in equilibrium. The classical stabilization policies were microeconomic in nature and the only stabilization policies needed were those geared towards ensuring perfect competition, hence the doctrine of *laissez-faire*.

The classical treatment of the role of money in the economy can be traced to the conception in 1568, of the classical quantity theory of money by Jean Bodin which was subsequently developed by John Locke, David Hume, Richard Cantillon, David Ricardo, and Irving Fisher. Fisher's Version, the Equation of Exchange, is the most famous and it serves as the classical approach to the determination of the relationship between the quantity of money and the price level. It is written as follows:

$$M\bar{V} \equiv P\bar{Q} \quad \text{.....} \quad 2.1$$

Where M is the quantity of money in circulation, assumed to be exogenously determined; V is the velocity of money, or the average number of times money changes hands which was assumed to be fixed simply because money was earned to be spent- the transaction motive; P is the general price level prevailing in the economy; and Q was the level of output produced in the economy also assumed to be fixed because the economy was always assumed to be in a state of full-employment. The classicalists argued that variations in the quantity of money is transmitted in equal proportion to variations in prices, hence the argument that money affects only nominal variables (prices and interest rates) and not real variables (output). Thus they argued that money was neutral in the determination of real output and interest rates.

2.1.2 The Neo-Classical School of Thought

The neo-classical approach to the determination of the equilibrium level of output was aimed at analyzing the determinants of changes in output, hence the *sources of growth approach*. This approach was developed by Solow (1956) and Swan (1956). It uses an aggregate, constant-returns-to-scale production function that combines labor and capital in the production of a composite good. Capital is assumed to exhibit diminishing marginal returns; savings are a fixed proportion of output while technology improves at a constant exogenous rate. The neo-classical

production function specified in a Cobb-Douglas form in output per capita, y_t is expressed as follows:

$$y_t = A_t k_t^{1-\sigma} \quad , 0 \prec \sigma \prec 1 \qquad \text{..... 2.2}$$

where k_t denotes the capital-labor ratio and A_t measures the level of technology. Capital accumulation is given by:

$$\dot{k} = sy_t - \delta k_t, \quad 0 \prec s, \quad \delta \prec 1 \qquad \text{..... 2.3}$$

where s denotes the propensity to save and δ the rate of depreciation of physical capital. The model assumes equality in the goods market hence saving equals investment. The model argues that at the *steady-state*, the rate of growth of real output per worker is determined by the growth rate of the population and technology and that the savings rate has only level (short-run) effect and not growth (long-run) effect on output. Hence monetary and fiscal policies are assumed to indirectly determine output in the economy.

2.1.3 The Keynesian School of Thought

The Keynesian theory to the determination of equilibrium level of output (income) and interest rate in the economy is a fundamental attack dubbed the *Keynesian Revolution* which is directed at *Say's Law*. Keynes argued that aggregate supply depends on the producers (firms) plans to produce goods and services while aggregate demand depends on households plan to consume and to save. Output is determined at the point where households' plans coincide with producers' plans. Unlike the classical economists, Keynes argued that households consume a fraction of their income and save the other and that there is no guarantee that whatever is saved is invested. Hence saving is not always equal to investment consequently, aggregate supply may not be equal to aggregate demand.

With respect to the role of money in affecting output in the economy, unlike classical economists, Keynes divided the motive for holding (*demand for money*) into three parts: the transactionary motive (M_t) which results as a means of facilitating daily transactions which he considered an increasing function of income (output); the precautionary motive (M_p) which

results out of the desire to avoid unforeseen contingencies, also an increasing function of income (output); and finally, speculative motive (M_{SP}) which results out of the desire to take advantage of the changes in the money or asset market, which he considered an inverse function of the interest rate. The Keynesian money demand function (M_D) is depicted as:

$$M_D = M_T + M_{SP}, \qquad where \quad M_T = M_t + M_p \text{ .... } 2.4$$

Focusing on the speculative motive for holding money, Keynes argued that increases in the quantity of money (which is assumed exogenous) in circulation lead to a fall in the interest rates which increases investment hence output. He argued that there exists a point, *the liquidity trap*, at which an increase in money supply will have no effect on the interest rates hence investment and output will remain unchanged. In so doing, Keynes argued that variations in government spending and taxation were the most effective means of varying interest rates and output.

2.1.4 The Monetarists School of Thought

The monetarists' interpretation of the determinants of fluctuations in aggregate output in the economy is founded in the modern quantity theory of money. The monetarists believe that changes in the money stock are the predominant factor explaining changes in nominal output (income). They argued that in the short-run, the supply of money does influence real variables but in the long-run, the influence of money is primarily on the price level and other nominal magnitudes. They argued that in the wake of a stable demand for money, most of the observed instability in the economy could be attributed to fluctuations in the money supply induced by the monetary authorities. They recommend that the lag between changes in the money stock and changes in nominal output is long and variable, so that attempts to use discretionary monetary policy to fine tune the economy could turn out to be destabilizing and as such, the money supply should be allowed to grow at a fixed rate in line with the underlying growth of output to ensure long-term price stability. The monetarists reject the Keynesian fine-tuning the economy (fiscal policy) on grounds that an increase in government spending increases output, since money demand is an increasing function of output (income), hence an increase in money supply leads to portfolio re-allocation. This increases the price of other assets that are equally attractive as money (loosely bonds) thus increasing the interest rate. An increase in the interest rate reduces investment, employment and consequently output.

2.1.5 The New Classical School of Thought

The emergence of the new classical school of thought was due to the necessity of providing a strong emphasis on underpinning macroeconomic theorizing with neo-classical choice-theoretic micro-foundations within a *Walrasian general equilibrium framework.* The key proponents of this school were Robert Lucas, Neil Wallace, Thomas Sargent, among others. The new classical economists argued that all economic agents are rational; that is, agents are continuous optimizers subject to the constraints that they face, firms maximize profits and labour output and households maximize utility, (Snowdon and Howard, 2005). They further argued that agents do not suffer from money illusion hence only real variables (relative prices) matter for optimizing decisions and that complete and continuous wage and price flexibility ensure that markets continuously clear as agents exhaust all mutually beneficial gains from trade, leaving no unexploited profitable opportunities. New Classical theories are based on three pillars: rational expectations, natural rate of unemployment, and instantaneous market clearing in the economy. In these models, fluctuations in output and employment reflect the voluntary response of rational economic agents who misperceive money price changes for relative price changes due to incomplete information. Anticipated changes in aggregate demand will have no effect on real output, hence only unpredictable movements in aggregate demand will affect real variables. The New Classical economists' claim that monetary and fiscal policies are ineffective in altering the equilibrium level of output and interest rate in the economy unless they were sprung as a surprise on an unsuspecting public.

2.1.6 The New Keynesian School of Thought

The new Keynesian macroeconomics has been primarily concerned with the 'search for rigorous and convincing models of wage and/or price stickiness based on maximizing behaviour and rational expectations. The paramount task facing Keynesian theorists is to remedy the theoretical flaws and inconsistencies in the old Keynesian model. Therefore, new Keynesian theorists aim to construct a coherent theory of aggregate supply where wage and price rigidities can be rationalized. New Keynesian economists approach is characterized by imperfect competition, incomplete markets, heterogeneous labour market and asymmetric information, where agents are frequently concerned with fairness; hence the 'real' macro world is characterized by the possibility of coordination failures and macroeconomic externalities. New Keynesian argued that money is non-neutral hence non-neutralities arise from sticky prices and market imperfections

which explains the behaviour of prices. New Keynesian models assume price-making monopolistic, rather than perfectly competitive firms, (ibid).

New Keynesian economists accept that the source of shocks which generate aggregate disturbances can arise from either the supply side or the demand side. However, new Keynesians argue that there are frictions and imperfections within the economy which will amplify these shocks so that large fluctuations in real output and employment result. The important issue for new Keynesians is not so much the source of the shocks but how the economy responds to them. Within new Keynesian economics there have been two strands of research relating to the issue of aggregate fluctuations. The predominant approach has emphasized the importance of nominal rigidities. The second approach follows and explores the potentially destabilizing impact of wage and price flexibility. The New Keynesians argue that with a reduction in money supply and if a combination of menu costs and real rigidities makes the price level rigid, a decline in aggregate demand will lead to a fall in output. The decline in output reduces the effective demand for labour hence producing involuntary unemployment. The new Keynesian argued that downward pressure on wages and prices would increase output and as such they advocate measures which will increase aggregate demand. Monetary shocks have non-neutral effects in the short-run although money remains neutral in the long-run. The New Keynesians argued in favor of fiscal policy that targets a tax cut in order to encourage incentives of economic agents.

2.1.7 The Real Business Cycle (RBC) School Approach

The RBC economists argue that technical change is the most important source of economic shocks and that these shocks are propagated in perfectly competitive markets. RBC theory sees recessions and periods of economic growth as the efficient response to exogenous changes in the real economic environment. They further argue that the economy is continuously affected by the incidence of uncertainty which might occur as a result of adoption of new production techniques, changes in consumer's taste, and changes in government policies which affects the behaviour of agents. Most of these changes are not perfectly predicted by individual firms hence these shocks lead economic agents to continuously adjust their optimal plans. The RBC economists' rebuff the notion that the foremost cause of shocks originates from demand shocks or policy shocks such as variations in money supply. They argue that the level of national output necessarily maximizes *expected* utility, and government should therefore concentrate on the long-run structural policy

changes and not intervene through discretionary fiscal or monetary policy designed to actively smooth out economic short-term fluctuations. According to RBC theory, business cycles are therefore "real" in that they do not represent a failure of markets to clear but rather reflect the most efficient possible operation of the economy, given the structure of the economy. In so doing, RBC economists consider fiscal and monetary policies as ineffective in generating a shock to the economy.

2.1.8 The Credit View

Unlike other schools of macroeconomic thought which consider changes in the cost of acquiring loanable funds (interest rate) as the only factor accounting for the variations in economic activities, the credit view to output fluctuations holds that changes in the interest rate are not the only factors explaining fluctuations in the level of economic activities prevailing in the economy. Proponents of the credit view argued that the interaction between borrowers and lenders following a change in the quantity of money circulating in the economy plays a significant role in altering the level of economic activities, (Chingarande, 1999).

A reduction in the quantity of money circulating in the economy as result of a tight monetary policy reduces the level of transaction balance held by individuals. Assuming that the public's demand for transaction balance is constant, the supply of loanable funds (savings) will fall thus reducing the reserves of commercial banks and inhibiting their loan making potentials. Given an increase in the demand for loanable funds (investment) relative to the supply of loanable funds, coupled with the commercial banks' inability to innovate ways of reversing the falling trends in deposits, credit rationing becomes the only viable option. Consequently, only large firms with significant assets holdings are given access to loans hence smaller firms which contract loans to finance their investments are dispossessed of their main source of finance. Since the economy is populated with a large number of smaller firms which account for a major fraction of intermediate output used to produce final output, aggregate investment will fall hence reducing the level of aggregate economic activities (ibid).

Proponents of the credit views considers monetary policy as having a potentially destabilizing effect on the economy hence refuting the neutrality of money proposition held by some schools of macroeconomic thought. Bernanke and Gertler (1989) argued that a tight monetary policy leads to a fall in investment which translates into a decline in output.

2.2 Review of Empirical Literature

The empirical literature on the factors that have significant impact on altering output in the economy have endured a prolonged and unending debate just as the theoretical literature.

In an attempt to reestablish the significance of money, Friedman (1958), through a study of time series data of 18 non-war cycles since 1870, comparing the growth rates of money supply with changes in output for the US economy, on the basis of simple correlation, found that increases (decreases) in money growth preceded increases (decreases) in the level of economic activity. He concluded that money has greater influence on economic activities.

Friedman's conclusion was criticized by Culbertson (1960) and by Kareken and Solow (1963) on both methodological and statistical grounds. Using Friedman data, Kareken and Solow reran the test using rates of changes for both money supply and economic activity; they found no uniform lead of monetary changes over changes in the level of economic activity.

Friedman and Schwartz (1963) in their historic study, *Monetary History of United States: 1867-1960,* provided more persuasive evidence in support of his earlier claim that changes in the stock of money played a largely independent role in cyclical fluctuations. They found that although the stock of money tended to rise during both cyclical expansions and contractions, the rate of growth of the money supply had been slower during contractions than during expansions in the level of economic activity. Within the period of their study, they found that an appreciable fall in money supply had resulted into major economic contractions (recessions).

Friedman and Meiselman (1963), using a number of reduced form single equations based on annual U.S. data for the period 1897-1958 of consumption with broad money supply, on one hand, and consumption with net private domestic investment plus the government deficit on income and product account plus the net foreign balance on the other hand; found that movements in consumption were more highly correlated with monetary than fiscal variations.

The findings by Friedman and Meiselman were challenged by De Prano and Mayer (1965) and Ando and Modigliani (1965) who argued that there was an error with the autonomous expenditure used by Friedman and Meiselman. They argued that a change in the definition of

autonomous expenditure would improve the predictive capability of the autonomous expenditure equation.

The previous studies had used two equations to test the impacts of monetary and fiscal actions on output but none had used a single equation that incorporates the two policy measures as independent variables. The first attempt was made by Anderson and Jordan (1968) using quarterly US data. They used a single equation model with reduced-form relationships relating changes in nominal GNP to changes in several monetary and fiscal actions. Their measures of fiscal action were high employment, federal tax receipts and high employment Federal government expenditure while their monetary measures were the monetary base and the narrow money (currency plus demand deposits) stock. Using the *Almon lag* econometric techniques, they estimated changes in each of the measures of fiscal and monetary actions on changes in nominal GNP. They rejected the propositions that the response of economic activity to fiscal actions relative to monetary actions was larger, more predictable, and faster. To conclude, their results suggested that the overall effect of fiscal actions was relatively small and statistically insignificant.

Many economists were critical of Anderson and Jordan's findings. De-Leeuw and Kalchbrenner (1969), using the dataset used by the Anderson and Jordan study, estimated quarterly changes in nominal GNP on quarterly changes in fiscal and monetary variables. They found that fiscal policy has a more significant influence on GNP than monetary policy.

In a subsequent study, De-Leeuw and Gramlich (1969), in a study using large-scale econometric model found that monetary policy has larger impact on aggregate output than fiscal policy but that monetary policy works slower than fiscal policy despite its relative effectiveness.

Keran (1969), in a study to provide empirical evidence as to the influence of monetary policy on output given the effects of changing financial and institutional factors within the US economy, using dataset covering fifty years, found that monetary policy had significant impact on output as compared to fiscal policy.

Corrigan (1970) rejected Anderson and Jordan findings on the basis that the fiscal policy measure was endogenous and that the lag length was not optimally selected. He modified the Anderson and Jordan model and used their data to estimate quarterly changes in nominal GNP

on quarterly changes in the narrow money (currency plus demand deposits) stock and quarterly changes in tax stimulus (his fiscal policy measure). He concluded that fiscal policy, particularly tax rate changes, is of no significance in the determination of changes in output.

In 1970, Tobin (1970) renewed the challenge to Friedman and the monetarists' view of *money to output* causality. He challenged the reliability of the timing (leads and lags) evidence of Friedman and the monetarists. Using an *Ultra Keynesian Model*[5], Tobin proved how the timing evidence could be interpreted in support of the Keynesian position on business cycles and instability. He accused Friedman of falling foul of the *post Hoc Ergo Propter Hoc* fallacy. That is, he argued that correlation does not mean causation. Tobin accused Friedman of not having an explicit theoretical foundation linking cause and effect on which to base his monetarist claim. He argued that most of Friedman's work was "measurement without theory" and that monetarism remained too much a "black-box."

Elliot (1975), in a study to examine the relative importance of money supply changes compared to government expenditure changes in explaining fluctuations in nominal GNP for the US economy, employed a modified St. Louis equation for the period 1953 quarter 1 to 1969 quarter 4, using three econometric estimation techniques of (a) the Almon lag procedure, (b) the method of smoothness priors, and (c) unrestricted least squares, and employing lag periods reaching back 4, 8, and 12 quarters respectively. He found that fluctuations in nominal GNP more importantly attached to monetary movements than to movements in federal government expenditure.

Benjamin Friedman (1977) conducted a study of the US economy using quarterly U.S. data from the Anderson and Jordan study and included quarterly data for the period 1970 quarter one to 1976 quarter two in differenced form. Employing the use of the St. Louis equation, he presented evidence showing that fiscal policy was relatively more effective in bringing about a change in output than monetary policy.

To test the validity of Friedman's claim, Carlson (1978) re-estimated the St. Louis equation with the variables in a rate of change form and argued that Friedman's equation was plagued with the

[5] A Keynesian model that has a vertical IS curve and a horizontal LM curve.

problem of heteroscedasticity. Carlson found that only monetary policy has significant impact on economic activity and fiscal policy does not have any impact on real output.

Just as the empirical evidence for developed countries, notably the US, have been subject to unending debate and controversy, so too is the empirical evidence from developing countries. Bringing the debate to developing countries, Ajayi (1974), in studying the relative effectiveness of monetary and fiscal policies in Nigeria estimated the St. Louis equation. His dependent variable was the nominal GDP while his first independent variable was money supply which consisted of five different monetary aggregates (M1, M2, M3, High Powered money and broad high power money) and his second independent variable was fiscal policy which consisted of three fiscal aggregates (high employment budget surplus, full employment tax revenue and government current and capital expenditure). Employing a step-wise estimation technique, he regressed changes in nominal GDP on government expenditures, government revenue and money supply and found that monetary policy exerts more impact of output than fiscal policy in Nigeria.

Several studies conducted in developing countries such as Jayaraman (2002) for four South Pacific island countries (Fuji, Samoa, Tonga and Vanuatu), Masood and Ahmed (1980) for Pakistan, Saqib and Yesmin (1987) for Pakistan and Upadhyaya (1991) for developing countries, using single-equation St. Louis equation in the context of a distributed lags estimation framework, have found empirical evidence that supports the monetarists view that monetary policy is more effective in altering real output than fiscal policy. On the other hand, studies by Hussain (1982) for Pakistan and Chowdhury (1988) for Bangladesh found empirical evidence that supports the Keynesian view that fiscal policy is more effective in altering real output than monetary policy.

Darrat (1984) studied the relative effects of monetary and fiscal policy for five Latin American countries (Brazil, Chile, Mexico, Peru and Venezuela). He modified the St. Louis equation by including exports to capture the openness of these economies. Employing unconstrained OLS estimation technique with variables in growth rate form, he found empirical evidence that supports the Keynesian view that fiscal policy is more effective in altering real output than monetary policy.

In a study conducted on the relative effectiveness of monetary and fiscal policy in fifteen African countries, Ubogu (1985) used the St. Louis model in reduced form and found that monetary policy tends to exert more influence on economic activity in middle income countries than fiscal policy and that fiscal policy tends to exert more influence on economic activity in low income African countries than monetary policy.

Owoye and Onafowora (1994) studied the relative effectiveness of monetary and fiscal policy in ten African countries (Burundi, Ethiopia, Ghana, Kenya, Morocco, Nigeria, Sierra Leone, South Africa, Tanzania and Zambia) using the *Vector Autoregression* (VAR) estimation technique on the St. Louis equation with annual data covering the period 1960 to 1990. They found evidence that supports the monetarists' view in five countries on one hand, on the other; they found evidence from five countries that supports the Keynesian view.

Olaloye and Ikhide (1995) studied the relative effectiveness of monetary and fiscal policy in Nigeria using OLS estimation techniques on the St. Louis equation with monthly data for the period 1986-1991. They found evidence that fiscal policy exerts more influence on the Nigerian economy than monetary policy.

Using modified version of the St. Louis equation with OLS estimation technique on nominal data covering the period 1974-1993, Latif and Chowdhury (1998) found fiscal policy to be more effective than monetary policy in altering output in Bangladesh.

Hasan (2001) using the modified St. Louis equation with several econometric estimation techniques based on nominal data covering the period 1974-1996 found evidence that both fiscal and monetary policies are significant in promoting economic growth in Bangladesh. It was proven that the use of real variables would alter their initial findings.

In a more recent study, Rahman (2005) using data covering the period 1975-2003 and an unrestricted VAR framework based on the modified St. Louis equation with the real interest rate as an additional policy variable found that monetary policy has significant positive impact on real output growth in Bangladesh as compared to fiscal policy.

Kamau (1997) using a modified St. Louis reduced-form equation with data covering the period 1975 quarter 1 to 1995 quarter 3, and employing the econometric estimation technique of

cointegration and error correction modeling found empirical evidence that suggests that monetary policy was more effective than fiscal policy in influencing economic growth in Kenya.

Chingarande (1999), in a study to examine the relative impact of monetary and fiscal policy on economic activity in Zimbabwe, employed a modified St. Louis equation for the period 1981 quarter 4 to 1998 quarter 3, using the econometric techniques of time series cointegration and error correction modeling. She found monetary policy to be relatively stronger and predictable than fiscal policy in determining economic activity in Zimbabwe.

2.3 Conclusion

A review of the literature showed that while the debates between the fiscalists and the monetarists seem to be unending, the monetarists have been more forceful in presenting their view as compared to the fiscalists. The fiscalists have always been on the defensive refuting monetarists' innovation in presenting their views. The fiscalists have not created any model that incorporates both monetary and fiscal measures that test the relative effectiveness of monetary and fiscal policy while the monetarists' formulation of the St. Louis equation seems to be winning the debate. But the debate is far from being conclusive as empirical evidences presented by studies are influenced by structural differences prevailing in the economies, the choice of coverage period, the formulation used and the manner in which the decisive variables are defined.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

The aim of this chapter is to specify the methodology to be used in determining the relative effectiveness of monetary and fiscal policy on output in the Liberian economy. The first section specifies the model, the second section provides details on the time series properties of the variables used and the econometric estimation technique employed and finally, section three defines the variables used and the justification for their usage.

3.1 Model Specification

An analysis of the empirical literature review reveals that in an attempt to determine the relative effectiveness of monetary and fiscal policy on output, many models have been employed. These models range from the two-equation simple correlations model used by Friedman and Meiselman (1963), to the single equation model with reduced form relationship used by Anderson and Jordan (1968). The model to be used in this study is adopted from the one originally developed by Anderson and Jordan (1968) for the analysis of the relative effectiveness of monetary and fiscal policy. It is referred to as the *St. Louis Model.* It is an estimated relationship between changes in output and changes in the money supply and high employment government expenditure. The use of this model is preferred because it is the only model that captures the relative impact of monetary and fiscal actions on output within the context of a single equation.

Using a neo-classical production function for the production of aggregate output in the economy;

$$Y = f(A, L, K) \quad \ldots\ldots 3.1$$

where Y is output, A is productivity, L is labor and K is capital, so that output is related to labor, technology and capital. Consequently, the output growth function can be expressed as follows:

$$g_y = \Xi(g_A, g_L, g_I) \quad \ldots\ldots 3.1.1$$

where output growth (g_y) is driven by population growth (g_l), savings which lead to capital formation (investment) (g_k), and growth in technological change (g_A). Ξ is a functional notation.

Using Milton Friedman's money demand function in the spirit of the reformulated QTM, the demand for real money balances in the economy can be specified as follows:

$$\frac{M_D}{P} = f\left(Y^P, r, P^e, \mu\right) \quad \text{3.2}$$

where $\left(\frac{M_D}{P}\right)$ is the demand for real money balance; (Y^P) is permanent income, a proxy for wealth or budget constraint; (r) is the rate of returns on financial assets; (P^e) is expected inflation and (μ) represents individual tastes and preferences for holding money. Assuming equality in the money market where money demand equals money supply, such that:

$$M^D = M^S \quad \text{3.2.1}$$

Then, the money supply function grows as follows:

$$g_m = \Delta m_t + \pi m_t \quad \text{3.2.2}$$

This means that the growth in money supply depends on the change in the money stock over time (Δm_t), inflation (π) and the current money stock in the economy (m_t).

In recognition of the fact that government cannot spend more than it generates in terms of tax revenue and both domestic and external borrowing in the absence of grants, we specify the government's consolidated budget identity as follows:

$$\Delta L_t + \Delta B_t + E_t \Delta F_t^g = P_t\left(g_t - \tau_t\right) + i_t B_t + i_t^* E_t F_t^g + i_c L_t \quad \text{3.3}$$

Where (L_t) is the nominal stock of credit allocated by the central bank; (B_t) the stock of domestic-currency-denominated interest-bearing public debt; (F_t^g) the stock of foreign-currency denominated interest-bearing public debt; (g_t) the real public spending on goods and services

(including current and capital expenditures); (τ_t) the real tax revenue net of transfer payments; (i_t) the domestic interest rate; (i_t^*) the foreign interest rate; $(0 \le i_c \le i_t)$the interest rate paid by the government on central bank loans; (E_t) the nominal exchange rate; and $(P_t)$the domestic price level. We can then specify the St Louis Equation as follows:

$$\dot{Y}_t = \varphi + \sum_{i=0}^{N} \beta_i \dot{M}_{t-i} + \sum_{i=0}^{N} \lambda_i \dot{E}_{t-i} + \mu_{nt} \quad \text{..... 3.4}$$

The model is specified in such a manner that it links the rate of growth in nominal GNP at time t $\left(\dot{Y}_t\right)$ to lags of the rate of growth in the money supply at time t $\left(\dot{M}_t\right)$ and lags of the rate of growth in full, or high employment government expenditure at time t $\left(\dot{E}_t\right)$ with (μ_{nt}) being the stochastic error term.

According to Rahman (2005, p.1), 'some economists such as Stein (1980) and Ahmed et al. [sic] (1984) criticized the validity of using the St. Louis equation on the following grounds: the St. Louis equation is a reduced form equation and that the policy variables (money and government expenditure) included in this equation are not statistically exogenous; the St. Louis equation suffers from specification error because it omits some other relevant regressors (e.g. interest rates); the St. Louis equation is based on constrained Almon lag procedure and as such, the result obtained by the St. Louis equation could be biased and inconsistent; and the use of the model in developing economies with low degree of monetization remains somewhat less relevant.'

Despite these limitations the use of the St. Louis equation is retained in this study but some modifications are made. This study uses the *Vector Autoregression* (VAR) approach developed by Sims (1980). A VAR is an n-variable n-equation model which considers each variable potentially endogenous. Each endogenous variable is explained by its lagged value and the lagged values of all other endogenous variables in the model; usually, there are no exogenous variables in the model. The VAR model addresses the problem of endogeneity because it assumes all the variables in the system are potentially endogenous. Moreover the VAR model addresses the problems of using the constrained Almon lag in that it allows for selecting lag length optimally such that estimated residuals are white noise. To solve the problem of omitted

variables, the interest rate used by Rahman (2005) and the exchange rate are included. Additionally, two dummy variables are included: one to capture the effect of the Liberian civil crisis and the other to capture the effect of global oil and/or financial crisis on the Liberian economy.

Given the above modifications, we now specify our VAR process as follows:

$$y_t = \Phi y_{t-1} + ... + \Phi_p y_{t-p} + \theta_1 d_1 + \theta_2 d_2 + \alpha_0 + v_t \quad \text{.....3.5}$$

Where (y_t) is a $(m \times 1)$ vector of endogenous variables in the model for $(t = 1,2,...,T)$, which in this case are the gross domestic product GDP, broad money supply (MONEY), government expenditure (GOVT), nominal interest rate (LINTR) and the nominal exchange rate (EXCR), d_1 and d_2 are the Liberian civil crises dummy and international crises dummy respectively. Φ and θ are vectors of estimated and dummy coefficients; (α_0) is a $(m \times 1)$ vector of unknown coefficients and (v_t) is the serially uncorrelated $(m \times 1)$ vector of errors with zero mean and a constant positive definite variance-covariance matrix $\Omega = (\omega_{ij})$ where ω_{ij} is the (i, j) element of Ω. Assuming that the roots of the determinated equation

$$\left| I_m - \Phi_1 \varsigma^1 - \Phi_2 \varsigma^2 - ... \Phi_p \varsigma^p \right| = 0 \quad \text{.....3.5.1}$$

fall on and/or outside the unit circle. Given this stability condition, the model can be reparameterised as a *Vector Error Correction Model* (VECM) as follows:

$$\Delta y_t = -\Pi y_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta y_{t-i} + \alpha_0 + v_t \quad \text{.....3.6}$$

where

$$\Pi = I_m - \sum_{i=1}^{p} \Phi_i, \qquad \Gamma_i = -\sum_{j=i+1}^{p} \Phi_j, \quad i = 1,... p = 1 \quad \text{.....3.6.1}$$

3.2 Pre-estimation Tests

The use of time series data poses several challenges in the econometric estimation of a model. Since time series data is used for forecasting relationship between variables, it is essential to

carry out several tests in order to ascertain the time series properties of nominal GDP, money supply, government expenditure, the nominal interest rates and the nominal exchange rate being used in the study so as to improve the predictive accuracy of the model.

3.2.1 Descriptive Data Analysis and Statistical Tests

Data exploration is a pre-requisite for good model formulation and econometric estimation. This enables us to know the pattern of the data in order to give it a mathematical form. This will be done using both graphical analysis such as plots of variable on time and descriptive or quantitative statistics such as mean, standard deviation, skewness and kurtosis.

If a variable, say GDP, is not normally distributed, its errors will not be normally distributed, consequently, its estimated parameter will not be normally distributed thus the t and F statistics will not be reliable. To test for normality, this study employs the *Jarque-Bera Test* which compares the skewness coefficient (S) and kurtosis coefficient (K) of a variable, say, nominal GDP. The JB statistic is given below with (n) serving as the sample size:

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right] \quad \text{.....3.7}$$

$$JB \sim \chi^2(2)$$

Under the null hypothesis that the variable is normally distributed, the JB statistic follows the chi-square distribution with two degrees of freedom. The JB test of normality is a test of the joint hypothesis that $S = 0$ and $K = 3$ hence the JB statistic is expected to be zero. The closer it is to zero, the normally distributed nominal GDP will be and as such we do not reject the normality assumption. This procedure will be repeated for all variables in the model. In order to induce normality, if it is absent, this study will employ the use of the logarithmic transformation.

3.2.2 Unit Root Tests

The classical regression technique, specifically the ordinary least squares, assumes that a variable, say money supply, is stationary, meaning that its mean, variance and covariance are time invariant and as such the variable returns to its mean value after a shock. In order to conduct empirical work based on time series data, it is essential to establish the time series properties of the variable involved in the model. In this study, the variables are GDP, MONEY, EXCR,

GOVT and LINTR. This is done in order to avoid the problem of *spurious regression*. To determine the unit root properties of the variables, this study will employ the use of the following unit root tests: the *Augmented Dickey-Fuller (ADF)* test, the *Philip-Perron (PP)* test; the *Dickey-Fuller Generalized Least Squares (DF-GLS)*, and *the Kwiatkowski-Phillips-Schmidt-Shin (KPSS)*.

3.2.2.1 The ADF Unit Root Test

The ADF unit root test is an augmentation of the DF test developed by Dickey and Fuller (1979) which is based on the assumption that the errors are uncorrelated but in case this assumption is violated, the DF test is *augmented* by adding sufficient lagged difference terms of the regressand in the test equation in order to take care of serial correlations in the error terms. The ADF test model is given in equation 3.8:

$$\Delta y_t = \alpha_0 + \rho y_{t-1} + \sum_{i=1}^{P} \alpha_{3i} \Delta y_{t-i} + \varepsilon_t \quad \text{.....3.8}$$
$$\varepsilon_t \sim IID(0, \sigma^2)$$

The test is based on the null hypothesis of unit root $(\rho = 0)$ against the alternative hypothesis of no unit root $(\rho \prec 0)$ and as such we compare the ADF calculated τ-statistic which is calculated by equation 3.9 against the ADF critical t-statistic. If the null hypothesis is not rejected, we first difference the variable involved to induce stationarity.

$$ADF\,\tau - statistic = \frac{\rho}{S.E(\rho)} \quad \text{.....3.9}$$

3.2.2.2 The DF-GLS Unit Root Test

This study also considers the use of the DF-GLS test of Elliot et al. (1996), which is a more modified version of the ADF test. In the DF-GLS test, data are detrended so that explanatory variables are taken out of the data prior to running the test regression. This test is similar to the ADF test, but has a better performance in terms of small sample size and substantially improved power when an unknown mean or trend is present. The DF-GLS $\tau - ratio$ follows a Dickey-Fuller distribution in the constant case only, while the asymptotic distribution differs when both a constant and trend are included. The null hypothesis is specified like that of the ADF test.

3.2.2.3 The PP Unit Root Test

The Philip-Perron (PP) unit root test developed by Philip-Perron (1988) deals with potential serial correlation in the errors by employing a correction factor that estimates the long–run variance of the error process with a variant of the Newey–West formula. Like the ADF test, use of the PP test requires specification of a lag order; in the latter case, the lag order designates the number of lags to be included in the long–run variance estimate. The PP test allows for dependence among disturbances of either AR or MA form, but it has been shown to exhibit serious size distortions in the presence of negative autocorrelations. In principle, the PP tests should be more powerful than the ADF alternative. The same critical values are used for the ADF and PP tests. The test has a null hypothesis of unit root. The test regression for the PP test is given in equation 3.10 where D_t stands for the deterministic trend.

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + \mu_t \quad \text{.....3.10}$$

3.2.2.4 The KPSS Stationarity Test

The KPSS test developed by Kwiatkowski et al. (1992) is based on the null hypothesis of either trend stationarity or level stationarity and inference from this test is complementary to that derived from those based on the Dickey-Fuller distribution. The KPSS is often used in conjunction with the above mentioned unit root tests to investigate the possibility that a series is fractionally integrated, that is, neither I (1) nor I (0). The test regression for the KPSS test is given in equation 3.11 where D_t stands for the deterministic trend.

$$y_t = \beta' D_t + \mu_t + u_t$$
$$\mu_t = \mu_{t-1} + \varepsilon_t,\ \varepsilon_t \sim WN\left(0, \sigma_\varepsilon^2\right) \quad \text{.....3.11}$$

3.2.2.5 Unit Root Test in the Presence of Structural Breaks

The traditional unit root tests are ineffective in the presence of structural breaks as they lead to a *type-II error* and as such, this study relies on the alternative tests developed by Andrews and Zivot (1992) for one structural break and Clemente et al. (1998) for two structural breaks. These tests can readily be installed in STATA.

Initially, testing for unit root in the presence of structural breaks required selecting the date of the structural break. However, assuming that the time of the break is known *a priori* may not be the most efficient methodology. The actual dates of structural breaks may not coincide with dates chosen exogenously. The Andrews and Zivot test, henceforth the ZA methodology allows the data to indicate breakpoints endogenously rather than imposing a breakpoint from outside the system. The ZA methodology can be explained by considering three possible types of structural breaks in a series, i.e., Model A, assuming shift in intercept; Model B, assuming change in slope; and Model C, assuming change in both intercept and slope. For any given time series y_t, ZA tests equation of the form:

$$y = \mu + y_{t-1} + e_t \quad \text{.....3.12}$$

Here the null hypothesis is that the series y_t is integrated without an exogenous structural break against the alternative that the series y_t can be represented by a trend-stationary I (*0*) process with a breakpoint occurring at some unknown time. The ZA test chooses the breakpoint as the minimum *t*-value on the autoregressive y_t variable, which occurs at time 1 < TB < T leading to $\lambda = TB/T$, $\lambda \in [0.15, 0.85]$, by following the augmented regressions:

Model A: $$y_t = \mu + \beta t + \theta DU_t(\lambda) + \alpha y_{t-1} + \sum_{j=1}^{k} c_j \Delta y_{t-j} + \varepsilon_t \quad \text{.....3.12.1}$$

Model B: $$y_t = \mu + \beta t + \gamma DT_t^*(\lambda) + \alpha y_{t-1} + \sum_{j=1}^{k} c_j \Delta y_{t-j} + \varepsilon_t \quad \text{.....3.12.2}$$

Model C: $$y_t = \mu + \beta t + \theta DU_t(\lambda) + \gamma DT_t^*(\lambda) + \alpha y_{t-1} + \sum_{j=1}^{k} c_j \Delta y_{t-j} + \varepsilon_t \quad \text{.....3.12.3}$$

where $(DU)_t$ and $(DT)_t$ are sustained dummy variables capturing the mean shift and a trend shift occurring at the break date respectively, that is, $DU_t(\lambda) = 1$ if $t \succ T\lambda$, and 0 otherwise; $DT_t^*(\lambda) = t - T\lambda$ if $t \succ T\lambda$, and 0 otherwise. Δ is the difference operator, k is the number of lags determined for each possible breakpoint by one of the information criteria and ε_t is assumed to be an *i.i.d.* error term. The ZA methodology runs a regression for every possible break date sequentially and the time of the structural changes is detected based on the most

significant t-ratio for α. To test the unit root hypothesis, the smallest t-values are compared with a set of asymptotic critical values estimated by ZA which are larger in absolute sense than the ADF critical values. The ZA methodology is used in the case of a single structural break.

However, Clemente et al. (1998) suggest a unit root test that allows for two changes in the mean of an economic time series under the assumption of either innovational (IO) or additive outliers (AO). If the two breaks belong to the IO, we estimate the following equation;

$$\Delta y_t = \mu + d_1 DTB_{1t} + d_2 DTB_{2t} + \theta_1 DU_{1t} + \theta_2 DUI_{2t} + \alpha y_t + \sum_{j=1}^{k} c_j \Delta y_{t-j} + \varepsilon_t \quad \text{.....3.13}$$

where $DTB_t (i = 1,2)$ are pulse variables that take the value of 1 if $t = TB_t + 1$ and 0 otherwise, DU_t are defined as in the ZA test, and TB_1 and TB_2 are the dates when the shifts in the mean occur. Equation 3.13 is sequentially estimated and the unit root hypothesis is tested by obtaining minimal value of the t-statistic for the hypothesis $\alpha = 0$ for all break time combinations.

3.2.3 Cointegration Test

If a time series variable must be differenced d times before it becomes stationary, then it contains d unit roots and it is said to be integrated of order d, denoted $I(d)$. If two series y_t and x_t are both $I(d)$ but their linear combination produce residuals that are $I(d-b)$ where $b \succ 0$, then y_t and x_t are cointegrated of order (d,b). Cointegration is the statistical implication of the existence of a long-run relationship between economic variables. From a statistical point of view, a long-run relationship means that the variables move together over time so that short-run disturbances from the long-run trend will be corrected.

Testing for cointegration is possible by means of the *Engle-Granger two-stage procedure* and the *Engle-Granger-Yoo three-stage procedure*. These procedures, used in bivariate models, assume that there is one cointegrating vector hence they are of little significance in multivariate time series analysis. This study therefore makes use of the *Johansen Procedure*

In order to estimate equation 3.5, it is essential to test for cointegration within the VAR model. To test for cointegration, this study employs the *Johansen full information maximum likelihood (FIML) approach* developed by Johansen (1988) and Johansen and Juselius (1990). If

cointegration is found, equation 3.6 is estimated. The order of the VAR or VEC is determined based on the *SBC* and *AIC*. If the elements of (y_t) in equation 3.5 are integrated of order zero, (Π) is a full rank $(m \times m)$ matrix and the VAR is estimated in levels; if they are integrated of order one and not cointegrated then $(\Pi = 0)$ and the VAR model is estimated in first difference; and finally, if they are integrated of order one and cointegrated with $(\Pi = r)$, then $(\Pi = \alpha\beta)$ where $(\alpha \& \beta)$ are $(m \times r)$ full column rank matrices and there is $(r \prec m)$ linear combinations of (y_t), the cointegrating relations, $(\xi t = \beta' y_{t-1})$ which are integrated of order one, the VECM is estimated. Under cointegration, the VECM can be written as:

$$\Delta y_t = -\alpha\beta' y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + a_0 + v_t \quad \text{.....3.14}$$

where α is the matrix of feedback or adjustment coefficients which measure how strong the deviations are from equilibrium and the r stationary variables $\beta' y_{t-1}$, feedback into the system. If there are $0 \prec r \prec m$ cointegrating vectors, then some of the elements of α must be non zero, that is, there must be some Granger causality involving the levels of the variables in the system to keep the elements of (y_t) from diverging.

3.3 Model Estimation

Based on the results of section 3.2.3, the estimable equation is either estimated as a VAR or as a VECM. Due to the over-parameterization of both the VAR and VECM estimates, our empirical results are explained in terms of the impulse response functions and the forecast error variance decompositions. Additionally, Granger causality tests are conducted.

3.3.1 Impulse Response Function

Impulse response is employed to track the time path of GDP to shocks from MONEY; this is done for GOVT, EXCR, and LINTR individually. Impulse response traces how GDP responds over time to a shock in MONEY and compares this response to shocks from other variables (GOVT, EXCR and LINTR). In other words, this approach is designed to determine how each variable responds over time to an earlier shock in that variable and to shocks in other variables. Using equation 3.5 and assuming the below stability condition in equation 3.13 holds,

$$Y_t = \mu + \Psi(L)a_t = \mu + a_t + \Psi_1 a_{t-1} + \Psi_2 a_{t-2} + \dots$$
$$\Psi(L) = [\Phi(L)]^{-1} \quad \dots\dots 3.15$$

re-dating the system at time $t+s$, we have,

$$Y_{t+s} = \mu + a_{t+s} + \Psi_1 a_{t+s-1} + \Psi_2 a_{t+s-2} + \dots + \Psi_s a_t + \Psi_{s+1} a_{t-1} + \dots \dots 3.15.1$$

from equation 3.15.1, we can compute the nxn vector of multipliers as follow:

$$\frac{\partial Y_{t+s}}{\partial a_t} = \Psi_s = \left[\psi_{ij}^{(s)}\right] \dots\dots 3.15.2$$

The reaction of the i[th]-variable to a unit change in innovation j is then computed as follows:

$$\frac{\partial y_{i,t+s}}{\partial a_{jt}} = \psi_{ij}^{(s)} \dots\dots 13.15.3$$

3.3.2 Forecast Error Variance Decomposition (FEVD)

The variance decomposition helps in identifying the degree to which nominal GDP influences the other variables, (money supply, government expenditures, nominal exchange rate and nominal interest rate). Variables in a system will have a forecast error and the error in forecasting can be attributed to the present and past values of the variable in question and the past and present values of all other variables in the system. So by breaking down this forecast error we can determine the degree to which the variable in question is being influenced by its past and present values and to the other variables in the system. Considering the moving average (MA) representation of a stationary VAR (p) process with p being the order of the VAR,

$$X_t = CD_t + \sum_{i=0}^{\infty} \Theta_i w_t \dots\dots 3.16$$

where X_t is a $(K \times 1)$ vector of endogenous variables, Θ is the i^{th} $(K \times K)$ MA coefficient matrix, w_t is a $(K \times 1)$ vector of orthogonal white noise innovations all with a unit variance, C is an $(K \times M)$ coefficient matrix corresponding to the deterministic terms represented by the $(M \times 1)$ matrix D_t[6]. We can then write the h-step forecast error for the process as

[6] M is the number of deterministic variables. $M = 1$ if there is only a constant, $M = 2$ if there is a constant and a linear trend, etc.

$$X_{t+h} - X_t(h) = \sum_{i=0}^{h-1} \Theta_i w_{t+h-i} \quad \text{.....3.16.1}$$

with $X_t(h)$ being the optimal h-step forecast at period t for X_{t+h}.

3.3.3 Granger Causality

A fundamental problem in economics is determining whether changes in one variable are a cause of changes in another. For example, do changes in the money supply cause changes in GDP, or are GDP and money supply both endogenously determined? Answer to this question requires the Granger causality test developed by Granger (1969). GDP is said to be Granger caused by money supply if money supply helps in the prediction of GDP, or equivalently, if the coefficients on the lagged money supply are statistically significant. If we want to test the null hypothesis that *money supply does not Granger cause GDP*, our test can be illustrated as:

$$(GDP)_t = \sum_{i=1}^{k} \alpha_i (GDP)_{t-i} + \sum_{i=1}^{m} \beta_i (M2)_{t-i} \quad \text{.....3.17}$$

If the sum of the coefficients, $(\beta_1 + \beta_2 + ... + \beta_m)$, using the F-test, on $M2$ are statistically significant, we could fail to accept the null hypothesis. We could test for reverse Granger causality, that is, the null hypothesis that *GDP does not Granger cause money supply.* Our test is illustrated as:

$$(M2)_t = \sum_{i=1}^{j} \phi_i (M2)_{t-i} + \sum_{i=1}^{l} \varphi_i (GDP)_{t-i} \quad \text{.....3.18}$$

Similarly, if the sum of the coefficients, $(\varphi_1 + \varphi_2 + ... + \varphi_l)$, using the F-test, on *GDP* are statistically significant, we could fail to accept the null hypothesis. This test is conducted for all variables in the model. The Granger causality test may give one of the following three outcomes, one variable Granger causes the other; both variables Granger cause each other thus the presence of feedback as it is the case in a VAR model; and the variables do not Granger cause each other hence there is no Granger causality.

3.4 Post-estimation Tests

Post-estimation tests have been carried out to ascertain the fit of the model and to examine the structure of the residuals so as to ascertain the validity of inferences made from the estimated results. These tests include the following; inverse root test for model stability, the residual autocorrelation LM test and the residual normality test.

3.5 Definition of Variables

GDP: The measure of economic activity used in this study is the level of nominal GDP in constant LD. This is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. In the estimable equation, this is denoted as GDP.

MON: The measure of monetary policy used in this study is money supply (M2) in LD. Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. In the estimable equation, this is denoted as MON.

GOVT: The measure of fiscal policy for this study is autonomous government expenditures on final goods and services in the economy measured in LD. General Government final consumption expenditure includes all government current expenditures for purchases of goods and services including compensation of employees, most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. In the estimable equation, this is denoted as GOVT.

EXCR: External shocks affects the level of economic activity and the stabilization policy used, hence this study uses the nominal exchange rate as a measure of external influence on the Liberian economy. The nominal exchange rate is determined by national authorities or the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar). In the estimable equation, this is denoted as EXCR.

LINTR: In order to capture the effects of fiscal and monetary policy interactions, the lending interest rate is used. Both monetary and fiscal policies affect the level of economic activity via the nominal interest rate. Lending interest rate is the rate charged by banks on loans to prime customers. In the estimable equation, this variable is denoted as LINTR.

In recognition of the effects of crises on the Liberian economy, a dummy variable called CIVIL has been introduced. It takes the value of one for years of conflicts and zero otherwise. Additionally, a dummy called INT is used to capture the effects of global oil crises and the recent global financial crises on the Liberian economy. It takes the value of one for years of crises and zero otherwise.

3.6 A priori Expectations

The VAR model considers all variables in the system to be potentially endogenous and as such, there are no a priori expectations.

3.7 Data Sources

This study makes use of secondary annual time series data on government expenditure, money supply (M2), nominal interest rate, nominal exchange rate and the nominal GDP covering the period 1960 to 2008. The data sources comprise the African Development Indicators (ADI) database, the International Monetary Fund (IMF) International Financial Statistics (IFS), the Central Bank of Liberia and the Ministry of Finance of the Republic of Liberia databases.

3.8 Tools of Analysis

In order to establish the statistical properties of the variables in the model, this study employs the use of PcGive version 10. To establish the time series properties of the variables employed in the estimable model, this study makes use of STATA 10.0 and Eviews 6.0. Finally, to estimate the VAR model and its essential components, we make use of Eviews 6.0.

3.9 Conclusion

This chapter has outlined and presented the methodology used in this study. The succeeding chapters deal with the actual data estimation within the model outlined above and the interpretation of results.

CHAPTER FOUR

EMPIRICAL ESTIMATION RESULTS

4.0 Introduction

This chapter presents the results of the empirical estimation and gives an economic interpretation of the results thereof. We start with the presentation of descriptive statistics of all the variables contained in the model. We then determine the time series properties of the variables in the model, conduct pre-estimation tests of the model, estimate it and go on to present impulse response and forecast error variance decomposition and its interpretation before conducting the Granger causality tests.

4.1 Descriptive Data Analysis and Statistical Tests

Descriptive data analysis is essential for good model formulation. This entails determining the statistical properties of the variable in terms of the mean, variance, range, skewness, and kurtosis of the variables as well as graphical aids in the form of time series plots of the variables.

Table 6 reports the mean and standard deviation of the variables used in the estimable equation. The mean describes the central location of the data while the standard deviation, which is the first movement away from the mean, describes the spread of the data.

Table 6: Summary Statistics

Statistics	Gross Domestic Product	Exchange Rate	Government Expenditure	Money Supply	Lending Interest Rate
Mean	8.36e+08	14.58452	9.66e+08	1.01e+09	17.70508
Std. Dev.	4.21e+08	22.61525	1.55e+09	1.88e+09	2.438103

Table 6 shows that most of the data points for government expenditure and the lending interest rates are closer to the mean while those for the other variables are relatively far away from the mean. This result provides additional information to the result in section 4.1.2.

4.1.1 Graphical Data Analysis

In order to determine the trends in the macroeconomic variables over time, we carry out a graphical analysis. A trend analysis is essential in that it provides information about the movement in the value of the following variables during the period under review: gross domestic product, government expenditure, money supply, nominal exchange rate and the nominal lending interest rate. The trends in these variables provide information for the model of the unit root tests in section 4.2.

Figure 1 shows the movements in the level of the gross domestic product in Liberia; Figure 2 is a graphical representation of movements in the nominal exchange rates; Figure 3 is a graphical representation of movements in the level of government expenditures; Figure 4 is a graphical representation of movements in the level of the nominal lending interest rates; and Figure 5 is a graphical representation of the movements in the level of money supply.

Figure 1: Trends in Gross Domestic Product in Liberia: 1960-2008

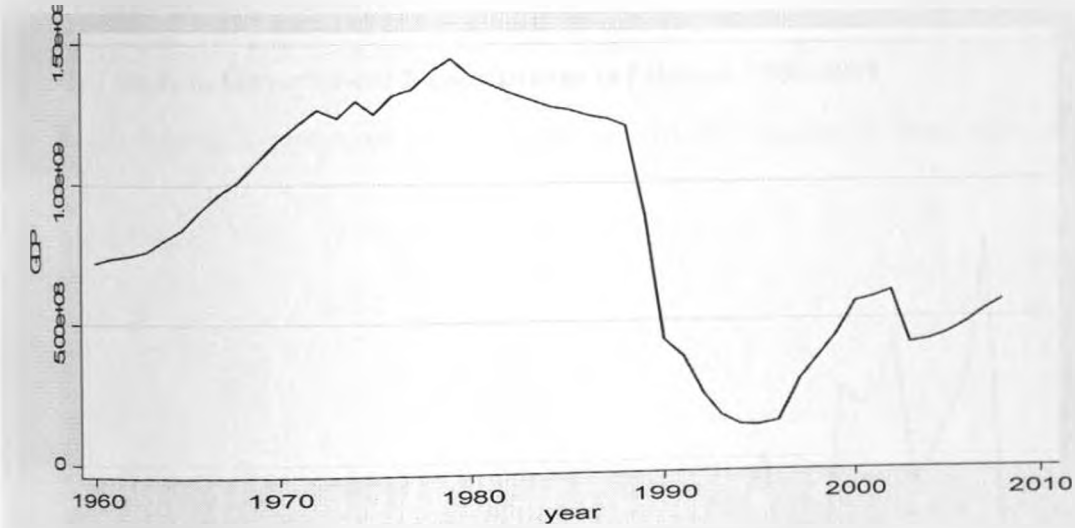


Figure 1 shows an increase in GDP from the 1960s up to the 1980s after which it declined steadily reaching its lowest point in the mid 1990s and again exhibiting an upward trend. In 2003, the series declined and by 2008 it showed signs of recovery.

Figure 2: **Trends in Nominal Exchange Rate in Liberia: 1960-2008**

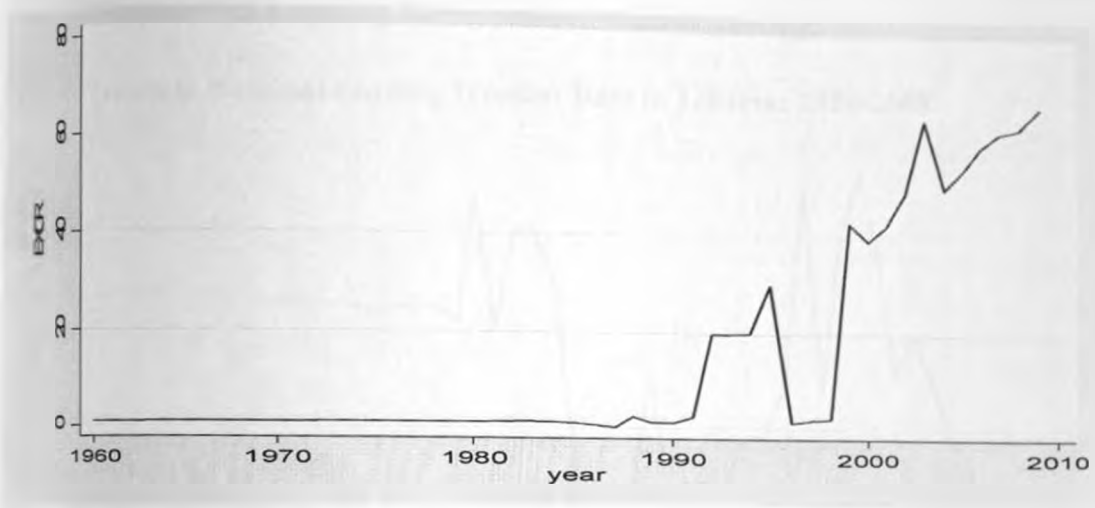


Figure 2 shows a relatively stable exchange rate between the Liberian dollar and the US dollar from the 1960s up to the late 1980s. From the mid 1980s up to 2008, the country experienced excessive exchange rate volatility.

Figure 3: **Trends in Government Expenditures in Liberia: 1960-2008**

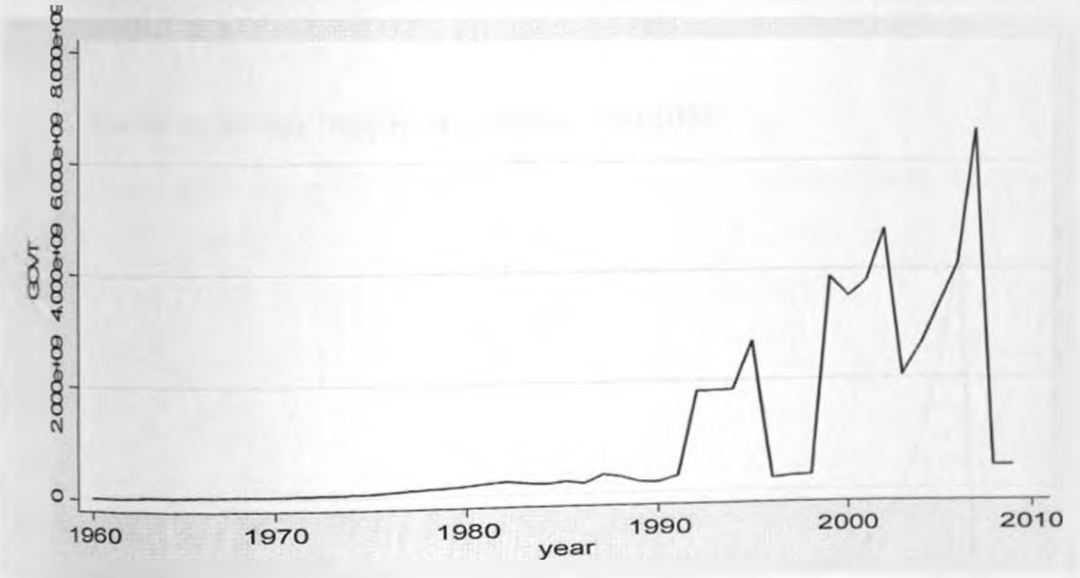


Figure 3 shows that the GOL practiced some level of fiscal discipline from the 1960s up to the 1980s with expenditures increasing negligibly. The fiscal indiscipline of the GOL in the 1980s and the transitional governments from the 1990s up to 2003, coupled with the civil crisis caused

government expenditures to fluctuate but generally exhibiting an upward trend. Dropping during crisis intensive years and increasing during years of relative stability.

Figure 4: Trends in Nominal Lending Interest Rate in Liberia: 1960-2008

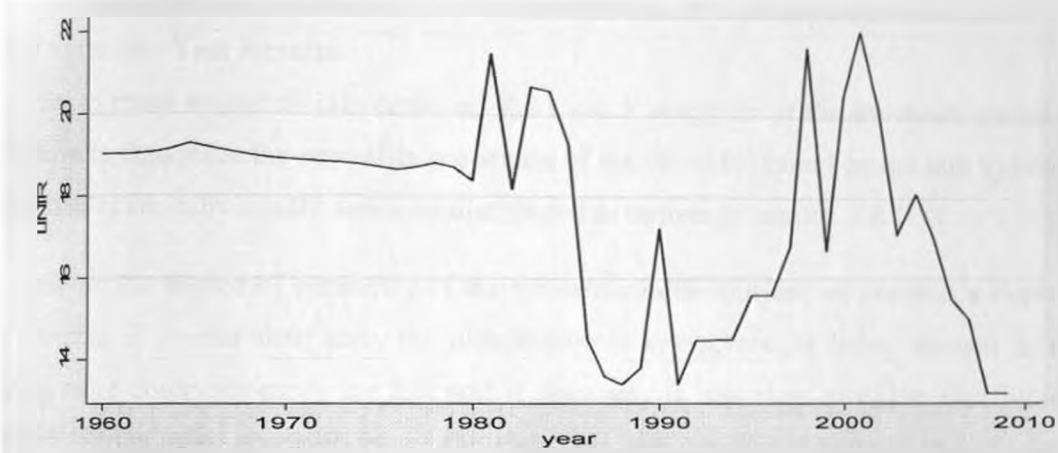


Figure 4 shows that the nominal lending interest rate was relatively stable from the 1960s up to 1980. Due to disruption in economic activities caused by the military takeover of the 1980s and the subsequent civil crisis, the nominal lending interest rate fluctuated severely from the 1980s up to 2008.

Figure 5: Trends in Money Supply in Liberia: 1960-2008

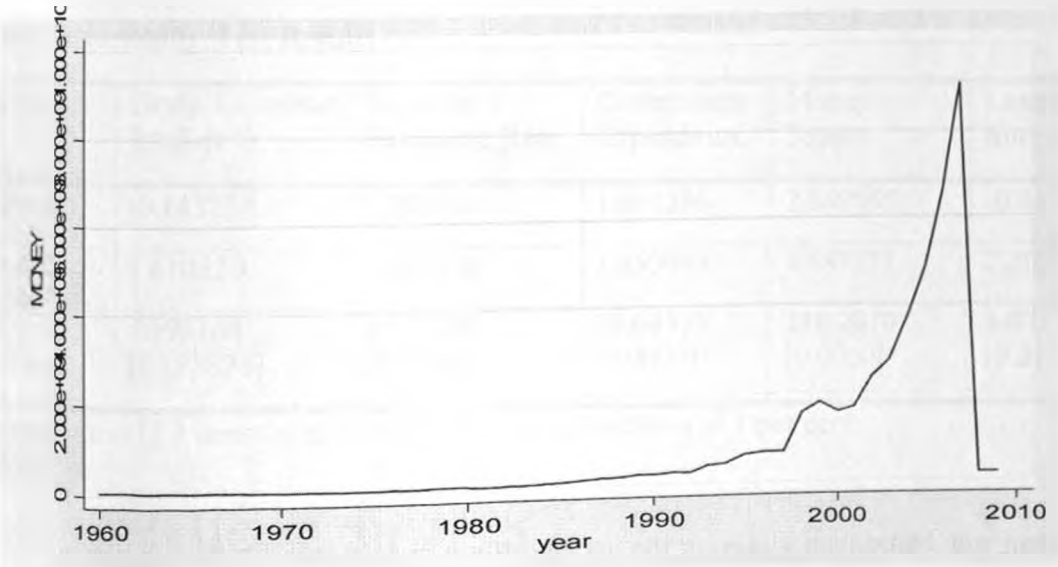


Figure 5 shows that the money supply remained relatively stable from the 1960s up to the mid 1980s. It however, exhibited an upward trend when the PRC government resorted to seignoirage during the late 1980s. This rise in money supply continued up to the mid 2000 after which it declined rapidly due to tight monetary policy pursued by the CBL.

4.1.2 Normality Test Results

In order to make statistical inferences on the t and F statistics of the estimated parameters, we first have to determine the normality properties of the variables based on the null hypothesis that the variables are individually normally distributed as outline in section 3.2.1.

To measure the degree of symmetry of the probability distribution, we conduct a skewness test. If skewness is greater than zero, the distribution is interpreted as being skewed to the right, having more observations on the left and if skewness is less than zero, the distribution is left skewed, having more observations on the right. We also conduct a kurtosis test. If kurtosis of a random variable is less than three, the distribution has thicker tails and a lower peak compared to a normal distribution. By contrast, kurtosis larger than 3 indicates a higher peak and thin tails. A normally distributed random variable should have skewness and kurtosis near zero and three, respectively. In this study, we used the skewness and kurtosis to compute the JB statistics which shows how the distributions of the variables deviate from the normal distribution. Table 7 shows the normality test of the variables used in this study.

Table 7: Normality Test Results

Statistics	Gross Domestic Product	Nominal Exchange Rate	Government Expenditure	Money Supply	Lending Interest Rate
Skewness	-0.143234	1.301234	1.804296	2.569865	-0.457768
Kurtosis	1.610520	3.036836	5.450993	9.687277	2.202138
JB Statistics	4.193164 [0.122876]	14.11290 [0.0008]*	39.64439 [0.0000]*	148.2010 [0.0000]*	3.072482 [0.215188]

P-values are in []. * denotes rejection of the null hypothesis at 1 per cent.

Table 7 shows that all the variables in the model are not normally distributed. For instance, the null hypothesis is rejected at the 10 per cent level of significance for gross domestic product and

the nominal lending interest rate simply because these variables are left skewed and thicker at the tails; hence the JB statistics is not zero. Similarly, the null hypothesis is rejected at the 1 per cent level of significance for money supply, government expenditures and the nominal exchange rate simply because these variables are right-skewed and flat at the tails; hence the JB statistics is not zero. The results contained in this section have serious implications on the residuals of the model.

We try to induce normality by making use of the logarithmic transformation but also the null hypotheses for all the variables in the model are rejected at log levels. Ensuring that the variables be normally distributed before using them is not mandatory. But in an attempt to obey a semblance of normality, variables whose null hypotheses are rejected at the 1 per cent level of significance in Table 7 have been transformed into logs although they are still non-normal.

4.2 Unit Root Test Results

The procedure for testing for the presence of unit root in a time series variable was outlined in section 3.2.2. Application of the unit root test poses several challenges for applied econometricians, two of which are as follow: when do we add a trend, a constant and/or a drift in the test model; and what should be the appropriate length of the lag differences that are needed to make the test model error term white noise?

The remedy to the first issue is gotten from the time series plot of the variable as depicted in section 4.2.1. Normally all macroeconomic time series variables do not begin from zero. The time series plot of our variables in section 4.2.1 justifies this reasoning and as such, a constant and a trend are used in all of the unit root tests.

The remedy to the second issue is obtained by making use of the automatic lag length selection based on the SIC with a maximum lag of 10 embedded in Eviews 6.0 for the ADF and DF-GLS tests and the Newey-West automatic bandwidth selection using Bartlett kernel for the KPSS and PP tests. Table 8 shows a comparative analysis of the ADF and the PP unit root test results.

Table 8: ADF and PP Unit Root Test Results

Variable	ADF Unit Root Test			PP Unit Root Test		
	τ^{ADF}	Lag differences	Verdict	τ^{PP}	Bandwidth	Verdict
GDP	-2.153	1	I(1)	-1.874	4	I(1)
ΔGDP	-3.750**	0	I(0)	-3.736**	2	I(0)
LEXCR	-2.941	0	I(1)	-2.867	4	I(1)
ΔLEXCR	-7.391*	0	I(0)	-11.821*	16	I(0)
LGOVT	-2.539	9	I(1)	-2.664	7	I(1)
ΔLGOVT	-3.963**	10	I(0)	-8.726*	13	I(0)
LMON	-2.054	0	I(1)	-2.057	4	I(1)
ΔLMON	-7.082*	0	I(0)	-7.118*	4	I(0)
LINTR	-3.074	0	I(1)	-3.120	3	I(1)
ΔLINTR	-9.455*	0	I(0)	-9.569*	2	I(0)

Δ means first difference. * and ** means rejection of the null at 1 and 5 percent respectively. Critical values for both ADF & PP tests: 1% (-4.205), 5% (-3.533) and 10% (-3.198).

Table 8 shows both the ADF and the PP unit root test results. Both the ADF and the PP unit root test results show that all the variables are non-stationary at levels at the conventional levels of significance but they are stationary after first differencing.

Table 9 provides a comparative analysis of the DF-GLS and the KPSS unit root test results.

Table 9: **DF-GLS & KPSS Unit Root Tests Results**

Variable	DF-GLS Unit Root Test			KPSS Unit Root Test		
	τ^{DF-GLS}	Lag differences	Verdict	$Z(\tau)$	Bandwidth	Verdict
GDP	-1.807	1	I(1)	0.145*	5	I(0)
ΔGDP	-3.83*	0	I(0)	-	-	-
LEXCR	-2.833	0	I(1)	0.21787	4	I(2)
ΔLEXCR	-8.055*	0	I(0)			
ΔΔLEXCR	-	-	-	0.178*	4	I(0)
LGOVT	-3.51**	0	I(0)	0.0557*	4	I(0)
LMON	-1.243	0	I(1)	0.234	5	I(1)
ΔLMON	-7.17*	0	I(0)	0.129*	4	I(0)
LINTR	-3.162	0	I(0)	0.0588*	5	I(0)

Δ means first difference. * and ** means rejection of the null at 1 and 5 percent respectively. Critical values: DF-GLS, 1% (-3.77), 5% (-3.19) & 10% (-2.89); KPSS, 1% (0.216), 5% (0.146) & 10% (0.119).

Table 9 shows both the DF-GLS and the KPSS unit root test results. Based on the DF-GLS test, GDP, LEXCR and LMON are non-stationary at levels but their first differences are stationary while LGOVT and LINTR are stationary at levels at 5 and 10 percent levels of significance respectively. Based on the KPSS test, we conclude that GDP is stationary at levels at both 1 and 5 per cent; LEXCR is non-stationary at levels but stationary at 1 per cent only after differencing it twice; LGOVT is stationary at levels at 1, 5 and 10 percent, the same as LINTR; and LMON is non-stationary at levels but stationary at 1 and 5 per cent after the first difference.

Table 10 provides results of the Andrews and Zivot (ZA) unit root test for the variables used in this model in the presence of a single structural break.

Table 10: ZA Unit Root Test Results

Variable	Intercept			Trend			Both		
	k	min t	TB	*k*	min t	TB	*k*	min t	TB
GDP	1	-6.452*	1989	1	-2.401	1970	1	5.627*	1989
LEXCR	0	-4.801	1999	0	-4.408	1987	0	-4.751	1991
ΔLEXCR	2	-5.9*	1988	2	-5.418*	2002	2	-5.929*	1999
LGOVT	2	-5.201**	1992	2	-4.674**	1971	2	-6.204*	2002
LMON	0	-3.058	1993	0	-3.691	1981	0	-3.604	1980
ΔLMON	0	-7.686*	2000	0	-8.248*	2002	0	-9.235*	2004
LINTR	0	-3.844	1986	0	-3.223	2002	0	-4.695	1998
ΔLINTR	0	-10.358*	2002	0	-9.913*	2001	0	-10.243*	1995

Estimation with 0.10 trimmed. Lag length is determined by the BIC. Min t is the minimum t-statistics calculated. Critical values- intercept: -5.43 (1%), -4.80 (5%); trend: -4.93 (1%), -4.42 (5%); both: -5.57 (1%), -5.08 (5%). * & ** means rejection of the null at 1% and 5%.

Table 10 shows the ZA test for three models, the optimal model based on the BIC for all the variables is the intercept model; hence we will only interpret this model. GDP and LGOVT are stationary at levels at 5 and 10 per cent respectively with a structural break occurring in 1989 and 1992 respectively. LEXCR, LMON, and LINTR are non-stationary at levels with structural breaks occurring in 1999, 1993 and 1986 respectively but all are stationary in first difference at 1 per cent with structural breaks occurring in 1988, 2000 and 2002 respectively.

Table 11 provides results on the Clemente, Montanes and Reyes (CLEMAO) unit root test of the variables used in this model in the presence of two structural breaks using both the additive and the innovative outliers. The additive outlier model captures a sudden change in the mean of the series while the innovative outlier model allows for a gradual shift in the mean of the series.

Table 11: **CLEMAO Unit Root Test Results**

Variable	Additive Outliers		Innovative Outliers	
	min t	Optimal Breakpoints	min t	Optimal Breakpoints
GDP	-5.168	1972, 1991	-5.382	1987, 1995
ΔΔGDP	-0.791	1988, 1997	-9.418**	1989, 1998
LEXCR	-1.429	1989, 2000	-7.368**	1990, 1997
LGOVT	-3.675	1978, 1996	-2.243	1975, 1990
ΔΔLGOVT	-0.175	1994, 1997	-5.734**	1991, 1998
LMON	-0.690	1985, 1995	-3.518	1983, 1996
ΔLMON	-8.062**	1973, 1979	-2.471	1974, 1980
LINTR	-3.283	1985, 1995	-4.856	1984. 1995
ΔLINTR	-1.690	1983, 1988	-10.328**	1984. 1988

Estimation with 0.10 trimmed. Min t is the minimum t-statistic calculated. 5% critical values – two breaks: -5.490

Table 11 shows two models, the additive outliers (AO) and the innovative outlier (IO). GDP and LGOVT are non-stationary in both levels and first differences in both the AO and IO models. LEXCR is stationary in levels in the IO model at 5 per cent but non-stationary in levels in the AO model. LMON and LINTR are non-stationary at levels in both the AO and IO models but stationary in first differences at 5 per cent in the AO and IO models respectively.

Analysis of the unit root properties revealed that both the ADF and the PP test results complement each other despite the fact that in principle, the PP test is stronger than the ADF test. One advantage the DF-GLS test has over the others is that it has substantially improved power when an unknown mean or trend is present and it performs better in smaller sample sizes. An advantage of the KPSS test is that it performs well when a series is fractionally integrated. Despite the advantages of the abovementioned test, the presence of structural breaks in the series renders their predictive powers useless. As such, in the presence of a single structural break, the

ZA test results take precedence over the previous tests and in the presence of two structural breaks, the CLEMAO test becomes the most reliable detector of the existence of unit root.

4.3 Cointegration Test Results

Traditionally, cointegration requires that the variables in the model be integrated of the same order before the Granger representation theorem holds true. This reasoning has been used extensively in the bivariate case with the application of the Engle-Granger two-stage and the Engle-Granger-Yoo three-stage procedures. An advantage of the Johansen procedure is that within a model of several variables, it is capable of handling a mix of variables that are integrated of order zero and one. But the econometrics literature is silent on the treatment of a model that has a mix of variables that are cointegrated of order zero, one and two. Since the CLEMAO unit root test is the most reliable in the presence of two structural, and the results in Table 11 shows that our variables are integrated of order: zero (LEXCR); one (LMON and LINTR); and two (GDP and LGOVT), hence, the use of an error correction model becomes conflicting. As such, following the example of Rahman (2005), this study estimates the model in VAR with stationary variables after appropriate differencing where necessary.

4.4 Vector Autoregressive (VAR) Estimates

Before estimating the VAR, we establish the optimal lag length so as to avoid the problems of heteroscedasticity and autocorrelation in the model. Table 12 provides information on the optimal lag length of the VAR model.

Table 12: Optimal Lag Length of the VAR

Lag	FPE	AIC	SBIC	HQIC
0	1.16e+16	51.18196	51.80256	51.40944
1	1.62e+15	49.18983	50.84476	49.79643
2	2.24e+15	49.43011	52.11936	50.41582
3	2.36e+15	49.29204	53.01561	50.65687
4	8.59e+14	47.90279	52.66069	49.64675
5	6.46e+13*	44.60823*	50.40046*	46.73131*

* signifies the optimal lag length. FPE means final prediction error.

More lags mean more parameters to estimate. This leads to less biased but more variant predictions. We try to find a lag order that does not sacrifice the precision of the model in terms of accuracy. Using Information criteria as lag order selection values will help us. The optimal lag length for this VAR has been determined using the AIC, FPE, SIC and HQIC. According to these criteria, the optimal lag length is 5 as shown in Table 12.

Due to the over-parameterization of the VAR estimates, the standard econometric practice is to interpret the impulse response function and the forecast error variance decomposition. This study uses the innovative accounting technique, which includes the impulse response and the variance decomposition estimated within VAR as these give elevated dynamic movements of the variable in question to change in other variables in the system. The VAR estimates are presented in Appendix 1.

4.5 Interpretation of the Impulse Response Function

Impulse response traces the response of one variable to innovations from other variables. This section gives the impulse response functions of nominal GDP (ΔΔGDP), the money supply (Δ LMON), government final consumption expenditures on goods and services (ΔΔLGOVT), the nominal exchange rate (LEXCR) and the nominal lending interest rate (ΔLINTR).

Table 13 reports the impulse response of nominal GDP to one standard deviation of innovation from itself and all variables contained in the model.

Table 13: Impulse Response of Nominal GDP

Period	Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	-20986570** (8674045)	-7218475 (8251613)	47679985* (5926134)	0.000000 (0.000000)	0.000000 (0.000000)
2	63903562** (2.5e+07)	46308538** (2.2e+07)	-47077173** (1.6e+07)	-31079353* (1.0e+07)	15426150 (9308677)
3	-35274735 (4.3e+07)	-43816290 (4.5e+07)	2868605 (3.0e+07)	28989266 (2.1e+07)	12945024 (1.8e+07)
4	-70532739 (5.6e+07)	-12995177 (6.4e+07)	37284434 (3.9e+07)	37680122 (2.8e+07)	10969397 (2.2e+07)
5	18975405 (7.7e+07)	23051866 (8.3e+07)	-399631.8 (5.0e+07)	-23124819 (3.8e+07)	-1626888 (3.1e+07)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 13 showss that money supply shocks have a statistically significant 2-period impact on nominal GDP. Money supply shocks have a negative impact in period 1 but a positive impact in period 2 which becomes statistically insignificant in subsequent periods. Government expenditure shocks have a positive statistically significant impact on nominal GDP in period 2 but its impact is statistically insignificant in subsequent periods. Nominal GDP shocks have a statistically significant 2-period impact on itself. Nominal GDP shocks have a positive impact in period 1 but a negative impact in period 2 which becomes statistically insignificant in subsequent periods. The nominal exchange rate shocks have a negative statistically significant impact on nominal GDP in period 2 but its impact is statistically insignificant in subsequent periods. The nominal interest rate shocks have no statistically significant impact on nominal GDP in all the periods.

Although both money supply shocks and government expenditures shocks have positive statistically significant impact on nominal GDP, money supply shocks have a relatively larger impact on nominal GDP than government expenditures shocks thus establishing empirical evidence in support of the relative potency of monetary policy over fiscal policy.

Table 14 reports the impulse response of money supply to one standard deviation of innovation from itself and all variables contained in the model.

Table 14: Impulse Response of Money Supply

Period	Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	0.20* (0.03)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2	0.06 (0.08)	0.0009 (0.08)	-0.13** (0.06)	0.02 (0.04)	0.07** (0.03)
3	-0.09 (0.11)	-0.11 (0.09)	0.08 (0.07)	-0.02 (0.04)	0.02 (0.05)
4	0.01 (0.14)	0.06 (0.11)	0.06 (0.09)	0.02 (0.06)	-0.06 (0.06)
5	0.10 (0.16)	0.02 (0.14)	-0.06 (0.11)	0.04 (0.07)	0.01 (0.07)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 14 indicates that money supply shock has a statistically significant positive impact on itself only in period 1. That impact becomes statistically insignificant in subsequent periods. The nominal exchange rate and government expenditures shocks have no statistically significant impact on money supply in all the periods. Nominal GDP shocks have a statistically significant negative impact on money supply in period 2 after which it becomes statistically insignificant in subsequent periods. The nominal interest rate shocks have a positive statistically significant impact on money supply in period 2 but its impact becomes statistically insignificant in subsequent periods.

Table 15 shows the impulse response of government expenditures to one standard deviation of innovation from itself and all variables contained in the model.

Table 15: Impulse Response of Government Expenditures

Period	Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	0.20 (0.11)	0.62* (0.07)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2	0.28 (0.27)	-0.63** (0.27)	-0.44** (0.18)	-0.02 (0.13)	0.45* (0.12)
3	-0.58 (0.44)	-0.06 (0.45)	0.28 (0.30)	-0.06 (0.21)	-0.13 (0.19)
4	-0.11 (0.53)	-0.08 (0.56)	0.40 (0.39)	0.05 (0.26)	-0.30 (0.24)
5	0.28 (0.67)	0.12 (0.73)	-0.10 (0.48)	0.14 (0.31)	-0.11 (0.30)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 15 shows that money supply shocks and nominal exchange rate shocks have no statistically significant impact on government expenditures during all periods. Government expenditures shocks have a statistically significant 2-period impact on itself. Government expenditures shocks have a positive impact in period 1 but a negative impact in period 2 which becomes statistically insignificant in subsequent periods. Nominal GDP shocks and nominal interest rate shocks have a statistically significant impact on government expenditures only in period 2. Nominal GDP shocks have a negative impact while nominal interest rate shocks have a positive impact.

Table 16 reports the impulse response of nominal exchange rate to a one standard deviation of innovation from itself and all variables contained in the model.

Table 16: Impulse Response of Nominal Exchange Rate

Period	Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	-0.25**	0.19**	0.11	0.41*	0.00
	(0.09)	(0.08)	(0.07)	(0.05)	(0.00)
2	0.26	0.49**	-0.18	0.20	0.36*
	(0.23)	(0.21)	(0.15)	(0.11)	(0.10)
3	0.18	0.17	-0.48	0.17	0.51**
	(0.36)	(0.33)	(0.25)	(0.18)	(0.18)
4	-0.23	-0.02	-0.07	0.15	0.41
	(0.50)	(0.41)	(0.30)	(0.22)	(0.24)
5	-0.18	-0.09	0.10	0.25	0.18
	(0.58)	(0.48)	(0.36)	(0.23)	(0.29)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 16 shows that money supply shocks have a negative short-run statistically significant impact on the nominal exchange rate only in period 1; this provides evidence on the significance of the foreign currency auction policy being implemented by the CBL. However, the impact is short-run due to capital flight and hoarding. Government expenditure shocks have a positive statistically significant 2-period impact on the nominal exchange rate. Over the years, a significant portion of the GOL's budget has been financed by foreign aid. An inflow of foreign aid has adverse effects on the nominal exchange rate. Nominal GDP shocks have no statistically significant impact on the nominal exchange rate during all periods. The nominal interest rate shocks have a positive statistically significant 2-period impact on the nominal exchange rate in periods 2 and 3. The nominal exchange rate shocks have a positive statistically significant impact on itself only in period 1 after which the impact becomes statistically insignificant.

Table 17 reports the impulse response of nominal interest rate to a one standard deviation of innovation from itself and all variables contained in the model.

Table 17: **Impulse Response of Nominal Interest Rate**

Period	Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	-0.43**	-0.08	-0.48	0.01	0.92*
	(0.19)	(0.18)	(0.16)	(0.15)	(0.11)
2	-0.74	-0.68	0.52	-0.002	-0.05
	(0.44)	(0.40)	(0.28)	(0.19)	(0.19)
3	-0.68	0.48	0.77	-0.002	-0.55
	(0.63)	(0.58)	(0.42)	(0.29)	(0.32)
4	1.10	1.50	-0.33	-0.25	-0.21
	(0.93)	(0.76)	(0.61)	(0.38)	(0.43)
5	-0.89	-1.65	-0.65	0.37	0.77
	(1.26)	(1.08)	(0.88)	(0.51)	(0.61)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 17 shows government expenditures shocks, the nominal GDP shocks and the nominal exchange rate shocks have no statistically significant impact on the nominal interest rate. The nominal interest rate shocks have a positive statistically significant impact on itself only in period 1 after which the impact becomes statistically insignificant. Money supply shocks have a negative statistically significant impact on the nominal interest rate only in period 1. This means that in the short-run, an increase in money supply reduces the nominal interest rate due to expectations on the part of commercial banks but in subsequent periods this impact becomes insignificant as a fairly large proportion of the population is not banking oriented.

4.6 Interpretation of Forecast Error Variance Decomposition

Variance decomposition depicts the proportion of movements in one variable that are due to errors in own shocks, vis-à-vis shocks to each other's variance in the system. Basically it gives information on how important each variable is in explaining variations in the variable in question in the system.

Table 18 reports the proportion of movements in nominal GDP explained by itself and the other variables in the model.

Table 18: **Forecast Error Variance Decomposition of Nominal GDP**

Period	Standard Error	Explained by shocks in				
		Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	52592048	15.92	1.88	82.19*	0.00	0.00
		(10.72)	(4.46)	(10.76)	(0.00)	(0.00)
2	1.11E+08	36.44**	17.69	36.17*	7.78	1.92
		(14.48)	(11.49)	(11.54)	(4.09)	(2.57)
3	1.29E+08	34.76**	24.81	27.10**	10.88	2.44
		(15.81)	(14.89)	(11.98)	(5.97)	(3.00)
4	1.57E+08	43.55**	17.37	23.87**	13.08**	2.13
		(14.74)	(13.92)	(9.38)	(6.14)	(2.77)
5	1.62E+08	42.54**	18.46	22.56**	14.41**	2.03
		(14.66)	(14.12)	(9.48)	(6.59)	(3.83)
6	1.67E+08	41.07**	17.35	21.21**	13.94**	6.42
		(14.87)	(14.12)	(9.50)	(5.72)	(5.47)
7	1.71E+08	39.06**	19.58	22.00**	13.26**	6.10
		(14.54)	(14.17)	(10.29)	(5.49)	(5.47)
8	1.88E+08	40.10**	16.35	25.04**	10.93**	7.58
		(15.15)	(14.39)	(10.91)	(5.36)	(5.65)
9	2.01E+08	36.24**	23.41	22.52**	10.05	7.78
		(14.91)	(14.97)	(10.64)	(5.33)	(5.53)
10	2.10E+08	34.17**	22.56	24.20**	9.19	9.87
		(15.33)	(15.21)	(10.58)	(5.28)	(5.82)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 18 shows that nominal GDP accounts for most of the variations in itself thus indicating that GDP is determined exogenously in Liberia. Apart from nominal GDP, money Supply alone explains more than 15 per cent of the forecast error variances of nominal output over all the time horizons with the exception of period 1 where it is statistically insignificant. Both government expenditure and the nominal lending interest rate do not contain any information about nominal GDP as the portions of forecast error variance of nominal GDP explained by government expenditure and nominal lending interest rate are statistically insignificant. The forecast error of nominal GDP explained by the nominal exchange rate is statistically significant only from period 4 to period 8 but statistically insignificant in the other periods. On the basis of this, we conclude that monetary policy is the most important factor for the prediction of future nominal output in Liberia, though the nominal exchange rate should also be given due attention.

Table 19 reports the proportion of movements in money supply explained by itself and the other variables in the model.

Table 19: Forecast Error Variance Decomposition of Money Supply

Period	Standard Error	Explained by shocks in				
		Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	0.20	100.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2	0.26	66.93* (13.08)	0.001 (7.54)	25.90** (11.74)	0.58 (3.01)	6.59 (5.46)
3	0.31	55.92* (13.60)	12.57 (11.37)	25.48** (10.34)	0.92 (3.68)	5.12 (5.00)
4	0.33	49.98* (14.05)	14.80 (12.32)	25.64** (9.86)	1.21 (4.10)	8.37 (5.85)
5	0.35	51.20* (14.55)	13.28 (12.24)	25.51** (9.61)	2.60 (4.98)	7.41 (5.32)
6	0.37	50.0* (14.82)	13.76 (12.48)	24.75** (9.99)	2.67 (4.55)	8.82 (6.11)
7	0.38	47.95* (15.14)	13.17 (12.95)	27.44** (10.51)	3.00 (4.65)	8.44 (6.00)
8	0.39	49.85* (15.08)	12.34 (13.43)	26.31** (10.73)	2.89 (4.68)	8.6 (5.98)
9	0.40	46.38* (15.79)	15.74 (13.93)	26.46** (10.84)	3.20 (4.84)	8.22 (6.00)
10	0.42	43.50** (16.03)	19.57 (14.07)	24.81** (10.91)	3.29 (4.82)	8.83 (6.07)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 19 shows that most of the variations in money supply are explained by money supply itself, thus indicating that, money supply in Liberia is independent and exogenous. The forecast error variance of money supply explained by nominal GDP is statistically significant in all periods except period one. Nominal GDP explains approximately 25 per cent of the variations in money supply from period 2 up to period 10. The forecast error variances of money supply in all time periods explained by government expenditure, the nominal exchange rate and the nominal interest rate are statistically insignificant.

Table 20 reports the proportion of movements in government expenditures explained by itself and the other variables in the model.

Table 20: **Forecast Error Variance Decomposition of Government Expenditures**

Period	Standard Error	Explained by shocks in				
		Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	0.65	9.14	90.86*	0.00	0.00	0.00
		(8.92)	(8.92)	(0.00)	(0.00)	(0.00)
2	1.14	9.14	60.42*	15.02	0.032	15.39**
		(9.58)	(15.61)	(10.33)	(1.77)	(6.14)
3	1.32	26.33	45.27**	15.70	0.26	12.43**
		(16.21)	(16.66)	(9.97)	(3.07)	(5.60)
4	1.42	23.31	39.48**	21.56**	0.35	15.29**
		(14.50)	(15.67)	(9.97)	(3.39)	(6.43)
5	1.46	25.48	37.66**	20.71**	1.21	14.94**
		(14.62)	(15.32)	(9.78)	(4.08)	(5.96)
6	1.55	24.09	35.56**	22.41**	4.20	13.74**
		(14.36)	(15.28)	(9.93)	(5.03)	(5.88)
7	1.70	20.37	39.04**	24.67**	4.32	11.60**
		(14.27)	(15.20)	(10.61)	(4.75)	(5.72)
8	1.90	20.73	43.91**	22.12**	3.90	9.34
		(14.71)	(15.67)	(10.23)	(4.62)	(5.50)
9	1.96	20.37	44.14**	22.33**	3.70	9.46
		(15.17)	(15.72)	(10.19)	(4.71)	(5.71)
10	2.11	27.27	38.80**	21.17**	4.55	8.21
		(15.34)	(15.85)	(10.01)	(4.89)	(5.93)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

Table 20 shows that much of the variations in government expenditure is explained by government expenditure itself indicating that government expenditure are to some extent exogenous as evidenced by the huge inflow of foreign aid into Liberia. Money supply and the nominal exchange rate do not contain any information about final government consumption expenditures on goods and services as the portions of forecast error variance of final government consumption expenditures on goods and services at various periods explained by these variables are not statistically significant. However, the forecast error variances of final government consumption expenditures on goods and services explained by the nominal lending interest rate and the nominal GDP are statistically significant from period 2 to period 7 and from period 4 to period 10 respectively. The relationship between government expenditures and the nominal interest rate shows that the GOL borrows from the banking system. Tables 18 and 19 established a bi-directional relationship between nominal GDP and money supply and since nominal GDP

explains movements in government expenditure, one can conclude that money supply indirectly explains movements in government expenditures.

Table 21 reports the proportion of movements in the nominal exchange rate explained by itself and the other variables in the model.

Table 21: Forecast Error Variance Decomposition of Nominal Exchange Rate

Period	Standard Error	Explained by shocks in				
		Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	0.53	21.94**	12.71	4.61	60.74*	0.00
		(10.93)	(8.46)	(5.36)	(11.26)	(0.00)
2	0.89	16.06**	35.35**	5.77	26.30**	16.53**
		(10.77)	(15.48)	(5.25)	(10.17)	(8.21)
3	1.17	11.68	22.33	20.09**	17.28**	28.62**
		(10.19)	(12.94)	(10.01)	(8.05)	(10.96)
4	1.28	13.17	18.94	17.34	16.10**	34.44**
		(11.66)	(12.15)	(9.55)	(7.57)	(11.55)
5	1.33	13.85	17.80	16.44	18.42**	33.50**
		(12.63)	(11.48)	(8.92)	(8.10)	(11.22)
6	1.41	16.98	16.02	17.27	17.27**	32.45**
		(13.33)	(11.32)	(9.07)	(7.26)	(11.00)
7	1.52	21.09	20.75	14.86	15.20**	28.10**
		(14.63)	(12.23)	(8.82)	(6.51)	(9.48)
8	1.62	29.90	18.36	13.50	13.46**	24.78**
		(15.53)	(12.04)	(8.95)	(5.92)	(9.02)
9	1.98	50.68*	12.65	10.10	9.59	16.98**
		(15.65)	(12.22)	(8.38)	(5.03)	(8.18)
10	2.11	50.22*	11.67	11.93	9.24	16.94**
		(15.71)	(12.37)	(8.81)	(5.20)	(8.20)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

The forecast error variances of nominal exchange rate as reported in Table 21 indicate that at period 1, about 61 per cent of its own forecast error variance is explained by itself. The percentage of forecast error variance of nominal exchange rate explained by itself falls significantly up to period 8 after which it becomes statistically insignificant. Nominal GDP and government expenditures are statistically significant in explaining movements in the nominal exchange rate only at periods 3 and 2 respectively where they explained about 20 and 35 per cent respectively. From period 2 up to period 10, nominal interest rate is statistically significant in

explaining more than 15 per cent of the movements in the nominal exchange rate in each of the periods. Money supply is initially statistically significant in explaining movements in the nominal exchange rate in periods 1 and 2 but that influence die out between periods 3 and 8. In periods 9 and 10, however, money supply explains about 50 per cent of the forecast error variances of the nominal exchange rate in each period. This provides evidence that movements in money supply in Liberia causes movements in the general price levels which affect the nominal exchange rate.

Table 22 shows the proportion of movements in the nominal interest rate explained by itself and the other variables in the model.

Table 22: Forecast Error Variance Decomposition of Nominal Interest Rate

Period	Standard Error	Explained by shocks in				
		Money Supply	Government Expenditure	Nominal GDP	Nominal Exchange Rate	Nominal Interest Rate
1	1.13	14.61 (10.63)	0.46 (3.48)	18.54 (9.60)	0.005 (2.23)	66.39* (11.46)
2	1.59	28.60** (13.89)	18.46 (12.53)	19.73** (8.69)	0.003 (2.40)	33.21** (12.07)
3	2.03	28.73** (13.26)	16.97 (12.81)	26.54** (9.59)	0.002 (2.35)	27.77** (9.27)
4	2.80	30.68** (14.50)	37.80** (14.26)	15.48** (7.79)	0.79 (2.49)	15.26** (6.54)
5	3.53	25.53 (13.99)	45.48* (14.11)	13.06 (8.79)	1.60 (2.73)	14.33** (6.02)
6	3.89	21.94 (13.95)	37.48** (13.94)	26.06** (11.91)	1.72 (3.52)	12.79** (5.73)
7	4.25	26.30 (14.86)	35.91** (14.16)	25.03** (11.57)	1.67 (4.00)	11.08 (6.08)
8	4.35	25.70 (15.29)	35.24** (14.30)	24.87** (11.10)	2.27 (4.29)	11.92 (6.35)
9	4.50	28.67 (15.51)	33.64** (14.40)	23.62** (10.98)	2.62 (4.54)	11.44 (6.43)
10	4.67	27.54 (15.81)	34.74** (14.73)	23.81** (11.08)	3.09 (4.66)	10.82 (6.21)

* and ** indicate point estimates are statistically significant at 1 and 5 per cent respectively.

The forecast error variances of nominal interest rate as reported in Table 22 indicate that in period 1, about 66 per cent of its own forecast error variance is explained by itself. The

percentage of forecast error variance of nominal interest rate explained by itself falls significantly up to period 6 after which it becomes statistically insignificant. The nominal exchange rate contains no information about the nominal interest rate as the portions of forecast error variances of the nominal interest rate at all periods explained by the nominal exchange rate are statistically insignificant. The forecast error variances of the nominal interest rate between periods 2 and 4 and periods 6 and 10 as explained by nominal GDP is statistically significant thus explaining about 26 per cent in periods 3 and 6. Money supply has a statistically significant short-run impact in explaining over 25 per cent of the forecast error variances of the nominal interest rate between periods 2 and 4. Government expenditures have a statistically significant long-run impact in explaining the forecast error variances of the nominal interest rate. Between periods 4 and 10, government expenditures account for about 30 per cent of the forecast error variances of the nominal interest rate. This provides evidence of crowding-out in Liberia.

4.7 Granger Causality Test Results

The results contained in this section were generated by the procedures outlined in section 3.3.3. The results were estimated with a maximum of 8 lags and they are displayed in Appendix 3.

The Granger causality test found independence between the following variables: government expenditures and money supply; nominal GDP and money supply; and money supply and the nominal interest rate.

Additionally, unidirectional causality was found running from the following variables: money supply to the nominal exchange rate at the 10 per cent level of significance; nominal GDP to government expenditures at the 1 per cent level of significance; nominal exchange rate to government expenditures at the 10 per cent level of significance; government expenditures and the nominal interest rate at the 10 per cent level of significance; and the nominal interest rate and the nominal exchange rate.

Finally, bidirectional causality was found between the following variables: the nominal exchange rate and the nominal GDP at the 5 and 10 per cent levels of significance; and the nominal interest rate and the nominal GDP at the 5 percent level of significance.

4.8 Post-estimation Diagnostic Test Results

In order to test the adequacy and appropriateness of the estimated VAR model, we conducted a number of diagnostic tests. The results are contained in sections 4.8.1, 4.8.2 and 4.8.3.

4.8.1 Residuals Test Results

Graphical analysis of the residuals shows that there is an outlier problem. If some data points lie "outside" the range of typical observations, they can have a distorting influence on the estimates of the regression coefficients. These abnormal data points are called outliers. This could be attributed to recording or coding errors, among others. A practical approach to dealing with outliers is to delete it. This procedure becomes inappropriate in time series analysis because the observations are numbered in time hence deleting an observation will create an information gap between the series. This study reports the graph of the residuals in appendix 2.

Additionally, the *langrange multiplier* (LM) test for serial correlation of the residuals was conducted. The LM test is based on the null hypothesis that there is no autocorrelation in the residuals up to lag h. Results for the LM test are displayed in Table 23.

Table 23: VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob.
1	39.54156	0.0325**
2	27.13969	0.3489
3	30.19323	0.2171
4	43.96229	0.0110**
5	47.08363	0.0048*
6	48.20734	0.0035*

From Table 23, the null cannot be accepted at the 5 percent level of significance at lags 1 and 4. Similarly, the null hypothesis cannot be accepted at the 1 per cent level of significance at lags 5 and 6. However, the null hypothesis is accepted at lags 2 and 3.

4.8.2 Normality of Residuals

We conducted the normality test on the residuals to enable us compare the third and fourth moment of the residuals to those from the normal distribution. Table 24 depicts the JB statistics for the five equations in the VAR.

Table 24: **VAR Residual Normality Test**

Equation	χ^2 Statistics	P-Value
D1LMONEY	1.373	0.50277
D2LGOVT	1.323	0.51606
D2GDP	0.696	0.70617
LEXCR	5.681	0.05841
D1LINTR	0.937	0.62594
ALL	10.012	0.43947

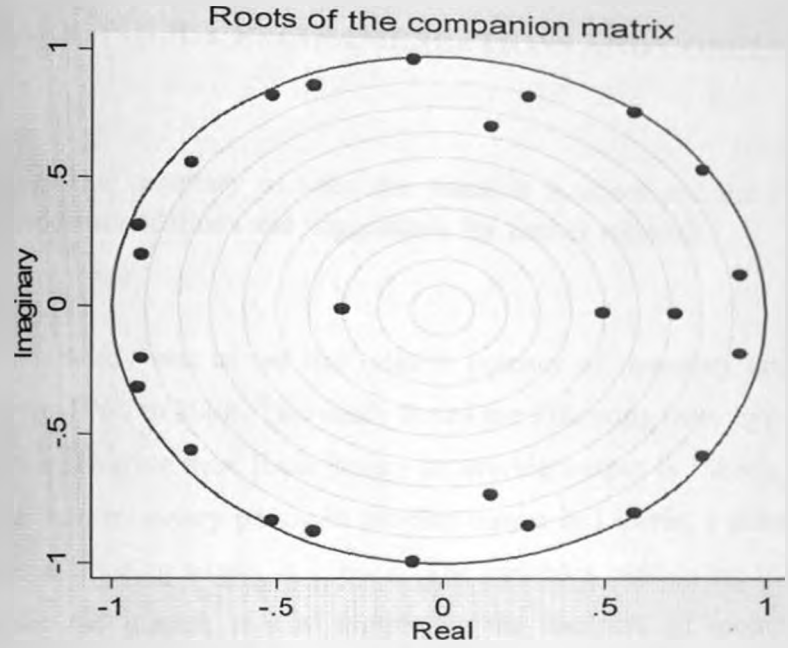
Table 24 shows that the null hypothesis of residual normality cannot be rejected in money supply equation, the government expenditures equation, the nominal GDP equation and the nominal interest rate equation. Interestingly, we may accept the null hypothesis for the nominal exchange rate equation at the 5 per cent level of significance but not at the 10 percent level of significance. Additionally, the null hypothesis of normality for the entire model cannot be rejected.

4.8.3 Stability Test Results

This test reports inverse roots of the characteristic AR polynomial. The VAR model is stationary if all roots have absolute value less than one and lie inside the unit circle. Figure 6 depicts the stability condition of the VAR.

From figure 6, it is evident that all the roots lie within the unit cycle hence the model is stable. Stability of the model implies that statistical inferences made on the basis of the estimated parameters are reliable and valid. In so doing, our impulse response functions and our forecast error variance decomposition become valid and statistical inferences made from them become reliable.

Figure 6: **Stability Test of the VAR**



4.9 Conclusion

The VAR estimates as shown by the impulse response function and forecast error variance decomposition provide evidence that monetary policy is relatively more potent than fiscal policy in explaining changes in output in Liberia during the period under study. The impulse response function and the forecast error variance decomposition shows that the nominal interest rate, our measure of a policy mix has had no impact on nominal output in Liberia. However, the impulse response function and the forecast error variance decomposition shows some evidence of foreign influence, via the exchange rate, influence on nominal output in Liberia.

However, the Granger causality test shows independence between monetary policy and nominal output on one hand and between fiscal policy and nominal output on the other. But bi-directional causality has been found between nominal output and nominal interest rate on one hand and nominal output and nominal exchange rate on the other thus indicating that a policy mix and foreign influence on the Liberian economy have a significant impact in explaining output in Liberia.

CHAPTER FIVE

SUMMARY, POLICY RECOMMENDATIONS AND CONCLUSION

5.0 Introduction

This chapter provides the summary of what the research is about and the main findings, the conclusion, policy recommendations and suggestions for further research.

5.1 Summary

The main aim of this study was to test the relative potency of monetary and fiscal policy on output in Liberia from 1960 to 2008. This study tested the following three hypotheses: monetary policy has been more effective than fiscal policy in altering output in Liberia; fiscal policy has been more effective than monetary policy in altering output in Liberia; a policy mix, if any has been more effective in altering output in Liberia. The variables used in the study were nominal GDP as the measure of output; money supply as the measure of monetary policy; final government consumption expenditures on goods and services as the measure of fiscal policy; the nominal interest rate as the measure of a policy mix; and the nominal exchange rate as the measure of foreign influence on the Liberian economy.

In an attempt to adhere to the normality assumption, the study transformed money supply, government expenditures and the nominal exchange rate into logs. Realizing the implications of using non-stationary annual time series data, the study employed a batch of unit root tests. The ADP and the PP unit root tests showed that all of the variables in the model were integrated of order one. The DF-GLS unit root test showed that nominal GDP, the logs of nominal exchange rate and the logs of money supply were integrated of order one while the logs of government expenditure and the nominal interest rate were integrated of order zero. The KPSS stationarity test showed that nominal GDP, the logs of government expenditures, and the nominal interest rate were integrated of order zero while the logs of nominal exchange rate and the logs of money supply were integrated of order two and one respectively. However, the results from these tests are invalid in the presence of structural breaks hence this study employed the ZA and CLEMAO unit root test in the presence of one and two structural breaks respectively. The ZA test found the logs of nominal exchange rate, logs of money supply and the nominal interest rate to be

integrated of order one while nominal GDP and the logs of government expenditure have been found to be integrated of order zero. The CLEMAO test found the nominal GDP and the log of government expenditures to be integrated of order two, the log of nominal exchange rate to be integrated of order zero and the log of money supply and the nominal interest rate to be integrated of order one. Result from the CLEMAO tests were used as the basis for estimating the model.

Using the St. Louis Model and realizing the potential dangers of endogeniety of the policy variables, this study employed the VAR estimation technique which addresses that pitfall. Cointegration within the VAR model was discarded as the variables were integrated of multiple orders. The optimal lag length of the VAR model was determined to be 5 based on the AIC and other criteria. The model was estimated and taking in consideration standard econometric practices, the results were interpreted by means of the impulse response functions and the forecast error variance decomposition. Additionally, the Granger causality test was conducted.

The impulse response function in Table 13 provides evidence that monetary policy has had more influence on output than fiscal policy has had in Liberia. In consonance with the IRF, the forecast error variance decomposition in Table 18 also suggests that monetary policy has had more influence on output in Liberia than fiscal policy. However, IRF and FEVDC as depicted in Tables 13 and 18 respectively have rejected any influence of a policy mix on output in Liberia. Notwithstanding, the IRF and the FEVD as depicted in Tables 13 and 18 respectively provide evidence in support of foreign influence on the Liberian economy. The Granger causality test as depicted in Appendix 3 found no influence of monetary policy on output. The same holds true for fiscal policy. However, the Granger causality test found influence of nominal exchange rate and nominal interest rate on output implying that there has been a policy mix in Liberia and that foreign influence has a significant impact in altering output in Liberia.

Post estimation diagnostic tests revealed that the model is stable, the residuals of each equation in the system and the residuals of the entire system are normal. But with respect to autocorrelation of the residuals, the results showed that initially there are sign of autocorrelation which dissipates but only to return in subsequent lags.

5.2 Conclusion

In terms of the relative potency of monetary and fiscal policy on output in Liberia, the outcome of this study is in sharp contrast with those of De Prano & Mayer (1965), Ando & Modigliani (1965), De-Leeuw & Kalchbrenner (1969), Corrigan (1970), Benjamin Friedman (1977), Hussain (1982), Darrat (1984), Chowdhury (1988), Olaloye and Ikhide (1995), Latif & Chowdhury (1998), among others who found evidence in support of the relative potency of fiscal policy over monetary policy in altering output.

The findings of this study firmly support the evidences put forward by Friedman (1958), Friedman & Schwartz (1963), Friedman & Meiselman (1963), Anderson & Jordan (1968), De-Leeuw & Gramlich (1969), Keran (1969), Carlson (1978), Elliot (1975), Ajayi (1974), Masood & Ahmed (1980), Ubogu (1985), Saquib & Yesmin (1987), Upadhyaya (1991), Kamau (1997), Chingarande (1999), Jayaraman (2002), Rahman (2005), among others who found that monetary policy is more effective in altering output than fiscal policy.

5.3 Policy Implications and Recommendations

The findings of this study based on the IRF and FEVD suggest that only monetary policy is effective in altering output in Liberia while fiscal policy is ineffective. This suggests that in order to increase output, policy makers in Liberia should rely on monetary policy rather than fiscal policy. However, the conduct of monetary policy must be exercised with caution as regards the interest rate which reflects inflationary expectations and complemented with fiscal discipline in order to avoid inflationary effects in the economy and to attract foreign direct investment. Given the highly dollarized nature of the Liberian economy, the conduct of monetary policy must target a stable exchange rate that is consistent with sustained economic growth. Efforts should be made to ensure an independent CBL in order to instill financial discipline in the banking system and to ensure monetary accommodation of a fiscal expansion whenever it is necessary.

The IRF contained in Table 13 shows that monetary policy has a short-run impact on output thus indicating signs of capital flight and hoarding. To discourage hoarding, efforts should be made by the monetary authorities to strengthen the banking system so as to restore the public's confidence in the banking system that was lost due to the massive bank failures of the 1990s. This will go a long way in increasing the banking oriented population of Liberia. Additionally,

commercial banks should be encouraged to innovate services and financial instruments that will increase banking activities. To discourage capital flight, monetary authorities in Liberia need to formulate policies limiting the amount of money that is allowed to leave the country at a particular point in time. Efforts should be made to ensure that such transfers are made via the banking system only so that monetary authorities can be able to track the flows of money out of Liberia. This policy is essential for the Liberian economy as we have many foreign owned businesses in Liberia whose only objective is to siphon profits to their respective countries.

Finally, efforts should be made by the monetary authorities in Liberia to encourage the development of money and capital markets in Liberia so as to increase the policy instruments available at their disposal and to expand the financing options available at the disposal of the fiscal authorities in Liberia. There is also a need for increased co-ordination and co-operation between the fiscal and the monetary authorities in Liberia.

5.4 Limitations of the Study

Despite the various policy recommendations made in section 5.4, caution should be taken as policy recommendations based on a single study may be inappropriate. Additionally, this study is based on secondary annual series data whose major disadvantages are the credibility and degree of reliability. These problems are accentuated by the prolonged nature of the Liberian civil conflict. In view of the above, the accuracy and reliability of this analysis depends squarely on the accuracy of the estimation methods used to generate these data. Concerted efforts on the part of the GOL should be made to improve the data collection, storage and dissemination processes by the responsible agency.

5.5 Suggestions for Further Research

Further studies on the relative potency of monetary and fiscal policy on output in Liberia are required in order to make meaningful policy recommendations. Such studies could use disaggregated data specifically for the government expenditure variable so as to determine the portion of government expenditure that is of significant impact in altering output. Our findings imply that factors such as corruption, political patronage and excessive government expenditure on arms and ammunitions are the probable reasons as to why fiscal policy is of no significance in altering output in Liberia. By using disaggregated data, these pitfalls could be detected.

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APPENDIX 1

Vector Autoregression Estimates

Vector Autoregression Estimates
Date: 08/11/10 Time: 22:57
Sample (adjusted): 1967 2008
Included observations: 42 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D1LMONEY	D2LGOVT	D2GDP	LEXCR	D1LINTR
D1LMONEY(-1)	0.327814 (0.28099) [1.16666]	2.884571 (0.89434) [3.22536]	1.03E+08 (7.3E+07) [1.41190]	1.914227 (0.72830) [2.62833]	-1.732886 (1.55772) [-1.11245]
D1LMONEY(-2)	0.118949 (0.31775) [0.37435]	0.475725 (1.01134) [0.47039]	-29320489 (8.2E+07) [-0.35618]	-0.868579 (0.82358) [-1.05463]	-2.094947 (1.76151) [-1.18929]
D1LMONEY(-3)	0.361328 (0.32822) [1.10088]	1.078575 (1.04467) [1.03246]	-71825721 (8.5E+07) [-0.84468]	0.841474 (0.85073) [0.98913]	-1.188600 (1.81956) [-0.65324]
D1LMONEY(-4)	-0.008754 (0.25618) [-0.03417]	0.773445 (0.81538) [0.94857]	-67261294 (6.6E+07) [-1.01344]	0.321952 (0.66400) [0.48487]	-3.864432 (1.42019) [-2.72107]
D1LMONEY(-5)	0.141701 (0.33733) [0.42007]	2.082868 (1.07368) [1.93994]	-46160854 (8.7E+07) [-0.52819]	2.857473 (0.87435) [3.26812]	7.085302 (1.87008) [3.78877]
D2LGOVT(-1)	-0.028924 (0.11002) [-0.26291]	-0.999416 (0.35017) [-2.85410]	93008758 (2.9E+07) [3.26315]	0.694754 (0.28516) [2.43637]	-0.989807 (0.60991) [-1.62288]
D2LGOVT(-2)	0.085522 (0.16037) [0.53327]	-0.013516 (0.51044) [-0.02648]	1.34E+08 (4.2E+07) [3.23006]	1.049403 (0.41568) [2.52457]	-1.220531 (0.88906) [-1.37283]
D2LGOVT(-3)	0.108702 (0.15197) [0.71529]	0.225037 (0.48370) [0.46524]	10951210 (3.9E+07) [0.27815]	0.865409 (0.39390) [2.19703]	0.353941 (0.84248) [0.42012]
D2LGOVT(-4)	-0.326956 (0.13700)	-1.580407 (0.43606)	-1.33E+08 (3.5E+07)	-0.430148 (0.35511)	-0.866375 (0.75951)

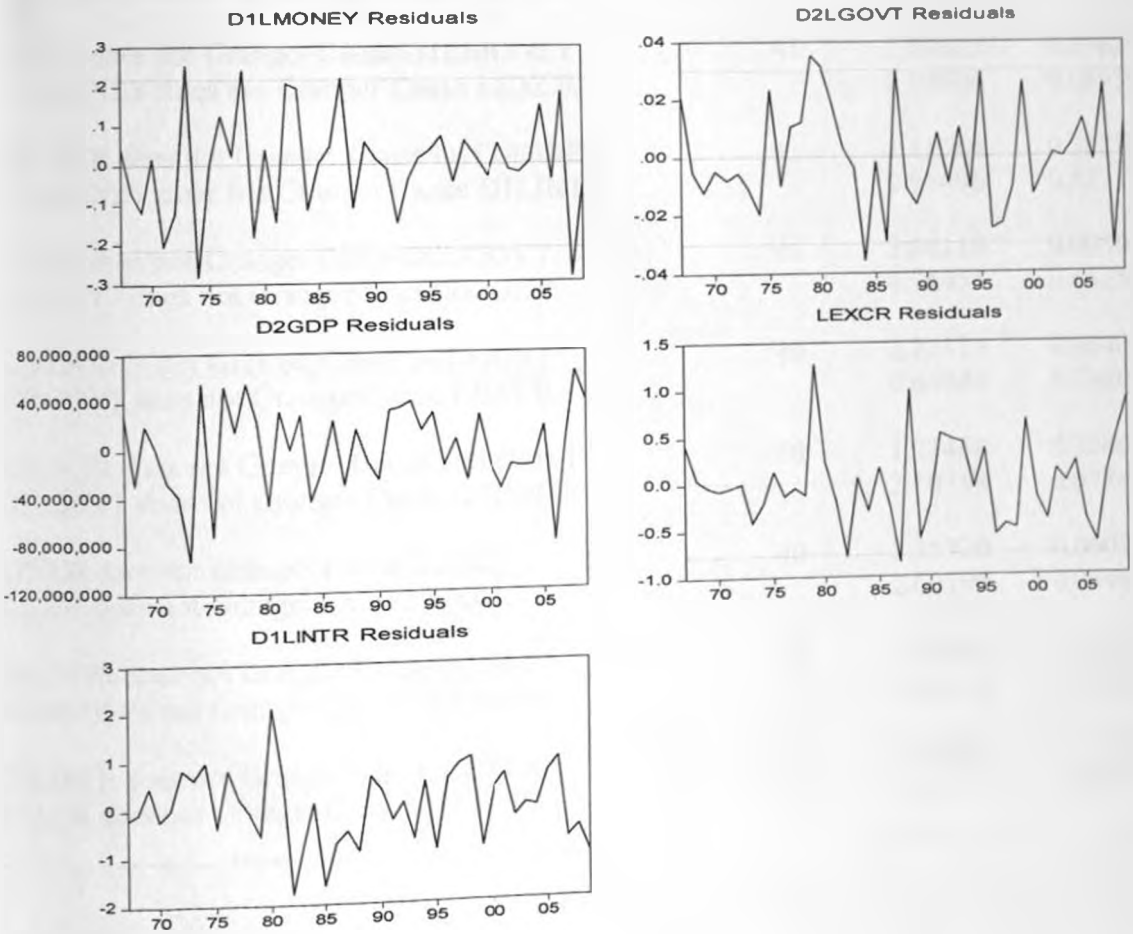
	[-2.38649]	[-3.62426]	[-3.75510]	[-1.21132]	[-1.14070]
D2LGOVT(-5)	-0.272315 (0.11580) [-2.35153]	-0.851555 (0.36859) [-2.31033]	-73470471 (3.0E+07) [-2.44886]	0.306687 (0.30016) [1.02175]	-0.483229 (0.64199) [-0.75271]
D2GDP(-1)	-2.15E-09 (8.8E-10) [-2.43814]	-4.16E-09 (2.8E-09) [-1.48434]	-0.636034 (0.22800) [-2.78964]	-9.22E-10 (2.3E-09) [-0.40407]	1.03E-08 (4.9E-09) [2.10545]
D2GDP(-2)	5.82E-10 (5.1E-10) [1.13540]	-8.67E-10 (1.6E-09) [-0.53088]	-0.003496 (0.13287) [-0.02631]	-2.57E-09 (1.3E-09) [-1.93701]	9.33E-09 (2.8E-09) [3.28014]
D2GDP(-3)	-2.05E-10 (5.2E-10) [-0.39773]	-4.29E-09 (1.6E-09) [-2.61191]	-0.010977 (0.13379) [-0.08204]	-4.91E-09 (1.3E-09) [-3.66997]	-5.13E-10 (2.9E-09) [-0.17927]
D2GDP(-4)	-5.26E-10 (5.6E-10) [-0.93907]	-4.65E-10 (1.8E-09) [-0.26078]	0.123258 (0.14524) [0.84863]	1.40E-09 (1.5E-09) [0.96381]	6.51E-09 (3.1E-09) [2.09373]
D2GDP(-5)	-4.81E-10 (5.4E-10) [-0.89502]	-1.87E-09 (1.7E-09) [-1.09276]	0.068755 (0.13922) [0.49384]	-4.22E-09 (1.4E-09) [-3.02859]	8.01E-09 (3.0E-09) [2.68864]
LEXCR(-1)	0.047022 (0.07628) [0.61640]	-0.058961 (0.24280) [-0.24283]	-76108213 (2.0E+07) [-3.85094]	0.476243 (0.19773) [2.40859]	-0.005014 (0.42290) [-0.01186]
LEXCR(-2)	-0.256302 (0.09466) [-2.70747]	-0.634397 (0.30131) [-2.10549]	58997223 (2.5E+07) [2.40555]	0.071502 (0.24537) [0.29141]	0.813250 (0.52480) [1.54964]
LEXCR(-3)	0.361156 (0.11552) [3.12627]	0.659279 (0.36769) [1.79301]	1.69E+08 (3.0E+07) [5.63873]	0.314467 (0.29943) [1.05021]	-1.218818 (0.64043) [-1.90312]
LEXCR(-4)	0.202640 (0.14193) [1.42774]	0.683179 (0.45175) [1.51230]	-59634439 (3.7E+07) [-1.62178]	0.330474 (0.36788) [0.89832]	-0.542873 (0.78683) [-0.68995]
LEXCR(-5)	-0.401411 (0.14909) [-2.69235]	-1.197589 (0.47454) [-2.52367]	-93935264 (3.9E+07) [-2.43189]	-0.433113 (0.38644) [-1.12077]	0.979881 (0.82654) [1.18553]

D1LINTR(-1)	0.072735 (0.03432) [2.11931]	0.486420 (0.10924) [4.45292]	16823738 (8891526) [1.89211]	0.393918 (0.08896) [4.42821]	-0.055288 (0.19026) [-0.29059]
D1LINTR(-2)	0.033847 (0.03302) [1.02509]	0.256398 (0.10509) [2.43973]	3011610. (8554262) [0.35206]	-0.067280 (0.08558) [-0.78615]	-0.169656 (0.18305) [-0.92685]
D1LINTR(-3)	0.010009 (0.02863) [0.34963]	0.103254 (0.09112) [1.13322]	-1676056. (7416551) [-0.22599]	0.047020 (0.07420) [0.63369]	-0.241569 (0.15870) [-1.52216]
D1LINTR(-4)	-0.004222 (0.02411) [-0.17507]	0.072453 (0.07675) [0.94400]	2900745. (6247289) [0.46432]	0.051732 (0.06250) [0.82768]	-0.161074 (0.13368) [-1.20492]
D1LINTR(-5)	0.028871 (0.02337) [1.23535]	0.147817 (0.07438) [1.98720]	-12791063 (6054696) [-2.11259]	0.209624 (0.06057) [3.46058]	-0.097924 (0.12956) [-0.75582]
C	0.084004 (0.06440) [1.30444]	0.262173 (0.20497) [1.27907]	-12431035 (1.7E+07) [-0.74508]	0.089770 (0.16692) [0.53781]	-0.150715 (0.35701) [-0.42216]
INT	-0.337644 (0.14132) [-2.38923]	-0.159300 (0.44980) [-0.35416]	-2076027. (3.7E+07) [-0.05670]	0.054323 (0.36629) [0.14830]	-0.399604 (0.78344) [-0.51006]
CIVIL	-0.076904 (0.14834) [-0.51843]	-1.008373 (0.47215) [-2.13572]	14071014 (3.8E+07) [0.36613]	-0.331461 (0.38449) [-0.86207]	0.738143 (0.82236) [0.89759]
R-squared	0.770904	0.881738	0.913349	0.970011	0.895351
Adj. R-squared	0.329076	0.653663	0.746237	0.912176	0.693529
Sum sq. resids	0.576917	5.844529	3.87E+16	3.875876	17.73055
S.E. equation	0.202998	0.646116	52592048	0.526164	1.125375
F-statistic	1.744806	3.865987	5.465490	16.77187	4.436327
Log likelihood	30.44685	-18.17998	-783.2037	-9.554560	-41.48543
Akaike AIC	-0.116516	2.199047	38.62875	1.788312	3.308830
Schwarz SC	1.041930	3.357493	39.78720	2.946759	4.467276

Mean dependent	0.099775	-0.068140	-666666.7	1.310514	-0.143632
S.D. dependent	0.247831	1.097895	1.04E+08	1.775470	2.032835
Determinant resid covariance (dof adj.)		5.02E+12			
Determinant resid covariance		2.07E+10			
Log likelihood		-796.7728			
Akaike information criterion		44.60823			
Schwarz criterion		50.40046			

APPENDIX 2

Graph of Residuals



APPENDIX 3

Granger Causality Test Results

Pairwise Granger Causality Tests
Date: 08/13/10 Time: 20:37
Sample: 1960 2008
Lags: 8

Null Hypothesis:	Obs.	F-Statistic	Probability
D2LGOVT does not Granger Cause D1LMONEY	40	1.67979	0.15728
D1LMONEY does not Granger Cause D2LGOVT		0.82268	0.59109
D2GDP does not Granger Cause D1LMONEY	40	1.32162	0.28215
D1LMONEY does not Granger Cause D2GDP		1.01743	0.45072
LEXCR does not Granger Cause D1LMONEY	41	1.53823	0.19639
D1LMONEY does not Granger Cause LEXCR		2.00606	0.08959
D1LINTR does not Granger Cause D1LMONEY	41	1.11566	0.38779
D1LMONEY does not Granger Cause D1LINTR		0.91496	0.52110
D2GDP does not Granger Cause D2LGOVT	40	3.88110	0.00501
D2LGOVT does not Granger Cause D2GDP		0.74455	0.65258
LEXCR does not Granger Cause D2LGOVT	40	2.22315	0.06406
D2LGOVT does not Granger Cause LEXCR		0.64044	0.73607
D1LINTR does not Granger Cause D2LGOVT	40	1.27468	0.30402
D2LGOVT does not Granger Cause D1LINTR		2.10754	0.07747
LEXCR does not Granger Cause D2GDP	40	2.25920	0.06038
D2GDP does not Granger Cause LEXCR		2.60199	0.03465
D1LINTR does not Granger Cause D2GDP	40	2.85826	0.02309
D2GDP does not Granger Cause D1LINTR		2.79135	0.02565
D1LINTR does not Granger Cause LEXCR	41	2.11256	0.07492
LEXCR does not Granger Cause D1LINTR		0.46526	0.86830

APPENDIX 4

Dataset

Year	Nominal GDP	Nominal Exchange Rate	Government Expenditures	Money Supply	Nominal Interest Rate	Civil Crises Dummy	International Crises Dummy
1960	7.19E+08	0.968397	19200002	75742068	19.01857	0	0
1961	7.37E+08	0.968397	19200002	75742068	19.01857	0	0
1962	7.47E+08	0.971032	24400000	72200092	19.048	0	0
1963	7.64E+08	0.974492	30700000	67908851	19.08663	0	0
1964	8.03E+08	0.981587	34200000	65524828	19.16586	0	0
1965	8.41E+08	0.993441	35600000	64571218	19.29824	0	0
1966	9.06E+08	1.008116	39500000	61914736	19.20518	0	0
1967	9.67E+08	1.022974	41400000	60620552	19.10813	0	0
1968	1.01E+09	1.035691	42500000	59871287	19.02506	0	0
1969	1.09E+09	1.045679	45300000	57964069	18.95983	0	0
1970	1.16E+09	1.052441	45100000	58100299	18.91566	0	0
1971	1.22E+09	1.057148	53100000	52651103	18.88491	0	0
1972	1.27E+09	1.060486	55400000	51084460	18.86311	0	0
1973	1.24E+09	1.064621	56000000	50675770	18.8361	0	1
1974	1.30E+09	1.071133	64500000	44886000	18.79357	0	0
1975	1.25E+09	1.080837	73200000	38960000	18.73018	0	0
1976	1.32E+09	1.091871	89300000	59254000	18.65811	0	0
1977	1.34E+09	1.081787	1.20E+08	53167000	18.72398	0	0
1978	1.40E+09	1.06624	1.39E+08	72468000	18.82553	0	0
1979	1.45E+09	1.080816	1.57E+08	72561000	18.73032	1	0
1980	1.39E+09	1.131387	1.82E+08	69751000	18.4	1	0
1981	1.36E+09	1.189262	2.11E+08	54043000	21.5	1	1
1982	1.33E+09	1.261644	2.43E+08	66152000	18.2	1	0
1983	1.30E+09	1.292999	2.04E+08	76068000	20.7	1	0
1984	1.28E+09	1.221005	1.87E+08	91305000	20.6	1	0
1985	1.26E+09	0.993599	2.30E+08	1.15E+08	19.3	1	0
1986	1.24E+09	0.563756	1.85E+08	1.50E+08	14.5	0	0
1987	1.23E+09	0.181515	3.42E+08	1.78E+08	13.6	0	0
1988	1.21E+09	2.370261	2.97E+08	1.90E+08	13.4	0	0
1989	8.84E+08	1.181515	2.07E+08	2.37E+08	13.8	1	0
1990	4.33E+08	1.14407	1.88E+08	2.37E+08	17.23614	1	0
1991	3.71E+08	2.373021	2.97E+08	2.82E+08	13.40017	1	0
1992	2.41E+08	19.87432	1.81E+09	2.66E+08	14.48457	1	0
1993	1.62E+08	20.00234	1.82E+09	4.26E+08	14.4925	1	0

1994	1.26E+08	20.12342	1.83E+09	4.58E+08	14.5	1	0
1995	1.21E+08	30.09328	2.70E+09	6.53E+08	15.6	1	0
1996	1.36E+08	1.24406	2.19E+08	6.96E+08	15.6	1	0
1997	2.80E+08	1.833702	2.51E+08	6.87E+08	16.8	1	0
1998	3.63E+08	2.102386	2.74E+08	1.57E+09	21.7	1	0
1999	4.46E+08	43.25917	3.86E+09	1.81E+09	16.7	1	0
2000	5.61E+08	39.50404	3.51E+09	1.60E+09	20.5	1	0
2001	5.77E+08	42.75878	3.79E+09	1.70E+09	22.1	1	0
2002	5.99E+08	49.50796	4.73E+09	2.36E+09	20.2	1	0
2003	4.11E+08	65.00883	2.07E+09	2.76E+09	17.1	1	0
2004	4.22E+08	50.50894	2.63E+09	3.73E+09	18.1	0	0
2005	4.44E+08	54.50975	3.37E+09	4.87E+09	17	0	0
2006	4.79E+08	59.50109	4.10E+09	6.64E+09	15.5	0	0
2007	5.24E+08	62.50275	6.56E+09	9.10E+09	15	0	1
2008	5.61E+08	63.5	4.16E+08	4.09E+09	13.17262	0	1

Sources: African Development Indicator 2010 CD-ROM and IMF-IFS