EXCHANGE RATE AND BALANCE OF PAYMENTS ADJUSTMENT IN SIERRA LEONE, 1970-2005

BY

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ABSTRACT

In spite of series of exchange rate adjustments in the 1980s and the adoption of the managed floating exchange rate regime in 1990, Sierra Leone still experiences poor external sector performance. The nominal exchange rate has been depreciating since the 1980s without reflection on the real exchange rate and the balance of payments. Both the theoretical and empirical literature on the effects of the nominal exchange rate on the real exchange rate and, hence, the balance of payments, are inconclusive. Previous studies on Sierra Leone focused on the elasticity approach, ignoring the wide macroeconomic implications of changes in the exchange rate. This study therefore examined the role of the exchange rate in balance of payments adjustment in Sierra Leone.

Based on the absorption approach to the balance of payments, a small open-economy macroeconomic model that incorporated the linkages among fiscal, monetary and exchange rate policies, and the balance of payments was constructed using annual data from 1970 to 2005. The empirical analysis was based on estimating the macroeconomic model using the three stage least squares, and counterfactual policy simulations. Using Ordinary Least Squares with moving average errors, an equilibrium real exchange rate model which was derived from the basic tradable and non-tradable goods framework was also estimated.

Although increase in the nominal exchange rate was inflationary, it increased the real exchange rate, non-mineral export, aggregate export, output, absorption and import. Moreover, it decreased the trade balance and increased the overall balance of payments. The correlation coefficients between actual and simulated series ranged from 0.5 to 0.94, while the covariance proportions of the Theil's inequality coefficients ranged from 0.47 to 0.98. An 85 % increase in the nominal exchange rate increased the price level by 3.9 %, real exchange rate by 6.9 %, non-mineral export by 117.1% and the balance of payments by 22.6% while it decreased the trade balance by 48.4%. Loose fiscal and monetary policies and trade restrictions reduced the potency of nominal exchange rate in attaining real exchange rate depreciation and improvement in the balance of payments of Sierra Leone. The estimated equilibrium real exchange rate model showed that an increase in investment appreciated the equilibrium real exchange rate, implying that investment took place more in the non-tradable goods sector than the tradable goods sector

of Sierra Leone. Also, deterioration in-terms-of trade and trade restrictions appreciated the equilibrium real exchange rate.

Nominal exchange rate depreciation leads to depreciation of the real exchange rate, and expansionary fiscal and monetary policies appreciate the real exchange rate. Although nominal exchange rate depreciation increases export and hence income, it raises import and therefore deteriorates the trade balance. It is, therefore, recommended that fiscal and monetary policies be coordinated such that tight monetary policy is given priority, as this enhances the benefit of nominal exchange rate depreciation. Also, bolstering domestic capacity for the production of import-competing goods is essential.

Keywords: Exchange rate, Balance of payments, Macroeconomic model, Sierra Leone.

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CERTIFICATION

I certify that this work was carried out by Mr. Robert Dauda Korsu in the Department of Economics, University of Ibadan

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DEDICATION

This work is dedicated to my mother Mrs Gbaysay Korsu (nee Kondoh) and my father Mr. Robert Dauda Korsu

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE
INTRODUCTION

1.1 Introduction

Every nation depends on international trade and payments, and the balance of payments reflects the performance of an economy in relation to the rest of the world. To this end, the balance of payments has been essential to all countries. Based on the importance of the balance of payments and the exchange rate, reduction of the degree of balance of payments disequilibrium and exchange rate stability have been among the objectives of the International Monetary Fund (IMF)[1] since its inception at the Bretton Woods conference in 1944. Central banks of developed and developing countries as well, have therefore included reduction of the degree of balance of payments disequilibrium and exchange rate stability among their objectives.

Prior to the 1980s, the current accounts (of the balance-of- payments) of most developing countries were weak. This emanated mainly from the inability of their exports to finance imports. Their exports are mostly agricultural and other primary products (oil and precious stones), while their imports are mainly capital goods, intermediate producer goods, raw materials and consumer goods. However, these deficits were less than the surpluses on the capital accounts[2]. Thus, the deficits were financed by resource transfer from the capital accounts, which took the form of (private) foreign direct investment (FDI) by multinational corporations (MNCs), foreign aid (loans and grants). Increased loans, which increased external debt, played a greater role in the reserve accumulation process. The existence of favorurable international economic environment after the first oil shock (1973) and increased international lending to developing countries by commercial lenders were the factors behind the great role of external debt in the reserve accumulation of the period 1973-1979. This was mainly because oil exporting countries

[1] The IMF is one of the two institutions that came up at the Bretton Woods Conference for Post-war reconstruction and development. One of its key mandates is to help member countries in solving chronic balance of payments problem with policy and financial assistance.

[2]The capital account shows the value of the receipt of investment and foreign private and public lending in excess of repayment of principal and interest on external debts and transfers on investment made abroad.

increased their savings of the petrodollar from the hike in oil prices and the private international banks increased their lending to the developing world following the 1973 oil shock. Emanating from the increased external debt therefore, the capital account surpluses of most developing economies enabled them to accumulate international reserves as the capital account surpluses more than offset the deficits in the current accounts.

After the second oil shock of 1979, the situation was different. This time, the international economic environment was not favourable. Interest rates increased in the industrial world, incomes of the developed nations reduced, import bills of non-oil exporting countries increased and primary commodity export prices reduced (thereby reducing the developing countries' export earnings). The increase in import bills and reduction in primary commodity export prices increased debt-service obligations of the developing countries. Upon the observations that debt-servicing was weak, international banks reduced lending to developing countries. This scenario and huge capital flight produced balance of payments accounts in which the surpluses on the capital accounts in the 1970s became deficits in the 1980s (Todaro and Smith, 2003). Hence, in the 1980s the developing countries experienced acute deterioration in both their current and capital account balances and this remained the case in the 1990s and 2000s in many developing economies.

In sub-Saharan Africa, the growing overvalued exchange rate that took off in the early 1980s has also contributed to the poor performance on the current account balance of most of these countries (Ghura and Grennes 1993), thereby aggravating the poor performance on the balance of payments of these economies.

Economists have argued that exchange rate is an important variable in an open economy. The main reason being that the exchange rate influences other prices (wages, interest rate and the general price level) and the allocation of resources (between the tradable and the non-tradable sectors of the economy). Moreover, the exchange rate is affected by macroeconomic policies. It has also been argued that the exchange rate policies of the high performing East Asian countries, which contributed to low volatility of real exchange rate and avoided real exchange rate misalignment (overvaluation), were major factors among their success, especially their healthy export performance (Elbadawi and Soto, 1997). Hence exchange rate policies play crucial role in the growth and development process of an economy.

The International Monetary System under the Bretton Woods era (1944-1971) was such that the exchange rates were pegged and capital control was high, making capital account less important than the current account. Thus, the international finance literature was concerned with the conditions under which the current account disequilibrium could be eliminated. Since the collapse of the Bretton Woods system (and the adoption of the floating exchange rate regime) in 1973 the exchange rates have been highly volatile in both developed and developing countries and in most developing countries, nominal exchange rate depreciation has been sustained without reflection on their real exchange rates. This has brought the issue of real exchange rate determination into the forefront. Hence, both the effects of the exchange rate on the trade balance as well as the overall balance of payments, and the determinants of the real exchange rate have become pertinent issues in the international finance literature.

1.2 The problem

The performance of the external sector of Sierra Leone has been poor since the 1980s. The poor external sector performance coexists with high rate of inflation and low growth of output. Moreover, despite the increase in real GDP growth and decrease in the rate of inflation in the post-war period (2001-2005), external sector performance as measured by external balance on goods and services and net foreign assets is worse than it was in the 1970s through the 1990s. Over the period 1970-2005, the nominal exchange rate[3]appreciated only in 1978, 1980, 1988 and 2001. This implies that on the average, the nominal exchange rate of Sierra Leone has been depreciating since the 1970s, while external sector performance is still weak.

Adjustments of the nominal exchange rate (in the fixed exchange rate regime) have been attempts to bolster external sector performance in Sierra Leone, while increased external-debt has been used to finance the deficit in the current account. The domestic currency (the leone) was devalued for the first time in 1967, following the devaluation of the British pound. The country adopted series of exchange rate management policies, especially in the 1980s, under the fixed exchange rate regime of the 1970s and 1980s. In April 1990, the country adopted a

[3]The nominal exchange rate is defined here as leones per United States dollar so that an increase is depreciation of the domestic currency and a decrease is an appreciation of the domestic currency.

(managed) floating exchange rate regime. This regime has been characterized by sustained nominal exchange rate depreciation.

Despite the series of devaluations of the nominal exchange rate in the fixed exchange rate regime and the continuous depreciation of the nominal exchange rate in the floating exchange rate regime, the external sector performance of Sierra Leone is still poor. This is a manifestation of the fact that real exchange rate depreciation has not been obtained or maintained by the nominal depreciations. While nominal exchange rate devaluation/depreciation has been common, real exchange rate depreciation has not been a common phenomenon. Over the period 1970-1975, nominal exchange rate depreciated by 1.4 % while real exchange rate appreciated, 1.3 %. Over the period 1980-1985, nominal exchange rate depreciated by 34.1 % while real exchange rate appreciated, by 3.0 %. Over the period 1991-1995, nominal exchange rate depreciated by 42.0 % while real exchange rate appreciated, by 1.7 %. Over the period 1996-2000, while nominal exchange rate depreciated by 23.8 % real exchange rate depreciated by only 5.0 % and over the period 2001-2005, nominal exchange rate depreciation was 6.9% while real exchange rate depreciation was only 3.0 %. Moreover, the substitution of the fixed exchange rate regime with the managed floating exchange rate regime in Sierra Leone, in 1990, was done on the basis that external sector performance would improve by reducing real exchange rate misalignment. However, the country still experiences poor external sector performance.

For appropriate macroeconomic management, the research questions that therefore follow from these observations are: What is the effect of the nominal exchange rate on the real exchange rate (which is the conventional measure of the competitiveness of the economy to international trade)? Are there macroeconomic factors, apart from the nominal exchange rate, that explain the behaviour of the real exchange rate? Does real exchange rate depreciation improve the balance of payments? Has the (managed) floating exchange rate regime been associated with less misalignment of the real exchange rate than the fixed exchange rate regime? An understanding of these issues can help policy makers in resolving the poor external sector performance and making appropriate exchange rate management policies.

1.3 Objectives of the study

The overall objective of the study is to investigate the role of the exchange rate in balance of payments adjustment in Sierra Leone.

The specific objectives are to:

(i) investigate the effects of the nominal exchange rate on the real exchange rate, trade balance and overall balance of payments.

(ii) investigate the determinants of the actual (short-run) and equilibrium (long-run) real exchange rates

(iii) determine a model-based equilibrium real exchange rate and characterise the nature of real exchange rate misalignment in Sierra Leone, from the early 1970s to 2005.

1.4 Justification for the research

There are four justifications for this study. First, the theoretical and empirical literature on the effects of exchange rate on the balance of payments is inconclusive. At the theoretical level, Krugman and Taylor (1978), Porter and Ranney (1982), Krueger (1983) and Khan and Montiel (1989) have argued that a devaluation or depreciation of the nominal exchange rate improves the balance of payments. On the other hand, other authors have argued that devaluation worsens the balance of payments (Williamson, 1983 and Wijnbergen, 1986). In the case of the empirical literature, Cooper 1971, Salant (1976), Onafowora (2001) and De Silva and Zhu (2004) for example, have found that devaluation improves the balance of payments while Laffer (1976), Rose and Yallen (1989) and Agbola (2004) have found that devaluation does not improve the balance of payments.

Second, despite the nominal devaluations of the domestic currency before 1990, adoption of the managed floating exchange rate regime (in 1990) and the continuous depreciation of the

nominal exchange rate in the managed floating exchange rate regime, external sector performance of Sierra Leone has been poor. It is therefore important to investigate the role of the nominal exchange rate in the determination of the competitiveness (the real exchange rate) of the economy, determine whether other factors are behind the determination of competitiveness of the economy of Sierra Leone to international trade and ascertain the effects of real exchange rate on external sector performance. This would provide guideline for policy makers in addressing the issue of external sector development.

Third, despite the existence of a plethora of empirical work on the effects of exchange rate on the balance of payments, there is dearth of work in the case of Sierra Leone, and the empirical evidence on Sierra Leone focused on the elasticity approach, ignoring the macroeconomic wide implications of changes in the nominal exchange rate. For example, Rawlins and Praven (2000) specified and estimated an Almon Distributed Lag process of trade balance for Sierra Leone and 18 other African countries using annual data comprising monetary- and fiscal- policy variables as regressors. Their findings suggest that for Sierra Leone a depreciation of the real exchange rate improves the trade balance. However, their study does not model the possible sources of real exchange rate depreciation. Moreover, their study did not take into consideration the various interactions among macroeconomic variables, following change in the real exchange rate.

Fourth, good export performance is essential for sustained economic growth and to obtain good export performance, the competitiveness of exports to international trade must be established. This requires the real exchange rate to be at its right value or to be very close to its right value (its equilibrium value). Hence, knowledge of the determinants of the actual and equilibrium real exchange rates is essential. Such knowledge provides information on the determinants of real exchange rate misalignment, since real exchange rate misalignment is the gap between the equilibrium and actual real exchange rates. This enables policy makers to realign the real exchange rate in an effort to bolster external sector performance.

This study extends the existing literature in the following ways: (i) By recognising the linkages among fiscal policy, monetary policy, exchange rate policy and external sector performance, and therefore estimating a small macroeconomic model that captures these linkages, with the view of determining the role of exchange rate in balance of payments adjustment in Sierra Leone. (ii) By making the real exchange rate endogenous, on the basis that the effects of nominal exchange rate on the trade balance is through the real exchange rate, and

investigating its determinants by building, estimating and solving a small macroeconomic model under different policy scenarios. This accounts for not only the direct effect but also the indirect effect of nominal exchange rate on the real exchange rate (through the rate of inflation) and the role of the fiscal and monetary policies on the real exchange rate. (iii) By accounting for both simultaneity bias (common in macroeconomic models) and spurious regression (common in time-series data) in estimating the macroeconomic model, in order to determine the role of exchange rate in balance of payments adjustment.

1.5 Scope of the study

The research is a study on a small, open and developing country, Sierra Leone. The choice is made out of the researcher's interest, drawing from the fact that for more than two decades the country has experience poor external sector performance coupled with high inflation and low growth of output. The study period is from 1970 to 2005. The choice of the period is based on the fact that the period is long enough to capture the financial repression regime, the high inflationary as well as low inflationary periods of Sierra Leone. The study focuses on the role of exchange rate in balance of payments adjustment and considers both the direct and indirect effects of a change in the nominal exchange rate.

1.6 Organisation of the study

The organization of the rest of the thesis is given in what follows. A review of macroeconomic performance and Policies in Sierra Leone is done in chapter two. This includes discussion on the trends in GDP growth, inflation, trade balance, foreign reserve, monetary policy, fiscal policy and exchange rate policy. Chapter three is the literature review. It discusses both the theoretical and empirical literature on the effects of exchange rate on the balance of payments and the determinants of the real exchange rate. This is done in order to address the overall objective of the study from the perspective of existing theories and previous empirical works. It also enables us to have knowledge of the gaps in the literature.

Chapter four is the theoretical framework and methodology. Here, the theoretical foundation for the empirical model used to address the objectives of the study is discussed. The

specifications of the various equations of the model, the inherent logic of the model and the estimation procedure are also discussed in this chapter.

In chapter five, the results of the estimated equations of the model, their interpretations, and simulation exercises are discussed. Calculation of and discussion on the model-based equilibrium real exchange rate and real exchange rate misalignment from the early1970s to 2005 are also done in this chapter.

Chapter six is a presentation of the summary, conclusion and lessons for policy. Limitations of the study and suggestions for further research are also presented in this chapter.

CHAPTER TWO

MACROECONOMIC PERFORMANCE AND POLICIES IN SIERRA LEONE

A review of the macroeconomic performance of Sierra Leone, with respect to inflation, growth of real output and external sector performance, is undertaken in this chapter. Trends in the demand management policies (monetary and fiscal policies) as well as exchange rate policy in Sierra Leone are also reviewed here.

2.1 Macroeconomic performance of Sierra Leone

It is a common knowledge that the macroeconomic performance of sub-Sahara African (SSA) countries in the 1980s was weak, emanating mainly from inappropriate domestic policies though external factors have also been identified to have played a role. The economic performance for most of these economies was worse in the 1990s than in the 1980s. The poor economic performance of SSA since the 1980s holds for Sierra Leone as well.

Sierra Leone recorded positive growth of real gross domestic product (GDP) in the early 1970s to mid 1970s, with growth of real GDP ranging from a minimum of 0.89 %, in 1972 to7.94 %, in 1970 (see Table 2.1) with an average of 3.24% (see Table 2.2). The rate of inflation was relatively low between 1970 and 1973 ranging from a minimum of -1.27 %, in 1971 to a maximum of 6.41 %, in 1970. The rate of inflation became double digit for the first time since 1970 in 1974 and was also double digit in 1975 (see Table 2.1). The poor performance on inflation rate in 1974 and 1975 was mainly as a result of the hike in the oil price of 1973, which affected domestic prices with lags though growth of output was still favourable in these periods. Average inflation rate from 1970 to 1975 was 8.44 %. This average was higher than 5 % as a result of the high inflation rates of 1974 and 1975.

Table 2.1: Internal and External Balance Positions of Sierra Leone, 1970 to 2005

Year	Real GDP Growth* (%)*	Inflation Rate (%)	Trade Balance (% of GDP)	Net Foreign Assets (Millions of Leones)	Foreign Reserves, Excluding Gold (Millions of dollars)
1970	7.94	6.41	-3.59	27.17	39.36
1971	3.35	-1.27	-3.74	25.78	38.41
1972	0.89	5.50	-1.05	35.92	46.45
1973	2.21	5.62	-4.96	42.08	51.78
1974	3.38	14.42	-13.97	36.53	54.62
1975	1.64	19.95	-10.97	13.74	28.41
1976	-0.45	17.13	-10.10	-4.91	25.2
1977	0.05	8.35	-6.86	-1.14	33.4
1978	2.35	10.93	-13.26	-28.31	34.79
1979	4.32	21.23	-11.93	-51.09	46.7
1980	4.62	12.90	-18.45	-157.29	30.6
1981	2.80	23.38	-15.91	-285.17	15.95
1982	4.56	26.89	-14.43	-307.61	8.43
1983	-2.15	68.51	-4.72	-738.85	16.2
1984	3.93	66.58	-2.18	-774.08	7.75
1985	-5.61	76.58	-3.20	-1796.71	10.82
1986	1.22	80.87	-0.55	-9353.91	13.65
1987	6.74	178.70	1.18	-8299.17	6.33
1988	-7.62	34.29	-5.49	-13388.7	7.43
1989	0.72	60.80	-4.76	-20601.4	3.73
1990	3.24	110.95	-1.57	-63771	5.43
1991	2.30	102.69	-0.67	-144591	9.63
1992	-23.47	65.50	0.63	-188052	18.93
1993	1.36	22.21	-3.75	-204117	28.97
1994	-1.99	24.20	-3.83	-338852	40.64
1995	-8.69	25.99	-11.00	-396296	34.62
1996	5.74	23.14	-17.37	-178045	26.59
1997	-21.36	14.95	-7.74	-190891	38.46
1998	-0.89	35.53	-13.10	-251499	43.86
1999	-9.17	34.09	-11.80	-367011	39.47
2000	3.29	-0.84	-21.64	-212524	49.21
2001	4.40	2.09	-19.40	-245811	51.31
2002	5.93	-3.29	-23.05	-183182	84.69
2003	6.19	7.60	-21.09	-247119	66.62
2004	7.51	14.19	-13.85	-127895	125.1
2005	7.50	12.05	-16.04	-128550	170.51

Table 2.1 Continued: Internal and External Balance Positions of Sierra Leone, 1970 to 2005

Year	Real GDP Growth* (%)	Inflation Rate (%)	Trade Balance (% of GDP)	Net Foreign Assets (Millions of Leones)	Foreign Reserves, Excluding Gold (Millions of dollars)
Pre-War Years (1970-1990)	1.82	40.42	-7.17	-5684.67	25.02
War Years (1991-2000)	-5.29	34.75	-9.03	-247188	33.04
Post-War Years (2001-2005)	6.31	6.53	-18.69	-186511	99.65

Sources: Calculated from International Financial Statistics CD-ROM 2007
*Calculated from World Development Indicators CD-ROM 2007

Though import was higher than export in the early 1970s and the growth of import was also higher than the growth of export, leading to deficit in the trade balance in the period 1970 to 1975, net foreign assets was positive. Hence capital flow in the form of loans and grants were the factors behind the favourable balance of payments of this period. The ratio of export to GDP was 23.99 % between 1970 and 1975 while the ratio of import to GDP was 30.37 % and the trade balance as a ratio of GDP was -6.38 % in this period. While import grew by 12.27 % in this period export grew by only 3.61% (see Table 2.2).

The late 1970s was not favourable for Sierra Leone though real GDP growth was positive. The growth of GDP fell from the average of 3.24 % in the period 1970 to 1975 to 1.57 % between 1976 and 1979 (see Table 2.2), ranging between -0.45 % in 1976 and 4.32 % in 1979 (see Table 2.1). The rate of inflation increased from the average of 8. 44 % in the period 1970 to 1975 to an average of 14.41 % between 1976 and 1979 while trade balance,, as a ratio of GDP worsened from -6.38 % in the period 1970 to 1975 to -10.54 % in the period 1976 to 1979 (see Table 2.2).

The economy deteriorated in the 1980s in terms of both internal balance (economic growth and inflation) and external balance. This was mainly as a result of imprudent fiscal policy and the fact that monetary policy was accommodating fiscal policy. Moreover, the exchange rate was fixed while fiscal and monetary policies were inconsistent, leading to overvaluation of the domestic currency, thus adversely affecting export while encouraging import.

Table 2.2: Basic Macro Economic Indicators for Sierra Leone, 1970 to 2005

Indicator	1970-1975	1976-1979	1980-1985	1986-1990	1991-1995	1996-2000	2001-2005
Real GDP Growth (%)*	3.24	1.57	1.36	0.86	-6.1	-4.48	6..31
Inflation Rate (%)	8.43	14.41	45.81	93.12	48.12	21.37	6.53
Export (% of GDP)	23.99	20.03	13.31	18.36	14.72	2.15	8.95
Import (% of GDP)	30.37	30.57	23.13	20.6	18.49	16.48	27.63
Export Growth (%)	3.61	19.86	28.58	123.08	22.95	18.14	80.01
Import Growth (%)	12.27	19.59	21.88	101.83	39.61	44.76	26.66
Trade Balance (% of GDP)	-6.38	-10.5	-9.82	-2.24	-3.72	-14.33	-18.69
Foreign Reserves Excluding Gold (Millions of U.S dollar)	43.17	35.02	14.96	7.31	26.56	39.52	99.65
Net Foreign Assets (Millions of Leone)	30.2	-21.4	-676.62	-23083	-254382	-239994	-186511.4
Investment (% of GDP)	12.83	11.66	13.39	8.55	7.52	6.08	9.86
External Debt (Millions of U.S dollar)*	138	319.6	610.03	1046.3	1444	1255.4	1607.98
Foreign Aid (Millions of U.S dollar)*	11.74	33.8	70.34	84.25	180.26	145.26	346.49
Nominal Exchange Rate (Bilateral with U.S)	0.84	1.09	2.16	58.78	540.84	1472.4	2404.8
Nominal Exchange Rate Depreciation (%)	1.4	4.8	34.07	112.07	41.97	23.83	6.9
Real Exchange Rate (Bilateral with U.S dollar)	1958.59	1669	1332.97	1683.4	1819.7	1835.4	2287.11
Real Exchange Rate Depreciation (%) (Bilateral with U.S dollar)	-1.31	4.65	-3.03	16.01	-1.66	5.00	3.02
Real Interest Rate (%)	-11.17	-6.81	-36.77	-68.91	-11.15	3.16	12.21
Budget Deficit, excluding Grant (% of GDP)	3.47	8.51	11.46	7.66	6.14	9.74	13.44
M1 Growth (%)	11.77	20.66	41.37	74.74	30.45	24.98	25.02
M2 Growth (%)	12.7	23.79	35.34	71.5	31.96	27.89	27.3

Source: Calculated by author from International Financial Statistics CD ROM 2007

* Calculated by author from World Development Indicators CD ROM 2007

Fiscal deficit (excluding grant) as a ratio of GDP increased from the value of 3.47 % over the period 1970-1975 to 8.51 % over the period 1976-1979 and increased further to 11.46 % over the period 1980-1985. Growth of narrow money increased from 11.77 % over the period 1970-1975 to 20.66 % over the period 1976-1979 and increased further to 41.37 % over the period 1980-1985. Growth of broad money increased from 12.7 % over the period 1970-1975 to 23.79 % over the period 1976-1979 and increased further to 34.34 % over the period 1980-1985. The rate of inflation rose from the average of 8.41 % over the period 1970-1975 to 14.41 % over the period 1976-1979 and increased further to an average of 45.81% over the period 1980-1985. Growth of real GDP fell from an average of 3.24 over the period 1970-1975 to 1.57 % over the period 1976-1979 to an average of 1.36 % over the period 1980-1985. Net foreign assets declined from an average of 30.2 million leones over the period 1970-1975 to -21.36 million leones over the period 1976-1979 and further declined to an average of -676.62 million leones over the period 1980-1985. Though export growth was higher than import growth between 1976 and 1985 export value was lower than import value. Hence, the trade balance was in deficit as in the period 1970-1975. Trade balance as a percentage of GDP declined from an average of -6.38 % over the period 1970-1975 to an average of -10.54 % over the period 1976-1979 and increased to only -9.82 % over the period1980-1985 (see Table 2.2).

Poor export performance and low levels of capital inflow led to low levels of foreign reserves in the 1980s. Foreign reserves excluding gold which reduced from an average of 43.17 million U.S dollars in the period 1970 to1975 to 35.02 million U.S dollars in the period 1976 to1979 was only 14.96 million U.S dollars in the period 1980 to1985, and between 1986 and 1990 it was as low as 7.31 million U.S dollars (see Table 2.2).

In order to rebuild the economy, the government introduced the National Economic Emergency Program (NEEP) in November 1987. This comprised rigid currency holdings and control of cross border trade and prices of staple products. These measures which proved to be futile were abolished in December 1989 for the Economic Recovery Program (ERP). The ERP came from the series of meetings with the IMF and the World Bank in relation to the adoption of an adjustment program. Though the program had elements in common with the conventional IMF program it did not have direct support from the IMF. The prime objective of the program was to restore economic growth through structural reforms, including fiscal and monetary restraints.

This was not the first time Sierra Leone had relationship with the IMF. The first financial program was signed in August 1966 with the aim of reducing the overall credit in order to reduce the demand for imports to ensure improvement in the balance of payments. Until 1984, the stabilization program with the IMF was regular since 1979. The relationship with the IMF (financial assistance) was cut in 1984 mainly because of the reluctance of the government[4] to curtail public expenditure, devalue the leone and cut subsidies on petrol and the staple food (rice).

The deterioration in economic performance which Sierra Leone experienced in the mid 1970s to the early 1980s became worse when the country fell apart with the IMF in 1984. In 1985, GDP growth took the least value since 1970 (a value of -5.61%) and was only 1.22 % in 1986. While the growth of GDP was 6.74 % in 1987 it reduced to -7.62 % and 0.72 % in 1988 and 1989 respectively and inflation rate increased to 76.58 %, 80 % and 178.70 % in 1985, 1986 and 1987 respectively. Though GDP growth was good in 1987, the cost in terms of inflation was very high as inflation rate recorded the highest value in history (178.7%)-see Table 2.1. Foreign reserves fell further from an average of 14.96 million U.S dollars over the period 1980-1985 to an average of 7.31 million U.S dollars over the period 1986-1990. Trade balance as a ratio of GDP remained in deficit in this period though the deficit was lower than it was over the period 1980-1985. However, net foreign assets deteriorated in this period by more than three times its value over the period1980-1985 (see Table 2.2), reflecting higher capital flight and lower capital inflow.

In 1992, following the military coup that brought Captain Valentine Strasser to power, relationship with the IMF was deepened and the Structural Adjustment Program was adopted. The centerpiece of the program was fiscal and monetary restraint, reduction of the role of the government, improvement of service delivery and promotion of the private sector. The Adjustment Program that started in 1992 was supported by the IMF under the Rights Accumulation Program (RAP) from 1992 to 1994 and later under the Enhanced Structural Adjustment Facility (ESAF) from 1994 to 1996. The World Bank also supported the program through the Reconstruction Imports Credit (RIC) and later by the Structural Adjustment Credit (SAC). The rate of inflation therefore fell from 102.69 % in 1991 to 65 .5 % in 1992 and ranged

[4] This was the regime of Siaka Stevens' government, which came to power in 1968 after a general election that is still today described by political analyst as controversial.

between 22 % and 26% from 1993 to 1995, which were lower than the values in the previous decade. However, GDP growth was negative in 1992 (a value of -23.47 %), 1994 (a value of -1.99 %) and 1995 (a value of -9.17 %) while it was 1.36 % in 1993. The rate of inflation ranged between 23 % and 35 % from 1996 to 1999. In the years 1997 to 1999, GDP growth was negative though it was positive in 1996[5] (see Table 2.1). Trade balance as a ratio of GDP deteriorated from an average of -2.24 % over the period 1986-1990 to -3.72 % over the period 1991-1995 and -14.33 % over the period 1996-2000 (see Table 2.2).

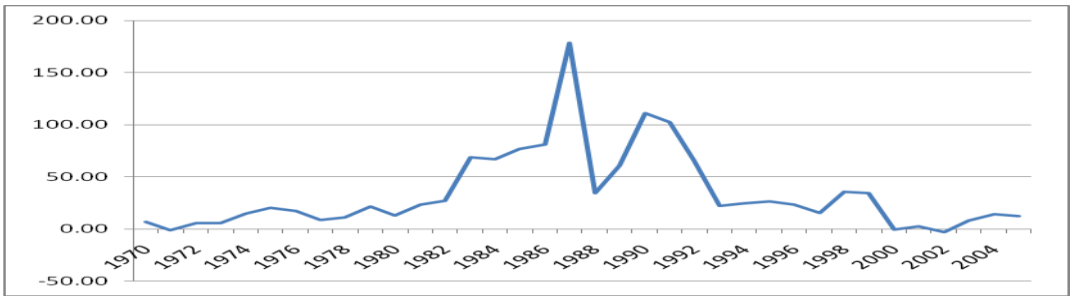
The rate of inflation reduced from 21.37 % over the period 1996-2000 to 6.53 % over the period 2001-2005, real GDP growth increased from -4.48 % over the period 1996-2000 to 6.31% over the period 2001-2005 (see Table 2.2). However, trade balance as a ratio of GDP worsened to -18.69 % over the period 2001-2005 from a value of -14.33 % over the period 1996-2000. Foreign reserves excluding gold increased from 39.52 million U.S dollars over the period 1996-2000 to 99.65 million dollars over the period 2001-2005 and net foreign assets increased from a deficit of 239994.00 million leones to a deficit of 186511.40 million leones. The deterioration in the trade balance over the period 2001-2005 vis-à-vis the previous decade while both foreign reserves and net foreign assets increased (though net foreign assets was still in deficit between 2001 and 2005) reflects the increase in external debt and foreign aid for post-war reconstruction and poverty reduction.

The performance of the economy of Sierra Leone in the period 2001- 2005 (the post-war period) was better than the 1980s and 1990s, in terms of inflation rate and output performance (see Figure 2.1). This is not surprising as this is a period of Structural Adjustment and stable political environment, reflected in increased investment-GDP ratio from 8.55 % over the period 1986-1990 to 9.86% in the post-war period (see Table 2.2). However, the performance on the side of the external sector (the trade account) was worse than it was in the 1980s and 1990s (see Figure 2.1). The, increase in foreign aid and external debt for reconstruction and poverty reduction, increased foreign reserve in the post-was period (see figure 2.1) and this tends to give the picture that external sector performance improved in the period 2001-2005 vis-à-vis the 1980s and 1990s.

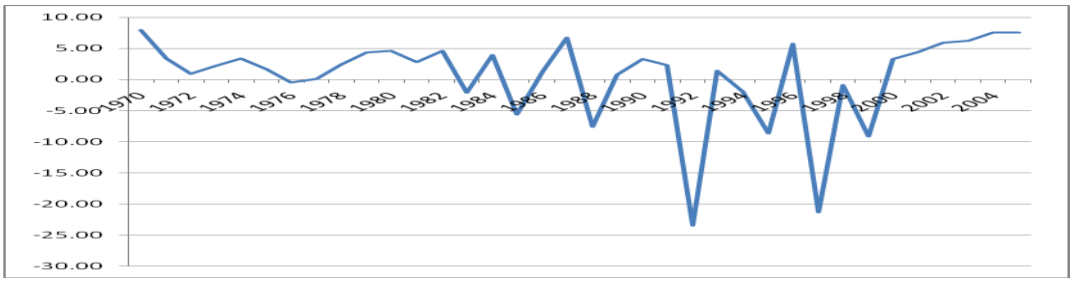
[5] The country had a democratically elected government for the first time since 1968 in March 1996.

Figure 2.1: Trends in Internal and External Balance Positions of Sierra Leone

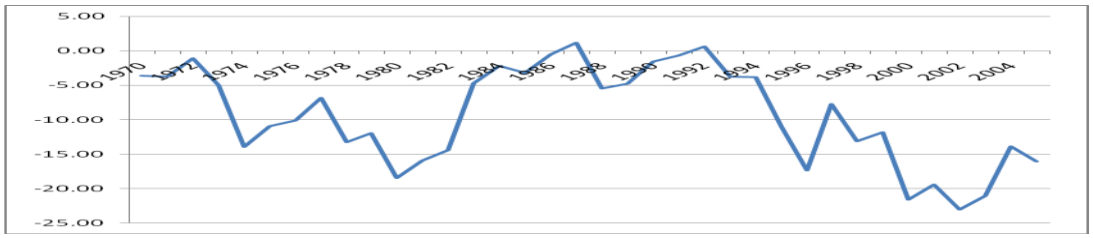
Panel 1: Inflation Rate



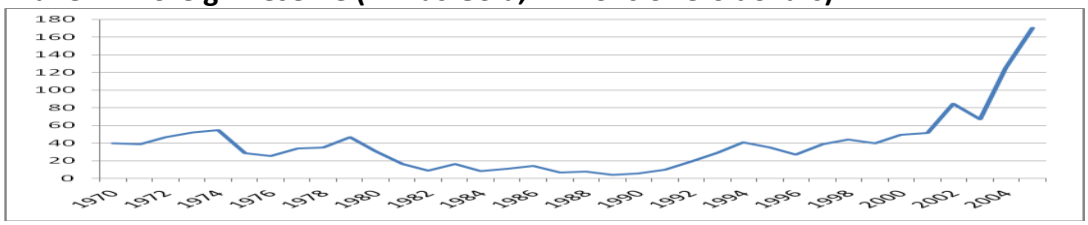
Panel 2: Real GDP Growth*



Panel 3: Trade Balance (% of GDP)



Panel 4: Foreign Reserve (Minus Gold, Millions of U.S dollars)



Source: Calculated by author from International Financial Statistics CD ROM 2007

* Calculated by author from World Development Indicators CD ROM 2007

2.2 Monetary policy stance in Sierra Leone

The Bank of Sierra Leone (BSL) is responsible for the formulation and implementation of monetary policy in Sierra Leone. The BSL was established after the abolition of the West African Currency Board (WACB) and was opened for business on August 4, 1964, after the BSL Act became a law on March 27, 1963. According to the BSL Amendment Act of 1970, the main purpose of setting up the BSL are: (i) to promote monetary stability and sound financial structure (ii) to maintain the internal and external value of the leone (iii) to promote credit and exchange conditions conducive to the balance growth of the economy. According to the recent act of the BSL (BSL Act 2000), the objective of the BSL is to achieve and maintain monetary stability and this function is assigned to the Monetary Policy Technical Committee (MPTC), headed by the Bank Governor. The committee has its main objective as the maintenance of low inflation consistent with achieving sustainable economic growth and financial stability. Thus, the ultimate objective of the Bank of Sierra Leone since its inception has been to maintain low inflation, sustainable economic growth and financial stability.

The objective of monetary policy by 1966 following Sierra Leone's first meeting with the IMF was to tighten money supply by an amount consistent with the reserve policy. The reserve policy was that monetary expansion should be below 7.5 million leones in fiscal year 1966/67, 3.0 million leones in fiscal year 1967/68 and 2.0 millions leones in fiscal year 1968/69. The increase in domestic credit for this period was set to finance the budget deficit and the remainder for the satisfaction of private sector bank credit requirements.

The monetary policy regime in Sierra Leone has been the use of broad money as the intermediate target and reserve money as the operational target while the ultimate objectives are price stability and sustained economic growth. However, the instruments of monetary policy have changed over the years. Until 1992, direct instruments (required reserve, special deposits, selective credit control and moral suasion) were used and interest rate was also administratively determined. These instruments were meant to directly control the growth of the balance sheets of commercial banks in order to limit the growth of money supply.

Despite the use of direct instruments to control the growth of the balance sheets of the commercial banks in order to limit the growth of money supply, restriction of money supply growth was generally not achieved. This emanated mainly from the fiscal dominance and monetary accommodation phenomena. Government expenditure was more than revenue and the

former was growing at a rate higher than the latter, leading to increased budget deficit that was financed mainly by government borrowing from the central bank. Table 2.3 shows the composition of money supply. Over the period 1970 to 1975 net foreign asset contributed more to money supply than the other components and this was followed by domestic credit to the private sector. But from the mid-1970s to 2005 net domestic credit to the government had the highest composition in broad money.

Over the period 1970-2005 the growth of narrow money supply was negative only in 1970 and 1981 while the growth of broad money was negative only in 1970. Moreover, apart from the year 1970, 1975 and 1981 the growth of both narrow and broad money were double digit through the direct-instrument monetary policy regime (1970- 1991). In 1975, narrow and broad money grew by 9.88% and 8.34 % respectively (see Table 2.4). The expansionary monetary policy actions in the direct-instrument regime (1970 to 1991) led to increased inflation rates in this period. Apart from the period 1970-1973 the rate of inflation was generally double-digit in this regime with the exception of 1977. The inflation rate ranged from a minimum of 10.93 %, in 1978, to a maximum of 178.7 %, in 1987, (see Table 2.4). The growth rates of both narrow and broad money were more than 60% in all these years from 1985 to 1991 and the rate of inflation in the same period was more than 60% in all the years with the exception of 1988 when the rate of inflation was 34.29 % (see Table 2.4).

To the extent that nominal interest rates were administratively determined and monetary authorities were reluctant to increase it by a large margin, real interest rates were negative throughout the period of the direct-instrument regime (1970 to 1991) with the exception of 1971 and 1972 (see Table 2.4). In December 1989, under the Economic Recovery Program (ERP), the monetary authorities undertook monetary reforms. Strict fiscal discipline in order to avert monetary expansion (a way of financing fiscal deficit) and structural reforms were at the heart of the program.

In 1992, following the military coup of Captain Valentine Strasser, the relation between the IMF and Sierra Leone, which broke up in 1984 (emanating from Sierra Leone's unwillingness to devalue the leone and curtail government expenditure, among others), was reestablished and deepened. The monetary authorities undertook monetary reforms under the Structural Adjustment Program (SAP). This involved the substitution of the use of direct-instruments of monetary policy with indirect (market-based) instruments and deregulation of interest rates. The

market based instrument that has been in use since 1992 is the open market operation (OMO). In August 1992, the markets for Treasury bills, which was segmented into bank and non-bank public was unified and open market operations were established in the primary market. The Treasury bills transactions were reorganized such that the commercial banks became agents and primary market dealers through which the public bids for the auction offer amount. A new type of government securities called the treasury bearer bonds (which has maturity period of twelve months) were introduced in August 1993 in order to target mainly the non-bank public, and are issued in the primary market on monthly basis. In February 1994 a clearing House mechanism for trading Treasury bills with commercial banks was introduced for the sale and purchase of Treasury bills before maturity.

The growth of narrow money in 1992 was about 25 %, this figure was the least since 1982 and growth of broad money in the same year was about 33 %, which was the least since 1985 (see Table 2.4). The rate of inflation was 65.5 % in 1992, which was lower than the three-digit values in 1990 and 1991. The real interest rate became positive (13. 13%) for the first time since 1973. The good monetary performance was maintained in 1993 and this reflected in the rate of inflation and hence the real interest rate. Inflation rate reduced to 22.21 % in 1993 and real interest rate was positive though lower than the value in 1992 (see Table 2.4). Though monetary growth and inflation rate were lower in the period 1992-1996 than the decade before this period, inflation rate was not less than 20 % in any of the period 1992-1996. This was because of low levels of output in this period as the country had been in war since 1991. Growth of GDP was -23.47% in 1992, about 1.36 % in 1993, -1.99 % and -8.69 % in 1994 and 1995 respectively. In 1996 [6] growth of GDP was 5.74 % (see Table 2.4). The growth of both narrow and broad money supply rose to the values of 57.14 % and 47.14 % respectively in 1997 from the respective values of 6.62% and 29.65% in 1996. The growth of narrow money supply was two-digit from 1999 to 2005 with the exception of 2000, ranging from 17.61%, in 2004 to 35.35 %, in 2001. The growth of broad money was two-digit from 1995 to 2005 with relatively low values

[6] This is the year the military government of 1992 handed power to the democratically elected government of President Ahmad Tejan Kabba.

in 1998 (11.27 %) and 2000 (12.08 %). The low growth of money supply and positive growth of real GDP (3.29 %) in 2000 led to a negative rate of inflation (deflation rate of -0.84%).Real interest rate became positive (27.06%) since 1996 and this was the highest since 1970 (see Table 2.4).

Table 2.3: Percentage Composition of Money Supply[a]

Period	M2 (Millions of Leones)	Percentage Composition				
		NDCg	DCp	NFA	NOI	Total[b]
1970-1975	65.87	32.07	43.49	49.55	25.11	100
1976-1979	160.49	86.97	37.81	-11.21	13.57	100
1980-1985	570.31	154.79	26.07	-105.22	-24.37	100
1986-1990	79,993.69	130.04	20.49	-283.55	-233.01	100
1991-1995	49,223.04	338.21	27.43	-503.56	-237.92	100
1996-2000	153,071.96	368.92	20.7	-164.56	125.05	100
2001-2005	480,558.80	166.96	22.83	-40.33	49.47	100

Source: Calculated from International Financial Statistics CD-ROM 2007

[a] Where: NDCg = Net Domestic Credit to the Government
DCp = Domestic Credit to the Private Sector
NFA = Net Foreign Assets
NOI = Net Other Items

[b] M2 = NDCg + DCp + NFA - NOI

Table 2.4: Selected Indicators of Monetary Management Process in Sierra Leone

YEAR	Growth of Narrow Money (M1)	Growth of Broad Money (M2)	Nominal interest Rate	Inflation Rate	Real Interest Rate	Real GDP growth*
1970	-9.09	-5.59	5.50	6.41	-0.91	7.94
1971	12.38	11.08	5.50	-1.27	6.77	3.35
1972	19.76	17.63	5.50	5.50	0.00	0.89
1973	24.08	26.12	5.50	5.62	-0.12	2.21
1974	13.63	18.63	5.50	14.42	-8.92	3.38
1975	9.88	8.34	5.50	19.95	-14.45	1.64
1976	19.61	22.19	5.50	17.13	-11.63	-0.45
1977	17.13	21.70	5.50	8.35	-2.85	0.05
1978	27.21	31.62	5.50	10.93	-5.43	2.35
1979	18.68	19.66	6.25	21.23	-14.98	4.32
1980	19.64	21.56	9.38	12.90	-3.52	4.62
1981	-0.43	2.62	10.00	23.38	-13.38	2.80
1982	66.72	56.80	10.00	26.89	-16.89	4.56
1983	41.92	31.63	11.00	68.51	-57.51	-2.15
1984	35.28	28.31	12.00	66.58	-54.58	3.93
1985	85.06	71.10	12.00	76.58	-64.58	-5.61
1986	105.78	88.40	14.50	80.87	-66.37	1.22
1987	56.01	64.02	16.50	178.70	-162.20	6.74
1988	60.54	56.88	18.00	34.29	-16.29	-7.62
1989	87.08	74.20	22.00	60.80	-38.80	0.72
1990	64.30	74.00	47.50	110.95	-63.45	3.24
1991	76.05	76.21	50.67	102.69	-52.02	2.30
1992	25.09	33.24	78.63	65.50	13.13	-23.47
1993	11.68	21.92	28.64	22.21	6.43	1.36
1994	9.95	8.81	12.19	24.20	-12.01	-1.99
1995	29.47	19.61	14.73	25.99	-11.26	-8.69
1996	6.62	29.65	29.25	23.14	6.11	5.74
1997	57.14	47.14	12.71	14.95	-2.24	-21.36
1998	7.34	11.27	22.10	35.53	-13.43	-0.89
1999	49.40	37.80	32.42	34.09	-1.67	-9.17
2000	4.38	12.08	26.22	-0.84	27.06	3.29
2001	35.35	33.67	13.74	2.09	11.65	4.40
2002	30.64	29.56	15.15	-3.29	18.44	5.93
2003	18.37	21.89	15.68	7.60	8.08	6.19
2004	17.61	20.08	26.14	14.19	11.95	7.51
2005	23.12	31.29	22.98	12.05	10.93	7.50

Source: Calculated by author from International Financial Statistics CD-ROM 2007

*Calculated from World Development Indicators CD-ROM

2.3 Fiscal policy stance in Sierra Leone

The fiscal performance of Sierra Leone has been poor since the mid-1970s. Since 1971 the budget balance of Sierra Leone has been in deficit. This poor performance emanates mainly from low tax revenue given increasing government expenditure. In periods when growth of government revenue increased, government expenditure grew more than the increase in revenue, with the consequence being consistent budget deficit (see Table 2.5).

In the early 1970s, budget deficit (excluding grant) as a ratio of GDP was less than 5 %. Fiscal deficit as a ratio of GDP (excluding grant) increased from an average of 3.47 % over the period 1970-1975 to 8.51% over the period 1976-1979. To the extent that government expenditure, grew more than government revenue over the period 1980-1985, fiscal deficit (excluding grant) as a ratio of GDP increased from an average of 8.51 % over the period 1976-979 to 11.46 % over the period 1980-1985 (see Table 2.6). The slow growth in fiscal revenue over the period 1980-1985 was mainly due to the more overvaluation and restrictive economic measures, which led to the diversion of a larger share of transaction to the parallel economy with tax evasion being a major consequence. In 1987, fiscal deficit (excluding grant) as a ratio of GDP stood at 18.58%, which was the highest in history (see Table 2.5). Financing of this deficit was done mainly by borrowing from the domestic banking system. Thus, growth of money supply was high and the consequence in terms of rate of inflation was experienced. Inflation rate was 179 % in this year; this is the highest value of inflation rate in history. Government expenditure as a ratio of GDP reduced from an average of about 21.74 % over the period 1980-985 to 13.71 % over the period 1986-1990 while government revenue as a ratio of GDP reduced from an average of 11.34 % over the period 1980-1985 to an average of 6.17 % over the period 1986-1990. Though government revenue reduced in the second half of the 1980s the reduction in government expenditure improved the performance on fiscal balance despite the fact that it was still in deficit. Budget deficit (excluding grant) as a ratio of GDP fell from 11. 46 % over the period 1980-1985 to 7.66 % over the period 1986-1990 (see Table 2.6).

Government revenue as a ratio of GDP was higher in the period 1991 to 1995 (the early years of the rebel war) than the period 1986 to 1990. However, government expenditure as a ratio of GDP was higher in the period 1991-1995 than the period 1986-1990. Moreover, government expenditure was higher than revenue in all the periods (see Table 2.6). The low budget deficit as

a ratio of GDP recorded in the period 1991to1995 relative to 1986 to 1990 was mainly as a result of the fiscal discipline that was emphasized in the Structural Adjustment Program which was adopted in 1992. Public sector employees with the exclusion of the military and police were reduced by more than 50 % (over 37000) over the period 1991-1995. This was done through the removal of ghost workers from the payroll and the retrenchment of redundant daily workers. Budget deficit as a ratio of GDP (excluding grant) increased from the value of 6.14 % over the period 1991-1995 to 9.74 % over the period 1996- 2000. This was mainly as a result of the escalation of the rebel war, which reduced government revenue and increased government expenditure. Government revenue as a ratio of GDP fell from 10.81 % over the period 1991-995 to 8.93 % over the period 1996-2000 while government expenditure as a ratio of GDP increased from an average of 16.95 % over the period 1991-1995 to 18.51 % over the period1996-2000 (see Table 2.6).

Despite the fact that the war ended in 2000, the years 2001 to 2005 (post-war period) also recorded budget deficits. Budget deficit as a ratio of GDP was higher in all the years from 2000 to 2005 than all the years from 1988 to 1998. Moreover, fiscal deficit (excluding grant) as a ratio of GDP was about 13 % over the period 2001-2005, which was higher than those of earlier periods. This implies that fiscal performance in the post-war period was worse than the war period (1991-2000) and the pre-war period (1970-1990). This is basically because of the increase in government expenditure in the post-war period for reconstruction and rehabilitation. Government expenditure as a ratio of GDP increased from an average of 18.51% over the period 1996-2000 to 25.85 % over the period 2001-2005.

In the early 1970s, foreign financing of the budget deficit dominated domestic financing, with the exception of 1971 and 1973.Budget deficit was financed mainly from domestic source in the period 1976 to 1991. Over the period 1992-2005, budget deficit was financed more from foreign sources than domestic sources, with the exception of 1999, 2000 and 2004 (see Figure 2.2). This also contributed to the low inflation rates over the period 1992-2005 in comparison to the 1980s and the early 1990s (see Table 2.4).

Table 2.5: Fiscal Performance of Sierra Leone, 1970 to 2005*

Year	G / GDP (%)	R / GDP (%)	G growth (%)	R Growth (%)	Fiscal Balance, excluding Grant (% of GDP)
1970	14.17	14.71	16.52	2.87	0.53
1971	16.49	15.4	14.18	2.78	-1.09
1972	19.17	16.86	18.61	11.73	-2.3
1973	19.4	16.32	11.88	7	-3.08
1974	23.57	19.19	47.58	42.83	-4.37
1975	27.41	16.94	39.43	5.78	-10.48
1976	23.44	15.55	-8.41	-1.65	-7.89
1977	22.9	16.04	18.5	25.16	-6.85
1978	29.27	18.49	46.01	31.66	-10.78
1979	30.23	16.9	25.04	10.62	-13.39
1980	28.89	16.43	7.3	9.14	-13.46
1981	27.67	17.07	7.13	16.23	-10.6
1982	21.97	11.31	-1.43	-17.72	-11.06
1983	22.16	8.3	17.96	-14.21	-15.25
1984	16.52	8.39	8.44	47.01	-8.89
1985	13.25	6.56	28.23	25.03	-9.53
1986	9.87	6.21	34.62	71.03	-3.66
1987	24.08	5.62	595.27	158.22	-18.58
1988	13.57	6.8	-13.97	84.57	-7.18
1989	12.71	6.62	52.28	58.29	-6.09
1990	8.32	5.59	15.52	48.89	-2.78
1991	13.41	7.77	277.28	225.57	-5.64
1992	16.78	10.42	84.44	97.65	-6.36
1993	18.04	12.44	38.08	53.44	-5.59
1994	19.56	12.6	32.99	24.16	-6.96
1995	16.32	9.39	2.54	-8.41	-6.93
1996	14.78	8.04	19.43	12.91	-6.74
1997	17.17	10.25	11.8	22.64	-6.93
1998	13.99	7.34	2.62	-9.71	-6.68
1999	20.94	7.11	71.97	11.17	-13.89
2000	27.87	11.44	46.59	77.32	-17.3
2001	28.49	12.99	22.99	36.61	-15.72
2002	28.62	12.15	23.33	14.82	-16.53
2003	25.74	12.38	6.35	20.52	-13.35
2004	23.77	12.33	15.07	24.09	-11.39
2005	22.62	17.16	10.32	61.36	-10.21

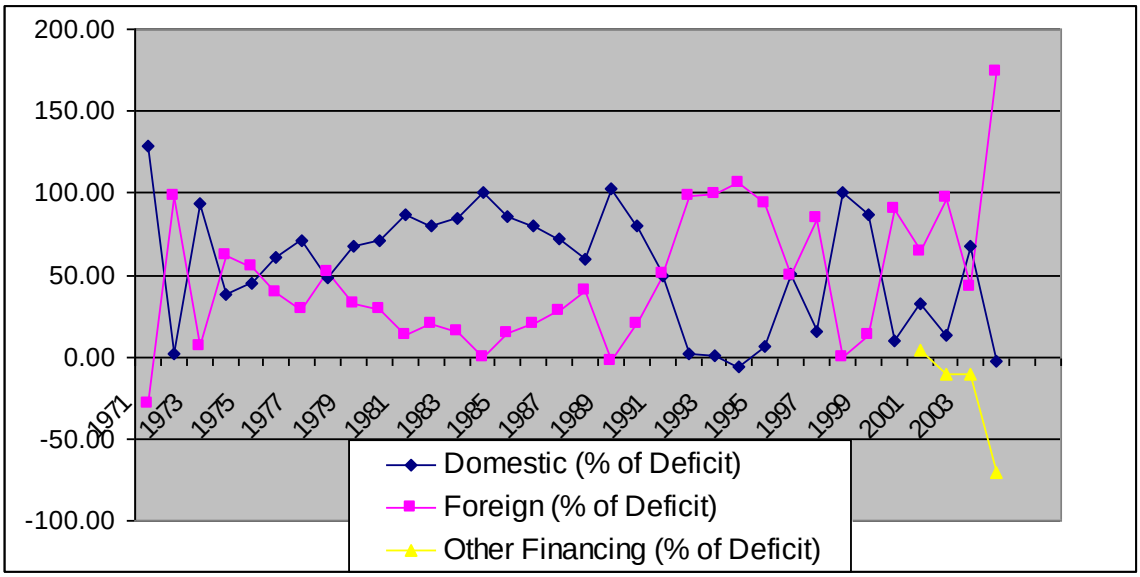
Source: Calculated by author from International Financial Statistics CD-ROM 2007
*Where: G = Government Expenditure, GDP = Gross Domestic Product and
R = Government Revenue

Table 2.6: Fiscal Performance of Sierra Leone, Period Average

Period	Government Expenditure (% of GDP)	Government Revenue (% of GDP)	Grant (% of Government Revenue)	Growth of Government Expenditure (%)	Growth of Government Revenue (%)	Budget Deficit: Excluding Grant (% of GDP)
1970-75	20.04	16.57	-	24.7	12.16	3.47
1976-79	26.46	16.75	4.67	20.28	16.45	8.51
1980-85	21.74	11.34	9.64	11.27	10.91	11.46
1986-90	13.71	6.17	24.22	136.75	84.2	7.66
1991-95	16.95	10.81	14.62	108.2	100.21	6.14
1996-2000	18.51	8.93	34.61	25.83	17.65	9.74
2001-2005	25.85	13.4	64.61	15.61	31.48	13.44

Source: Calculated by author from International Financial Statistics CD-ROM 2007

Figure 2.2: Fiscal Deficit Financing Methods in Sierra Leone



Source: Calculated from International Financial Statistics CD-ROM 2007

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2.4 Exchange rate policy in Sierra Leone

As in the case of many developing countries, Sierra Leone continued the use of the fixed exchange rate regime after the collapse of the Bretton Woods System in the early 1970s. The authorities were initially reluctant to devalue the leone or adopt the flexible exchange rate regime, which had been adopted in many developed economies following the collapse of the Bretton Woods System. The reluctance to devalue the leone was based on the fear that such action would reduce the external value of the leone and increase the general price level through the exchange rate pass-through phenomenon. However, with the experience of persistent deficit in the balance of payments, series of exchange rate adjustments were eventually adopted in the 1980s and eventually in 1990, the floating exchange rate regime (a managed type) was adopted.

The leone was devalued for the first time in November 1967 following the devaluation of the pound sterling, by 14.3 %. The key motivation of the devaluation was to prevent capital outflow following the devaluation of the pound sterling. The leone was pegged to the British pound in 1967 until 1978, at a rate of two leones per British pound (Le 2.00 = £ 1.00), when it was de-linked from the pound and set at the rate of Le 2.25 per special drawing right (SDR).

As a result of the declining economic performance of the early 1980s, including poor external sector performance, a dual exchange rate system was introduced in December 1982, under the Modified Exchange Rate Arrangement (MERA). This involved an official exchange rate and a commercial market rate. The official exchange rate was set at Le 1.52 per U.S $ while the commercial market rate had no definite rate. This policy did not prove to be effective since external sector performance continued to deteriorate. This was however not surprising since such a system often encourages the diversion of export remittances from the official market to the parallel market.

A unified exchange rate system was adopted in July 1986. However, fiscal deficit continued to grow and was mainly financed by borrowing from domestic banking system, especially through domestic credit to the government. Hence money supply was difficult to control, leading to inconsistent monetary expansion with high inflation and real exchange rate appreciation (see Figure 2.3) as consequences. In 1987, the rate of inflation was about 179 %, which is the highest in the inflationary history of Sierra Leone. Thus, external sector performance could not be improved despite the unification.

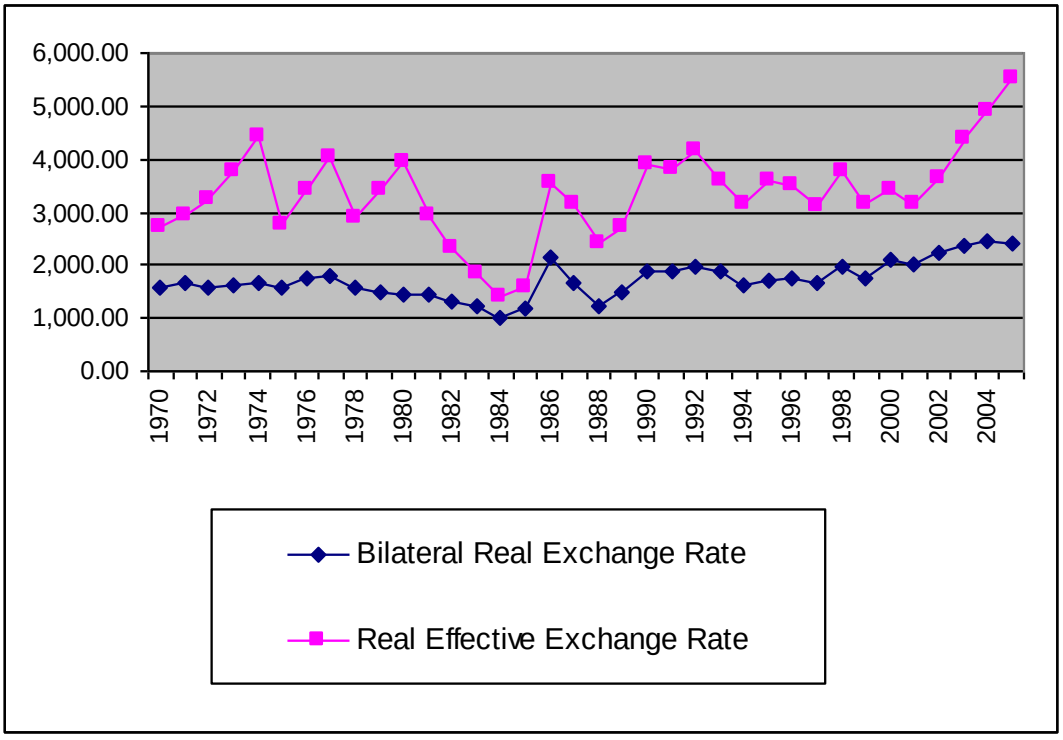
Given the increase in prices in the first half of 1987, the government revalued the leone from le 53.00 per U.S $ to le 23.00 in August 1987. The real exchange rate further appreciated in 1988 (see Figure2.2). In March 1989, the leone was devalued from le44.00 to le 65.00 per U.S $. The parallel market exchange rate then skyrocketed by the end of 1989. In order to reduce the gap between the parallel market rate and the official exchange rate, the government then devalued the leone to le120.00 per U.S dollar in January 1990.

In April 1990, the leone was floated and most current account transactions were liberalized. The main reason for the adoption of the floating exchange rate regime was the fact that in the fixed exchange rate regime the premium between the official and parallel market rate was getting larger. Thus, smuggling of diamond, gold and other produce was considered to be on the increase, thereby undermining the balance of payments. The nominal exchange rate has been depreciating since the adoption of the (managed) floating exchange rate regime (see Figure 2.4) but this could not be reflected in the real exchange rate except for the periods 2001-2005 (see Figure 2.3).

Following the liberalization of the nominal exchange rate, the black market premium reduced from an average of about 42 % over the period 1984-1990 to an average of about 12 % over the period 1991-2000 (despite the fact that 1991-2000 was war period (see Figure 2.5). The black market premium further decreased to about 6 % in the post-war period of the floating exchange rate regime, 2001 to 2005 (see figure 2.5). This indicates that though the floating exchange rate regime in Sierra Leone is of the managed type, the degree of overvaluation of the leone[7] decreased to a large extent with the adoption of the regime and was further decreased by more than half in the post-war period of the managed floating exchange rate regime.

[7] The black market premium is taken here as a preliminary measure of the equilibrium exchange rate.

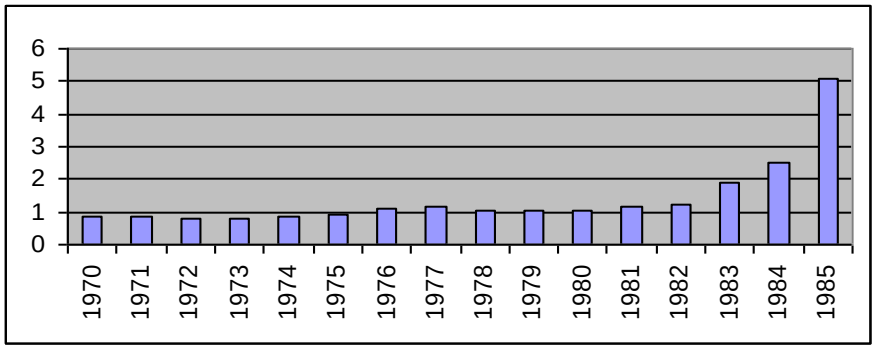
Figure 2.3: The Real Exchange Rate in Sierra Leone



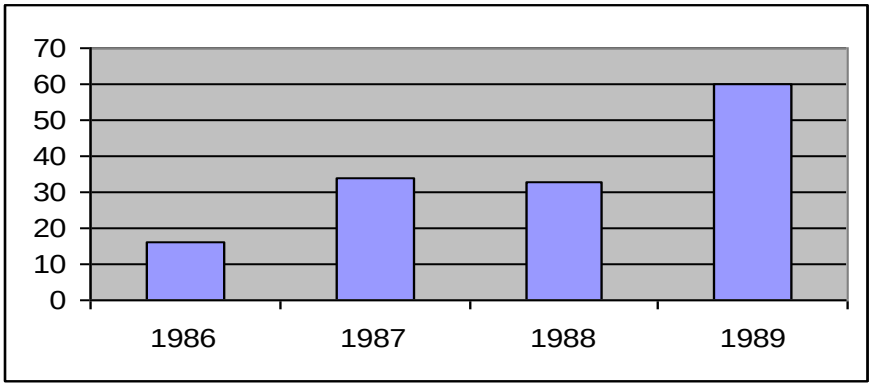
Source: Calculated by author from International Financial Statistics CD-ROM 2007

Figure 2.4: Nominal Exchange Rate in Sierra Leone (leones per U.S dollar)

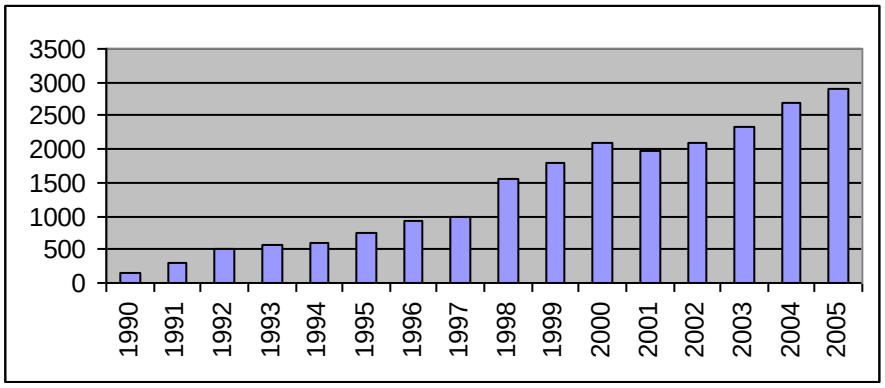
Panel A: Fixed Exchange Rate Regime (1970-1985)



Panel B: Fixed Exchange Rate Regime (1986-1989)

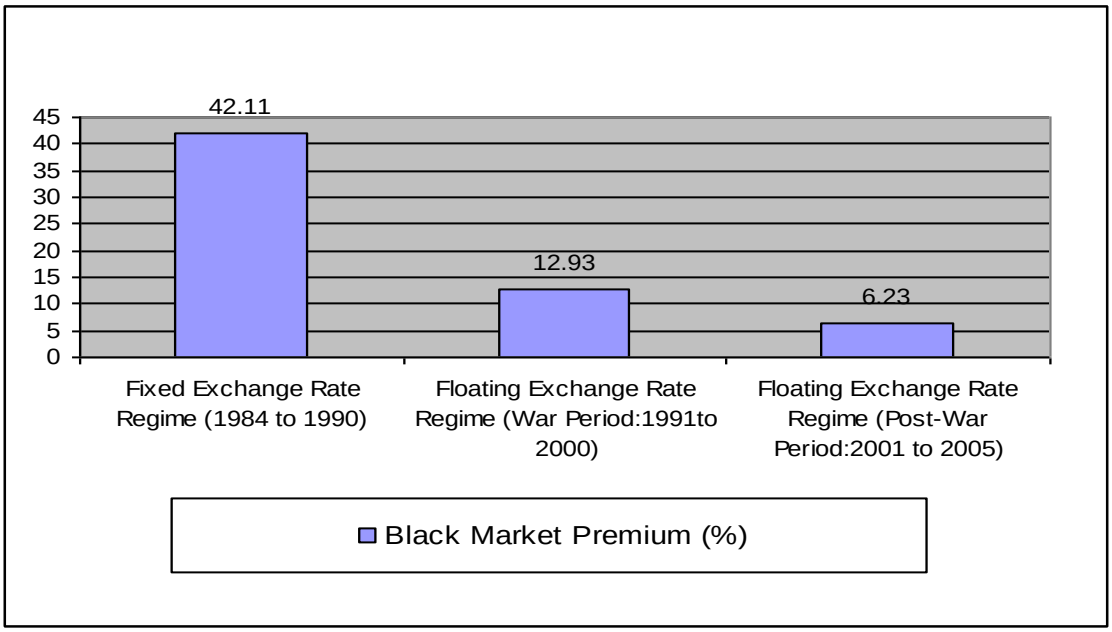


Panel C: Managed Floating Exchange Rate Regime (1990-2005)



Source: International Financial Statistics CD-ROM 2007

Figure 2.5: The Black Market Premium in Sierra Leone[8]



Source: Calculated from International Financial Statistics CD-ROM 2007 and Bank of Sierra Leone Bulletin 2007

[8] The data for parallel market exchange rate is obtained from the Bank of Sierra Leone Bulletin, Various Issues and exist only from 1984.

2.5 Conclusion from macroeconomic performance and policies in Sierra Leone

In terms of both internal and external balances, Sierra Leone had good macroeconomic performance in the early 1970s. The mid to late 1970s was a period of poor macroeconomic performance, and the case of the 1980s was worse than this period. Fiscal and monetary expansions under a fixed exchange rate regime were key factors behind this abysmal performance. High rates of inflation, real exchange rate appreciations and hence overvaluations of the real exchange rate were immediate consequences of these policies and these translated into poor export performance, low growth of output and increased import (given the country's low capacity to produce import competing goods). Thus, the trade balance of the balance of payments was consistently in deficit. Given low net export of services, low net factor income from abroad and high debt service obligations, the current account of the balance of payments of Sierra Leone was also consistently in deficit. Owing to the underdevelopment of the financial market of Sierra Leone, which makes portfolio investment very low, and the low foreign direct investment (FDI) as well as increased capital flight of the 1980s, the capital account could not compensate for the deficits in the current account; though foreign aid in the form of loans and grants were on the increase.

The managed floating exchange rate regime was adopted in April 1990, following series of exchange rate adjustments, and the Structural Adjustment Programme (SAP), which has tight fiscal and monetary policies as key elements, was adopted in 1992. Though budget deficit as a ratio of GDP was lower in the 1990s, growth of broad money was high (two digits for all but one of the years). On the average, monetary growth in this period was lower than the previous decade. Hence, average inflation rate was lower in the 1990s than the previous decade, though the rates of inflation of the 1990s were also unsatisfactory, ranging from 15 % to 103 %. The real exchange rate was fluctuating in the 1990s though dominated by appreciations while the trade balance as a ratio of GDP and net foreign assets continued to be in deficit in the 1990s. The growth of real GDP was negative for all but one of the years from 1992 to 1990, with 1992 and 1997 recording -23 % and -21 % respectively. The very poor macroeconomic performance of the 1990s despite the existence of the SAP and managed floating exchange rate regime could be attributed to the emergence of the decade-old war, which had started in March 1991.

The 2000s was a period of good macroeconomic performance, in terms of internal balance, (inflation rate and growth of real GDP) for the Sierra Leonean economy. This emanated mainly

from the fact that this period was a period of SAP, managed floating exchange rate regime and peaceful environment (since the rebel war ended in 2000). Though budget deficit as a ratio of GDP was higher in this period than the previous decade, growth of both narrow money and broad money were lower than those for the previous decade. This was mainly as a result of more reliance on foreign financing than domestic financing of fiscal deficit, precipitated by increased aid for post-war reconstruction and development. This led to lower rates of inflation than the previous two decades.

Despite the fact that the real exchange rate depreciated continuously in this period, the high increase in import emanating from increase in income, led to high deficit in trade balance (as a ratio of GDP). This deficit was higher than those in the previous decades, though the growth of export and export as a ratio of GDP were higher in this period than the averages for the previous decade (the war period). Hence, despite the increase in foreign aid, in the form of loans and grants, the external sector performance of this period was worse than the previous decade.

CHAPTER THREE

LITERATURE REVIEW

This chapter is dedicated to the review of the theoretical and empirical literature on the effects of exchange rate on the balance of payments and the determinants of the real exchange rate. The literature on the effects of nominal exchange rate on the balance of payments is reviewed first, followed by review of the literature on the determinants of the real exchange rate. In the former case, the various theories explaining the effects of nominal exchange rate on the balance of payments as well as the empirical review of the effects of nominal exchange rate on the balance of payments are done. In the latter case, conceptual issues on the real exchange rate are discussed, followed by the empirical literature on the determinants of the real exchange rate.

3.1 Effects of exchange rate on the balance of payments

3.1.1 Effects of exchange rate on the balance of payments: theory

The theoretical literature on the effects of exchange rate on the balance of payments provides mixed conclusion. Moreover, it shows that there are various channels through which exchange rate affects the trade balance or the balance of payments. The elasticity approach (also referred to as the relative-price approach) proposed by Bickerdike (1920), Robinson (1947) and Metzler (1948) is the earliest among the channels that explain the effect of exchange rate on the balance of payments.

The elasticity approach to the balance of payments posits that an increase in the nominal exchange rate reduces the relative prices of exports of the domestic country relative to the prices of the same goods produced in other countries. Hence the increase in nominal exchange rate makes exports become cheaper to residents abroad. Also, an increase in the nominal exchange rate reduces the prices of import-competing goods relative to imports. Thus, when a country is faced with a given import prices and can expand exports at constant cost, increase in the nominal

exchange rate increases export and reduces import by changing the relative prices of exports and imports. The increase in exports and decrease in imports thus improve the trade balance.

The advocates of the elasticity approach maintains that from a position of equilibrium in the trade balance, an increase in the nominal exchange rate will improve the trade balance if the Bickerdike-Robinson-Metzler (BRM) condition (also referred to as the full Marshall-Lerner condition), which is given in equation (3.1), holds.

$$\frac{\eta_x(\varepsilon_x - 1)}{\varepsilon_x + \eta_x} + \frac{\varepsilon_m(1 + \eta_m)}{\varepsilon_m + \eta_m} > 0 \qquad (3.1)$$

Where: η_x is the domestic country's elasticity of supply for exports, η_m is foreign elasticity of supply for the domestic country's imports, ε_x is the foreign elasticity of demand for the domestic country's export and ε_m is the domestic country's elasticity of demand for imports.

If the two supply elasticities in equation (3.1) are assumed to be infinite, the condition for an increase in the nominal exchange rate to improve the trade balance reduces to a simple version, which is referred to in the literature as the Marshall-Lerner condition. This is given as:

$$\varepsilon x + \varepsilon m > 1 \qquad (3.2)$$

This condition states that an increase in the nominal exchange rate improves the trade balance if the absolute value of the sum of the two demand elasticities (demand for domestic exports by foreign country and demand for imports by domestic country) is greater than one.

Another simplified version of the BRM condition is obtained by assuming that the domestic economy is small (that is, it cannot affect the prices of its exports and imports). In this case, the two foreign elasticities (foreign elasticity of demand for domestic exports and foreign elasticity of supply for domestic imports) are infinite. Under this condition, the full Marshall-Lerner condition, given in equation (3.1) reduces to the following simple version:

$$\eta x + \varepsilon m > 0 \qquad (3.3)$$

This states that an increase in the nominal exchange rate improves the trade balance if the sum of the domestic elasticity of supply of exports and demand for imports is greater than zero.

It may also be the case that the critical elasticity condition is not satisfied in the short run but in the long run it is satisfied. This is because both the demand and supply elasticities may be greater in the long run than the short run. This flows from the fact that trade volumes take some time to adjust to new equilibrium levels. Hence, an increase in the nominal exchange rate may

initially worsen the balance of payments and later improves it. This phenomenon is known as the J-curve effect of devaluation.

A basic problem with the elasticity approach is the fact that an increase in the nominal exchange rate increases the general price level but this issue is not considered in this approach. The increase in the general price level that follows a devaluation/depreciation of the nominal exchange rate may wipe out the benefit of the increase in the nominal exchange rate. This is the case when the rate of inflation engendered by the increase in the nominal exchange rate is greater than the depreciation of the nominal exchange rate. The channels through which the increase in the nominal exchange rate increases the domestic price level are: (i) increase in prices of imported raw materials, capital and intermediate goods (ii) increase in prices of import-substitutes and (iii) increase in wages, emanating from pressure on employers to increase wages or a wage indexation scheme (this comes from the initial increase in the general price level following the nominal devaluation/depreciation).

Another problem with the elasticity approach is the fact that it ignores the income effect of an increase in the nominal exchange rate. An increase in the nominal exchange rate, which increases net exports, increases income. But the increase in income is used to increase imports. Hence the increase in imports following an increase in income opposes the initial improvement in the trade balance. However, the net effect of these two opposing forces on the trade balance is unknown since the elasticity approach does not account for the income effect of a change in the nominal exchange rate. Therefore, in the adjustment mechanism, ignoring of the income effect in the elasticity approach implies that income effect in this approach is zero. This assumption therefore leads to the conclusion that as long as the relevant critical elasticity condition is satisfied devaluation/depreciation of the nominal exchange rate will improve the trade balance.

The income approach (Harrod 1933 and Keynes 1936), also called the multiplier approach, resolves one of the flaws in the elasticity approach. That is, lack of income effect in the elasticity approach. According to the income approach, an increase in the nominal exchange rate indeed increases income since it increases exports and reduces imports (this is maintained in the elasticity approach). The increase in income flowing from the increase in nominal exchange rate increases imports (this is the second round effect of the increase in exchange rate on imports). This increase in imports deteriorates the trade balance, thus opposing the initial improvement in the trade balance. The income approach therefore maintains that the net effect of the

devaluation/depreciation of the nominal exchange rate on the balance of payments is unknown as the trade balance increases initially by changing relative prices but decreases later since it increases income when the trade balance improves.

The income approach predicts that by taking the income effect of devaluation/depreciation of the nominal exchange rate into account, an increase in the nominal exchange rate will improve the trade balance if the marginal propensity to spend on domestic output by residents (this is equal to the marginal propensity to consume plus the marginal propensity to invest minus the marginal propensity to import) is less than one. This implies that even if the Marshall–Lerner condition is satisfied devaluation/depreciation of the nominal exchange rate does not necessarily improve the trade balance once income effect is taken into consideration.

While the income approach resolves the income-effect neglected in the elasticity approach it also fails to take into consideration the fact that an increase in the nominal exchange rate increases the general price level. This is because the starting point of the analysis of the income approach is the traditional elasticity approach, which is salient on the effect of the nominal exchange rate on the price level. Thus the indirect effect nominal exchange rate changes, through the price level, on the real exchange rate and hence the trade balance in ignored in both the elasticity and income approaches.

The Laursen-Metzler synthesis (Laursen and Metzler, 1950), as in the case of the income approach, takes the income effect into consideration and analyses the effect of an increase in the nominal exchange rate on the trade balance. This approach is a synthesis of the elasticity approach and the income approach and is Keynesian in spirit since it assumes that prices are rigid. It provides a more stringent condition (in comparison with the elasticity approach) under which an increase in the nominal exchange rate improves the trade balance. The stating point in the adjustment process of this approach also is the elasticity approach. The idea is that the relative-price changes when there is an increase in the nominal exchange rate and this increases income as it improves the trade balance by increasing exports and reducing imports. The increase in income increase imports, thus deteriorating the trade balance as in the income approach. Therefore, the initial improvement in the trade balance from the relative price changes is opposed by the increase in imports arising from the increase in income.

Hence, by taking both the relative price and income effects into consideration, Laursen and Metzler posit that an increase in the nominal exchange rate improves the trade balance when the

critical elasticity conditions are satisfied, but with a caveat. Given the fact that the increase in the nominal exchange rate increases total demand for domestic output (that is, demand for both domestic output by domestic residents and residents abroad), income also increases. To the extent that marginal propensity to import is positive imports increase following the increase in income. This opposes the initial improvement in the trade balance.

In the light of this consideration, the condition for devaluation/depreciation of the nominal exchange rate to improve the balance of payments should be more intense than it had to be in the case of no-income effect (the case of the elasticity approach). This condition is derived by Laursen and Metzler to be:

$$\varepsilon_x + \varepsilon_m > 1 + \frac{em_{y(}d_{e+}x_e)}{m(1-d_y)} \qquad (3.4)$$

Where: e is the nominal exchange rate (defined as domestic currency per foreign currency), m is import, m_y is marginal propensity to import, dy is marginal propensity to domestic demand (the effect of income on domestic demand), d_e is effect of nominal exchange rate on domestic demand and x_e is effect of nominal exchange rate on exports.

To the extent that an increase in income is expected to increase domestic demand ($d_y>0$), an increase in exchange rate is expected to increase exports ($x_e>0$), an increase in exchange rate is expected to increase domestic demand ($d_e>0$) and an increase in income is expected to increase imports ($m_y>0$) the expression on the right hand side of equation (3.4) is positive. Comparing equation (3.4) with equation (3.2) therefore reveals that the Laursen-Metzler synthesis provides a more intense condition for an exchange rate devaluation/depreciation to improve the balance of payments.

A fundamental problem with the Laursen-Metzler synthesis is that it does not take into consideration the effects of exchange rate depreciation on the general price level. Thus it assumes that the only reason for an increase in nominal exchange rate not to improve the trade balance when critical elasticity conditions are met is the fact that the income effect (which is negative) detracts from the initial relative price effect (which is positive).

The absorption approach (Alexander, 1952) examines the effects of an increase in the nominal exchange rate on the balance of payments by considering the relative effects of an increase in the exchange rate on income and absorption. The absorption approach maintains that

devaluation/depreciation of domestic currency improves the trade balance if: it increases income more than absorption, it reduces absorption more than income or it increases income and reduces absorption. The effect of the increase in nominal exchange rate on absorption occurs through increase in spending, which arises from the increase in income that follows devaluation/depreciation (this is referred to as the indirect effect of devaluation or depreciation on absorption). The effect of devaluation/depreciation of the nominal exchange rate on absorption also occurs through increase in prices, which affects absorption directly via the real balance effect or the money illusion effect (this is referred to as the direct effect because it affects absorption not through change in income). The real balance effect posits that as the exchange rate increases, the price level increases and real balances therefore decrease. Economic agents therefore reduce absorption in order to restore real balances. The money illusion effect posits that increase in the nominal exchange rate increases income and prices and this may reduce real income. But if consumers perceive the situation as an increase in wealth, they increase absorption.

The absorption approach, as in the cases of the elasticity, income and the Laursen-Metzler synthesis posits that the effect of devaluation on the trade balance is ambiguous. This is because both the qualitative and quantitative impact of a change in the nominal exchange rate on both income (through the idle resource effect and the terms of trade effect)[9] and absorption (through the direct effect and indirect effects)[10] are unknown.

The monetary approach to the balance of payments unlike the elasticity, income, Laursen-Metzler and absorption approaches, analyses the effect of the exchange rate on the balance of payments by taking the money market into consideration and assuming that the Purchasing Power Parity (PPP) holds. Moreover, it considers the overall balance of payments, proxied by foreign reserves, while the other approaches consider the trade balance as the balance of payments (the capital account and net income). It predicts that in the short run an increase in the

[9] The idle resource channel says that if there are unemployed resources in the economy an increase in the exchange rate shifts expenditure from foreign goods to domestic goods. The resulting increase in aggregate demand will lead to an increase in income. The terms of trade channel says that if the devaluation improves the terms of trade, real income will increase but if it deteriorates the terms of trade, then real income will fall.

[10] The indirect effect of an increase in the exchange rate on absorption says that an increase in the nominal exchange rate changes income, and absorption changes in the same direction as the change in income. The direct effect refers to the fact that as the nominal exchange rate changes, absorption can change through a channel that does not involve change in income: for example, through the real balance effect (which is always negative for a rise in the exchange rate) or money illusion effect (which is always positive for a rise in the exchange rate).

nominal exchange rate improves the balance of payments but in the long run, the monetary consequence of the balance of payments ensures that the improvement is neutralized by deterioration of the balance of payments. Hence an increase in the nominal exchange rate improves the balance of payments in the short run with neutral long run effect.

3.1.2 Effects of exchange rate on the balance of payments: methodological review

Empirical studies on the effects of exchange rate on the balance of payments started in the early 1970s with the work of Cooper (1971). The methodologies that have been applied in the literature are not uniform. In the early to mid 1970s, the methodology used was trend analysis of the part of the trade balance and/or foreign reserve few years before nominal exchange rate devaluation and few years after the devaluation. These trend analyses were done for a cross-section of countries and conclusions were consequently drawn from them. Studies that used this approach include Cooper (1971), Connolly and Taylor (1972), Laffer (1976) and Salant (1976). The application of econometric techniques, by estimating equations for the trade balance, current account and/or foreign reserve, started in the late 1970s. However, despite the fact that unit root is common in macroeconomic variables, these studies were not testing for unit root and hence cointegration. Thus, the results are not necessarily free from spurious regression. This was a common practice until the late 1980s. Studies that fall in this category include Miles (1979), Felmingham (1988) and Edwards (1989).

Most of the studies in the 1990s and 2000s tested for unit root and cointegration and then estimated single equation error correction model (ECM) or used vector autoregression (VAR), vector error correction model (VECM) and impulse response analysis. Studies in this category include Marwah (1996), Guptar-Kopoor and Ramakrishman (1999), Onaforwora (2003), De Silva and Zhu (2004), Agbola (2004) and Moura and Da Silva (2005). However, though the use of single-equation ECM, VAR, VECM (and hence impulse response function) involves testing for unit root and cointegration, it does not take into consideration the wide macroeconomic implications of changes in the nominal exchange rate. Hence, important indirect effects of a change in the nominal exchange rate on the balance of payments are ignored in these approaches.

Though some studies have approached the issue by using macro model, they also failed to test or account for unit root in the data. These studies include Gylfason and Risager (1984), Branson (1986), Green and Murinde (1992) and Taye (1999) and Musila and Newark (2003).

3.1.3 Effects of exchange rate on the balance of Payments: empirical evidence

There is extensive empirical research on the effects of exchange rate on the balance of payments though the evidence is split. Cooper (1971) is recognized as the first empirical evidence. Cooper (1971) examined the effects of 24 devaluations in 19 developing countries for the period 1959 to 1966 by examining the path of the trade balance and the overall balance of payments after devaluation. His findings show that devaluation improves the trade balance and the balance of payments. However, Cooper did not distinguish between the short-run and the long-run effects of an increase in the nominal exchange rate on external sector performance. Also, Cooper did not control for the effects of other variables on the trade balance and the balance of payments.

Many empirical studies have taken the drawbacks of the pioneering empirical study into consideration. For example, Connolly and Taylor (1972), used 16 of the devaluations in the Cooper sample and controlled for other macroeconomic variables by the use of domestic credit expansion. They observed the path of the overall balance of payments, which they defined as the net change in reserve, following devaluation. They found that devaluation is associated with improvement in the overall balance of payments and the higher the rate of domestic credit expansion after devaluation, the smaller the improvement in the balance of payments.

Laffer (1976) accounted for both the short-run and the long-run effects of devaluation on the trade balance. He examined the path of the trade balance over three years before devaluation, for the year of devaluation and three years after the year of devaluation. He found little evidence in favour of an increase in the nominal exchange rate improving the trade balance in the year of the change in the exchange rate (the short run) and three years after the year of the change (the

long run). He then concluded that there is no evidence of the J curve effect[11]. The implication is that a change in the nominal exchange rate is not effective in improving the balance of payments.

Salant (1976) also accounted for both the short run and the long run effects of an increase in the nominal exchange rate on the trade balance and the balance of payments by investigating the path of the trade balance and the balance of payments three years after the increase in the nominal exchange rate. Salant's findings showed that devaluation improved the trade balance for the three years of devaluation in less than one half of the countries in his sample. The implication of this is that devaluation is not effective in improving the balance of payments. However, though both Laffer and Salant examined both the short-run and long-run effects of an increase in the nominal exchange rate they did not control for the effects of other variables in their studies.

Miles (1979) was the first to consider the short- and long- run effects of an increase in the nominal exchange rate on the trade balance and the overall balance of payments and also controlled for the effects of other macroeconomic variables. Thus, correcting for the weaknesses of the works of Cooper (1971), Laffer (1976) and Salant (1976). He used Seemingly Unrelated Regression (SUR) techniques on a panel of fourteen developed countries that devalued their currencies in the 1960s. His study reveals that devaluation improved the balance of payments but not the trade balance. Despite the application of econometric analysis in his study he did not capture the various macroeconomic interactions following an exchange rate variation.

In the 1980s and 1990s, most of the studies on the effects of exchange rate on the balance of payments were on the developed countries (especially the U.S) and the results were not uniform. For example, Rose and Yellen (1989) by using United States data from 1960 to 1985 and Felmingham (1988) by applying an unrestricted distributed lag model to the Australian data from 1965 to 1985 found that an increase in the nominal exchange rate does not improve the trade balance even in the long run.

Other studies in the U.S and some other developed countries have found that devaluation improves the trade balance or the balance of payments at least in the long run. Studies that fall under this category include Marwah and Klein (1996) who applied Vector Autoregression (VAR) to the U.S data, Demirden and Pastine (1995) who employed disaggregated data for both

[11] In the Literature, the J-curve effect refers to the idea that devaluation initially worsens the trade balance but eventually improves the trade balance. This follows from the fact that the adjustment process of prices, imports and exports occurs with lags. Thus, the trade balance may initially decrease and later increase.

the U.S and Canada for the period 1977 to 1992 using Instrumental Variable (IV) and Ordinary Least Squares (OLS)[12], Guptar-Kapoor and Ramakrishman (1999), who employed a vector error correction model (VECM) followed by impulse response analysis for Japan and Boyd et. al. (2001), who used structural Cointegrating Vector Autoregressive Distributed Lag (VARDL) models from eight OECD countries. However, none of these studies focused on the behaviour of the macroeconomy following a Change in the nominal exchange rate.

Following the work of Upadhyaya and Dhakal (1997) for Colombia, Cyprus, Greece, Guatemala, Mexico, Morocco, Singapore, and Thailand, a number of studies have extended the works of earlier authors on the effects of exchange rate on the balance of payments to less developed countries using VAR and cointegration techniques after the 1990s. These include Bahmani-Oskooee and Kantipong (2001) for Thailand, Baharumshah (2001) for Thailand and Malasia, Onaforwora (2003) for Thailand, Malasia and Indonesia, Bahmani-Oskoee (2001) for Bahrain, Egypt, Jordan, Morocco, Syria, Tunisia and Turkey, De Silva and Zhu (2004) for Sri Lankan, Agbola (2004) for Ghana and Agbola and Damoense (2005) for South Africa. Although the methodologies used are quite similar the results are not uniform. While some obtained positive effect of devaluation/depreciation of the exchange rate on the balance of payments in at least the long run, others found negative effect.

Macro-simulation frameworks have also been used to examine the effects of exchange rate on the balance of payments. By using this approach, Gylfason and Risager (1984), Musila and Newark (2003), Taye (1999), Agenor (1990), and Green and Murinde (1992) found that an increase in the nominal exchange rate does not improve the trade balance and Branson (1986) and Solimano (1986) found that currency devaluation improves the trade balance.

Despite the fact that a number of studies have empirically investigated the effects of exchange rate on the balance of payments, very little is known about Sierra Leone. Rawlins and Praveen (2000) investigated the impact of real exchange-rate devaluation on the trade balance for Sierra Leone and 18 other African Countries. They specified and estimated an Almon Distributed Lag (ADL) process of trade balance using annual data that consists of monetary and fiscal policy variables. Their finding suggests that real exchange rate depreciation, improves the trade balance of Sierra Leone. However, their study does not distinguish between

[12] Their results showed support for the J-curve effect and after several periods the trade balance worsens. This is referred to in the literature as the S-curve effect

the effects of a depreciation of the nominal exchange rate and inflation on the trade balance since their policy variable is the real exchange rate. Furthermore, their study does not capture the various macroeconomic interactions that follow a change in the exchange rate. Moreover, their study does not identify the source (s) of real exchange rate depreciation.

The review of the literature reveals that both the theory and empirical evidence on the effects of exchange rate on the balance of payments are ambiguous and for Sierra Leone, little is known about this effect. Moreover, the methodologies used in the empirical studies are not uniform, ranging from trend analysis of the path of the trade balance and foreign reserve before and after currency devaluation/depreciation, estimation of distributed lag models, Vector autoregression (VAR) models and impulse response analysis, single equation error correction models, panel data techniques, and macro simulation. Furthermore, previous empirical studies in developing countries do not control for the effects of real exchange rate misalignment on the trade balance despite the fact that the real exchange rates of most developing countries were misaligned for long, especially in the era of the fixed exchange rate regimes they maintained after the collapse of the Bretton Woods System in 1973.

3.2 Determinants of real exchange rate

3.2.1 Alternative definitions and measurements of real exchange rate

In the literature, there are different analytical frameworks for the determination of the empirical values of the real exchange rate. The external real exchange rate concept (also referred to as the purchasing power parity (PPP) definition) considers the real exchange rate as the price of foreign goods relative to that of domestic goods, where both prices are expressed in the same currencies. That is, it defines the real exchange rate as the nominal exchange rate adjusted for the relative price levels of foreign and domestic economy. This is given as follows:

$$RER = e\left(\frac{P^*}{P}\right) \qquad (3.5)$$

Where: RER is the real exchange rate (bilateral), e is the nominal exchange rate , defined as domestic currency per foreign currency, P* is foreign price level and P is domestic price level.

There are two basic problems with the PPP approach to measuring the real exchange rate. First, the definition requires the use of price indices rather than a single price. This is because there are many goods in both the home and foreign countries. Hence multiple real exchange rate values could be obtained with this application as there are many price indices (which include the wholesale price index, the consumer price index and the GDP deflator). This leads to the question of which price index should be used for the computation of the real exchange rate. Second, despite the fact that the PPP real exchange rate is an index that gives information on the degree of international competitiveness of an economy, it does not capture changes in the relative incentives that guide resource allocation between the tradable and nontradable sectors of the Economy (Edwards, 1989).

The other definition of the real exchange rate is the internal real exchange rate concept (called the domestic tradable-non-tradable goods definition). This considers the real exchange rate as the price of tradable goods relative to that of non-tradable goods. That is:

$$RER = e\left(\frac{P^{*}_{T}}{P_{N}}\right) \qquad (3.6)$$

Where: RER is the real exchange rate (bilateral), e is the nominal exchange rate, P^{*}_{T} is the price of tradable goods and P_N is the price of non-tradable goods. This definition, unlike the PPP approach, summarises incentives that guide resource allocation across the tradable and nontradable sectors. The idea is that an increase in the RER (a depreciation of the RER) increases profitability of the tradable sector relative to the nontradable sector. This induces the movement of resources from the nontradable sector to the tradable sector. If relative price do not change in the rest of the world, the depreciation implies an improvement in the degree of international competitiveness of the home country. That is, the country now produces tradable goods in a more efficient way than before (relative to the rest of the world).

Edwards (1989) has shown that for a small country, if there are no taxes and the law of one price holds for tradable goods, changes in real exchange rate values obtained from the two definitions of real exchange rate will differ depending on the behaviour of foreign relative prices of tradables and nontradables. He showed that the real exchange rate values obtained from the two approaches may move in opposite direction.

While the internal real exchange rate (domestic tradable-nontradable relative price) definition is theoretically appealing it has not been widely used in empirical studies. The basis of this is that data on prices are not normally disaggregated into tradable and nontradable goods. Hence the PPP definition has been used as proxy for the internal real exchange rate definition in empirical studies.

3.2.2: Alternative measurements of equilibrium real exchange rate

As in the case of the determination of the values of the actual real exchange rate, a major concern in the literature on real-exchange-rate determination is the determination of the values of the (long-run) equilibrium real exchange rate and consequently the determination of the degree of misalignment between the equilibrium real exchange rate and the actual real exchange rate. The importance of the (long run) equilibrium real exchange rate hinges on the fact that policy makers are interested in knowing the right nominal exchange rate. Moreover, the right nominal exchange rate is the one that ensures that the equilibrium real exchange rate coincides with the actual real exchange rate. Furthermore, policy makers are interested in knowing whether the currency is overvalued or undervalued, so that they can determine how to clear the misalignment since the misalignment creates distortions in the economy. These include poor export performance, low agricultural output, high import growth, destabilization of the capital account and potential for debt crisis, breed of protection against imports, high inflation and promotion of rent-seeking activities (Pfeffman, 1985) This makes a case for having knowledge of not only the value of the actual real exchange rate but also the value of the (long run) equilibrium real exchange rate. If the actual real exchange rate and the equilibrium real exchange rate are different, then the real exchange rate is said to be misaligned. When the equilibrium real exchange rate is higher (or lower) than the actual real exchange rate the real exchange rate is said to be overvalued (or undervalued). In the case of an overvalued real exchange rate, devaluation of the nominal exchange rate is often recommended under a fixed exchange rate regime while in the case of undervaluation revaluation is recommended in order to clear or reduce the misalignment.

The misalignment of the real exchange rate has been measured as the percentage deviation of the real exchange rate from its equilibrium value. Hence real exchange rate misalignment also

has ambiguity in its measurement since it depends on the values of the equilibrium and actual real exchange rates. That is:

$$RERMIS_t = \left(\frac{ERER_t - RER_t}{ERER_t} \right) \times 100 \qquad (3.7)$$

Where RERMIS is real exchange rate misalignment, ERER is the equilibrium real exchange rate, RER is the actual real exchange rate and t is time subscript.

Three approaches have been widely used in the determination of the (long run) equilibrium real exchange rate (and hence the real exchange rate misalignments). These are the purchasing power parity (PPP) approach, the macroeconomic balance approach and the behavioural equilibrium exchange rate approach.

The PPP approach considers the equilibrium real exchange rate as a constant. Here the equilibrium real exchange rate is taken to be the real exchange rate of the year in which the current account is in balance. It considers the equilibrium real exchange rate to be an immutable number on the basis that the nominal exchange rate adjusts rapidly to price deferential between a country and its trading partners. The problem with this approach is that it has been established that absolute PPP does not hold (Elbadawi and Soto, 1997). Hence the equilibrium real exchange rate is not constant but changes as its fundamentals vary. Moreover, it is only a way to obtain equilibrium real exchange rate but not the determinants of the equilibrium real exchange rate. Hence relying on this approach may make it difficult to clear or minimize real exchange rate misalignment as policy for closing real exchange rate misalignment will focus only on the actual real exchange rate.

The macroeconomic balance approach (Williamson, 1985 and Faruqee and Isard, 1998) considers the equilibrium real exchange rate as the one that ensures simultaneous attainment of both internal and external equilibrium. Where internal equilibrium is defined as the attainment of full employment level of output and low level of inflation and external equilibrium is defined as the attainment of sustainable current account deficit (one that can be financed without undue borrowing or unnecessary loss of foreign reserves). Hence the equilibrium real exchange rate in this case is a range of equilibrium values rather than an immutable number, as in the PPP approach, and changes over time as its fundamental determinants change. These fundamental

determinants are considered to be the factors that determine internal and external balance. The macroeconomic balance approach recognises the fact that the fundamentals that determine the real exchange rate in the short run may be different from those that determine it in the long run. This idea is based on the fact that the fundamental determinants of internal and external equilibria may vary according to time horizon (Clark et al. 1994). However, it is difficult to determine the equilibrium real exchange rate using this approach because of the complexity in determining when an economy attains internal and external balances. The difficulty emanates from the fact that it involves the building of a macro econometric model taking into consideration the current account, full employment output, the price level and many other macroeconomic variables. Moreover, like the PPP approach, it is only a method of calculating equilibrium real exchange rate but not determination of factors that affect equilibrium real exchange rate. Furthermore, because of its complexity and data requirements, studies that have applied the macroeconomic balance approach to the determination of the equilibrium real exchange rate are on developed economies (for example, Williamson 1994 and Wren- Lewis 2003).

The behavioural equilibrium approach (Edwards 1988, 1989 and Clark and McDonal 1998, 2000), which is a model based approach to the determination of equilibrium real exchange rate maintains that the equilibrium real exchange rate is obtained by first determining a relationship between the observed real exchange rate and a vector of fundamentals (obtained from a reduced form model) to obtain the long-run effect of fundamentals on the real exchange rate. Second, to the extent that the actual value of the fundamentals constitute transitory component and permanent component they are decomposed into trend (permanent) component and transitory (cyclical) component using conventional methods of decomposition of a time series (for example, the Hodrick and Prescott (1997) filter, the Beveridge and Nelson (1981) decomposition or the moving average technique) in order to obtain the sustainable levels of the fundamentals. The permanent components (long-run trend values) of the fundamentals are then substituted into the estimated long-run relationship to obtain the long run equilibrium exchange rate, which does not have any transitory component. However, the value of the equilibrium real exchange rate (and hence misalignment) depends on the fundamentals used and the methodology used to estimate the long run parameters.The behavioural equilibrium approach has been applied to a number developing countries in order to determine the equilibrium real exchange rate and hence

the real exchange rate misalignment (for example, Edwards 1989 to twelve developing and middle-income countries, Elbadawi, 1994 to Chile, Ghana and India, Amin and Awung 1997 to Cameroon, Congo and Gabon and Parikh 1997 to South Africa, Mungule, 2004 to Zambia and Eita and Sichei, 2006 to Namibia).

3.2.3 Empirical evidence on the determinants of real exchange rate

Empirical studies on the determination of real exchange rate (hence real exchange rate misalignment) have been challenging. This difficulty arises from the fact that both the actual and equilibrium real exchange rate have to be determined. Moreover, the equilibrium real exchange rate is unobservable.

A strand of the literature on real exchange rate is the case of the developed economies. This strand uses the purchasing power parity (PPP) or the macroeconomic balance approach to determine the equilibrium real exchange rate and hence the degree of real exchange rate misalignment without paying attention to the determinants of the real exchange rate. Hence the focus of this strand is mainly the determination of the degree of misalignment of the real exchange rate rather than the determinants of the real exchange rate.

Another strand in the literature is the case of developing countries. This was pioneered by Edwards (1988, 1989) and later by Rodriquez (1989), Elbadawi (1994) and Montiel (1997). Edwards (1989) built a theoretical model for developing countries to explain the short and long run determinants of the real exchange rate. He applied the model to a panel of twelve countries observed over the period 1962 and 1985 by using fixed effect model. His sample includes Brazil, Columbia, Elsavador, Greece, India, Israel, Malaysia, Phillippines, South Africa, Srilanka, Thailand and Yugoslavia. His finding is consistent with his theoretical prescription that in the short run both real and nominal variables affect the real exchange rate while in the long run only real variables affect the real exchange rate (that is, only real variables affect the equilibrium real exchange rate). His finding showed that the fundamental (long-run) determinants of the real exchange rate are the terms of trade, level and composition of government consumption, controls on capital flows, exchange and trade controls, technological progress and capital accumulation. His study reveals that in the short run both the nominal exchange rate and domestic credit as well as the real variables that determine the long run real exchange rate are the determinants of the

real exchange rate. The coefficient of terms of trade was found to be negative, the coefficient of the ratio of government expenditure to GDP was found to be negative, the coefficient of exchange and trade controls (proxied by parallel market premium) was found to be negative, the coefficients of technological progress (proxied by output growth) was found to be positive (contradicting the Ricardo-Balassa hypothesis), the coefficient of capital flow (lagged) was found to be negative and the coefficient of capital accumulation (measured as investment-GDP ratio) was found to be positive. He also found that in the short run nominal exchange rate depreciation leads to a depreciation of the real exchange rate while an increase in domestic credit leads to an appreciation of the real exchange rate.

The work of Edwards (1989) inspired many studies on the determinants of the real exchange rate as well as the determination of real exchange rate misalignment in developing countries. These studies include Ghura and Grennes (1993) for a panel of sub-Saharan African economies, Elbadawi (1994) for Chile, Ghana and India, Cottani et al (1990) for a group of developing countries, Amin and Awung (1997) for Cameroon,Congo and Gabon, Parikh (1997) for South Africa, Aron et al. (1997) for South Africa, Baye and Khan (2002) for Nigeria, Mwega (1993) for Kenya, Olopoenia (1992) for Nigeria, Obadan (1994) for Nigeria, Ogun (1998) for Nigeria, Eita and Sichei (2006) for Namibia, Baffes et. al.(1997) for Cote d'Ivoire and Burkina Faso, Hyder and Mahboob (2006) for Pakistan and Mungule (2004) for Zambia.

Owing to data problem, the numbers of real variables that have been used as explanatory variables in the determination of the real exchange rate have not been the same across empirical studies but the nominal variables used are nominal exchange rate and domestic credit (or excess domestic credit). A common observation in the studies on the determinants of the real exchange rate in the developing countries are that both the nominal exchange rate and domestic credit expansion have short run impact on the real exchange rate while real variables have both long run and short run impact on the real exchange rate. Moreover, an increase in the nominal exchange rate (nominal devaluation/depreciation) increases the real exchange rate, thereby reducing real exchange rate misalignment while an increase in domestic credit appreciates the real exchange rate, thereby widening real exchange rate misalignment.

Single equation approach has been used to determine the impact of monetary variables on the short-run (actual) real exchange rate. This approach assumes that excess domestic credit increases the price level thereby leading to appreciation of the real exchange rate. However,

instead of having the domestic price level as a determinant of real exchange rate, estimating an inflation equation, incorporating the monetary sector behaviour in determining the rate of inflation and hence examining the dynamic effect of domestic credit expansion on the real exchange rate, a static approach which leaves out the indirect effects of fiscal and monetary expansion on the real exchange rate has been employed by previous studies. They tend to capture this effect by including a measure excess domestic credit, which assumes unitary income elasticity of demand for domestic credit in the real exchange rate equation. But this treatment does not suffice since the effect of excess domestic credit on real exchange rate is indirect (through the rate of inflation) but not direct. Moreover, the demand for domestic credit may not be unitary elastic with respect to income.

Some studies have applied the Ordinary Least Squares (OLS) regression to investigate the determinants of the real exchange rate (for example, Ghura and Green, 1993, Cottani et al, 1990, Sekkat and Varondakis, 1998 and Afridi, 1995) while some others have applied the technique of unit root, cointegration and equilibrium correction modeling (for example, Elbadawi 1994, Montiel 1997, 1999, Elbadawi and Soto 1997, Gelbard and Nagayasu ,1999, Kadenge, 1998, Baffes et al.,1999, Faruquee,1995, Feyzioglu,1997, Kemme and Roy, 2005 Hyder and Mahbood 2006, and Eita and Sichei, 2006).

Another observation in the literature is the fact that while some studies examine the determinants of the short-run real exchange rate as well as the (long-run) equilibrium real exchange rate (and hence characterize the nature of misalignment of the real exchange rate) other studies go further to determine the effect of real exchange rate misalignment on key macroeconomic variables. Studies in the former category include: Baffes et al. (1999), Baye and Khan (2002), Kemme and Roy (2005), Eita and Sichei (2006), Hyder and Mahbood (2006). Studies that fall under the latter category include: Edwards (1989), who found that in his sample of twelve developing countries, those with less real exchange rate misalignment performed better (in terms of growth of output) than those with more real exchange rate misalignment; Ghura and Grennes (1993) who found that real exchange rate misalignment negatively affects income growth, exports, imports, investment and savings; Ogun (1998), who found that real exchange rate misalignment has negative effect on non-oil exports of Nigeria, Grober (1993), who found that exchange rate misalignment had no effect on the exports of Argentina, Brazil, Colombia, Greece, Malaysia, Mexico, Philippines, South Africa, Thailand and Yugoslavia. However,

Grober's result is in contrast with most of the other developing-country studies probably because his measure of misalignment was based on the black market premium while most of the other studies on developing countries used the model based approach to obtain the equilibrium real exchange rate (and hence the real exchange rate misalignment).

The review of the empirical literature on the determinants of the real exchange rate and characterizing the real exchange rate misalignment reveals that while much has been done on developing countries, nothing is known in the case of Sierra Leone. Moreover, single equation technique with OLS or cointegrtion and ECM technique is the common tool of application in previous studies, leaving away many macroeconomic interactions that follow a change in an exogenous variable. This study departs from previous studies by determining the dynamics of the real exchange rate in a system framework, whereby the effects of nominal exchange rate, domestic credit and some other variables on the actual real exchange rate are investigated in a simulation context (rather than the traditional single equation technique used in previous empirical studies on developing countries).

3.3 Conclusion from the literature review

The theoretical, methodological and empirical reviews of the literature on the role of exchange rate in balance of payments adjustment reveal that much has been done but there are still gaps in the literature. These gaps, which are filled by this study, are given as follows:

(i) Among the studies that have examined the effects of nominal exchange rate on the trade balance and hence the balance of payments, none models the indirect effect of the nominal exchange rate on the real exchange rate, which occurs through changes in the general price level. This indirect effect is important since a depreciation of the nominal exchange rate increases the general price level by increasing the price of import. The resulting inflation undermines the competitiveness of an economy (the real exchange rate appreciates) and this opposes the direct effect of the increase in the nominal exchange rate on the real exchange rate. Thus, the trade balance may deteriorate as a result of the inflationary effect of nominal exchange rate depreciation.

(ii) Despite the attempts by some studies to test and account for unit root in variables (common in time series models) and the attempts by others to solve the simultaneity-bias problem (common in macroeconomic models), none of the previous studies have handled both problems though both are important.

(iii) There is dearth of literature on the role of the exchange rate in balance of payments adjustment in Sierra Leone and the wide macroeconomic implications of changes in the exchange rate have been ignored.

(iv) None of the theories of balance of payments incorporates the role of fiscal and monetary policies in determining competitiveness and hence adjustment of the balance of payments. This is important for countries facing consistent fiscal deficit which is financed by the monetary authorities. This situation is peculiar to Sierra Leone, as in the case of most developing economies.

CHAPTER FOUR
THEORETICAL FRAMEWORK AND METHODOLOGY

The study estimates a small macroeconomic model to investigate the effects of the nominal exchange rate on the real exchange rate, trade balance and the overall balance of payments as well as the determinants of the actual (short-run) real exchange rate. The study also estimates the equilibrium (long-run) real exchange rate model in order to investigate the determinants of the equilibrium real exchange rate. This section therefore discusses the theoretical frameworks, specification of equations and estimation techniques for the macroeconomic model and the equilibrium real exchange rate model.

4.1 The macroeconomic model

4.1.1 Theoretical framework for the macroeconomic model

Among the theories that explain the effects of exchange rate on the balance of payments (the relative-price approach, income approach, Laursen-Metzler synthesis, monetary approach and the absorption approach), it is only the absorption approach that analyses the effect of the exchange rate on the balance of payments from a broad macroeconomic perspective. That is, unlike other theories, it takes into consideration many channels through which an exchange rate change passes to affect the balance of payments (and these channels even include the traditional relative-price and income approaches). In the light of these observations, the theoretical framework for the empirical macro model is the absorption approach to the balance of payments.

The absorption approach to the balance of payments leaves out the role of the capital account, considers net factor income and transfers from abroad to be negligible and therefore takes the trade balance as the current account and hence the balance of payments[13]. The approach derives the current account from the national income identity, which is given as:

[13] This assumption holds in the Sierra Leonean economy since the financial market is not developed and is therefore not integrated with the world's financial market.

$$Y = C + I + X - M \quad (4.1)$$

Where: $C = a + bY, b > 0$ (4.2)

$$I = g + hY, h > 0 \quad (4.3)$$

Where b is marginal propensity to consume, h is marginal propensity to invest, b+h is the marginal propensity to absorb (spend), Y is income, C is consumption, I is investment, X is export and M is import.

The expenditure on goods by domestic residents (called absorption, A) and the balance of payments (B) are given respectively in equations (4.4) and (4.5).

$$A = C + I \quad (4.4)$$

$$B = X - M \quad (4.5)$$

Substituting (4.4) and (4.5) into (4.1) gives:

$$Y = A + B \quad (4.6)$$

From equation (4.6), the balance of payments is given as:

$$B = Y - A \quad (4.7)$$

Hence $\Delta B = \Delta Y - \Delta A$ (4.8)

Equation (4.8) is the fundamental equation of the absorption approach to the balance of payments. This says that an increase in the nominal exchange rate will affect the balance of payments by changing income, absorption, or both. Specifically, devaluation improves the balance of payments if it increases income more than it increases absorption, if it reduces absorption more than it reduces income or if it increases income and reduces absorption.

According to the absorption approach, there are two channels through which an increase in the nominal exchange rate (devaluation/depreciation) affects income. These are the idle resource (also called the unemployed resource) channel and the terms of trade channel. The idle resource channel says that if there are unemployed resources in the economy, the changes in relative prices that follow an increase in the nominal exchange rate shifts expenditure from foreign goods to domestic goods. The resulting increase in aggregate demand will lead to an increase in income. The terms of trade channel says that if the increase in nominal exchange rate improves the terms of trade, real income will increase but if it deteriorates the terms of trade, real income

will fall. Since the idle resource effect and the terms of trade effect interact to obtain the net effect on income, the effect of an increase in the exchange rate on income is ambiguous.

By substituting (4.2) and (4.3) into (4.4) and taking changes, we obtain:

$$\Delta A = (b+h)\Delta Y \qquad (4.9)$$

Hence, $\frac{\Delta A}{\Delta Y} = b+h$.

But $b > 0$ and $h > 0$. Therefore, $b+h > 0$.

Since b+h is positive, when an increase in the nominal exchange rate increases income absorption will increase and if it decreases income absorption will decrease. This is referred to as the indirect effect of devaluation on absorption because it affects absorption by changing income. By substituting (4.9) into (4.8), the effect of an increase in the nominal exchange rate that changes income, on the balance of payments is obtained. This gives:

$$\Delta B = \Delta Y - (b+h)\Delta Y$$

$$= \left[1-(b+h)\right]\Delta Y$$

Hence, $\frac{\Delta B}{\Delta Y} = 1-(b+h)$. From this, $\frac{\Delta B}{\Delta Y} > 0$ if $1-(b+h) > 0$. But this holds when $b+h < 1$.Therefore, $\frac{\Delta B}{\Delta Y} > 0$ if $b+h < 1$ (4.10)

Inequality (4.10) shows that an increase in the nominal exchange rate that increases income improves the balance of payments if the marginal propensity to absorb is less than one.

According to the absorption approach, a change in the nominal exchange rate also affects absorption without affecting income. This effect is referred to as the direct effect of a change in the nominal exchange rate on absorption. For example, an increase in the exchange rate increases the general price level and real balances reduce, given the nominal money supply. To restore real balances, economic agents reduce consumption and investment, and absorption reduces. This is referred to as the real (or cash) balance effect, which is always negative. The money-illusion effect is another explanation of the direct effect of a change in the nominal exchange rate on absorption. The idea is that an increase in the nominal exchange rate can increase income and the price level simultaneously. But if workers perceive the situation as a rise in real income (that is, if they have money illusion), they increase their expenditure through increases in consumption

and investment, which is an increase in absorption. Hence the money illusion effect is always positive. This effect opposes the real balance effect, implying that the net direct effect of an increase in exchange rate on absorption is ambiguous.

The discussion on the absorption approach therefore shows that the effect of the nominal exchange rate on the balance of payments is ambiguous and the effect is independent of the direction of change in income.

4.1.2 The structure of the macroeconomic model

The absorption approach to the balance of payments, which is the theoretical framework for the study, is modified here by taking the structure of the Sierra Leonean economy into consideration. One of the extensions is by incorporating the fiscal-monetary interaction into the transmission mechanism of a change in the nominal exchange rate. This is done on two counts. First, the devaluations of the leone during the fixed exchange rate regime in Sierra Leone and the continuous depreciations of the leone in the current managed floating regime have fiscal implications, which in turn has a monetary dimension and hence an external sector effect. Second, Sierra Leone has been facing high budget deficit since the mid 1970s and this deficit has been financed mainly by the monetary seigniorage, leading to high growth of money supply and hence high inflation rates, with poor external sector implications[14]. The absorption approach to the balance of payments is also modified here by introducing the effects of nominal exchange rate on the overall balance of payments, rather than just limiting the effect to the trade balance. Another extension of the absorption approach is that, export is disaggregated into diamond export, non-diamond mineral export (for example, gold, rutile and bauxite) and non-mineral export (agricultural and manufacturing products). This is essentially to account for the fact that a higher proportion of the export revenue of Sierra Leone is from diamond and its export does not depend on the real exchange rate, unlike the case of agricultural export. In what follows we discuss the specifications of the equations that form the macroeconomic model, the inherent logic of the macroeconomic model and the estimation techniques.

[14] According to the monetary approach to the exchange rate determination, an increase in domestic money supply depreciates the nominal exchange rate in a floating exchange rate regime and deteriorates the balance of payments in a fixed exchange rate regime. Hence monetary policy, exchange rate and the balance of payments are related.

4.1.2 .1 Real exchange rate and price level

4.1.2.1.1 The real exchange rate

The theoretical framework for modeling the dynamics of the real exchange rate is the intertemporal optimizing model developed by Edwards (1989). The choice draws from the fact that it is the only theoretical model that explains the effect of nominal exchange rate on the real exchange rate in developing countries. Also, it captures the effect of inconsistent macroeconomic policies (monetary and fiscal policies) on the real exchange rate. The model, unlike other theoretical models that focus only on the determinants of the equilibrium real exchange rate distinguishes factors that determine the equilibrium real exchange rate from those that determine the short-run dynamics of the real exchange. Moreover, the model was developed to capture the structure of a typical developing country. This model has been used to estimate real exchange rate models in many developing countries (For example, Mungule 2004 for Zambia and Ghura and Grennes 1993 for sub Sahara Africa (SSA).

His model takes into account the effects of nominal exchange rate depreciation/ devaluation and macroeconomic policies (monetary and fiscal policies) on the short run dynamics of the real exchange rate and controls for initial equilibrium condition (disequilibrium between the long run equilibrium real exchange rate and the actual real exchange rate).

According to this model, the real exchange rate dynamics is determined by three forces: (i) nominal exchange rate depreciation/devaluation. That is, nominal exchange rate depreciation leads to real exchange rate depreciation in the short run (ii) the tendency for actual real exchange rate to correct existing misalignments between long run equilibrium real exchange rate and actual real exchange rate. This self-correcting process is considered to be higher when the reduction in price of nontradable goods is higher. (iii) macroeconomic policies. That is unsustainable (inconsistent) macroeconomic policies appreciate the real exchange rate. This is functionally represented as follows:

$$\Delta LnRER_t = \Psi\left(LnRER_t^* - LnRER_{t-1}\right) - \Omega\left(Z_t - Z_t^*\right) + \Phi\left(Lne_t - Lne_{t-1}\right) \qquad (4.11)$$

$$0 < \Psi < 1,\ 0 < \Omega < 1 \text{ and } 0 < \Phi < 1$$

Where: RER = actual real exchange rate, RER* = equilibrium real exchange rate, Z = index of macro policies, Z* = the sustainable level of macro policies, e = nominal exchange rate, t is time subscript and Δ is the difference operator.

The first term on the right hand side of equation (4.11) captures the autonomous tendency for the actual real exchange rate to correct existing misalignment with Ψ being the speed at which this takes place. The second term captures the effect of unsustainable macro policies on the movement of the real exchange rate and the third term captures the effect of nominal exchange rate depreciation/devaluation on the real exchange rate movement.

A basic problem encountered in estimating equation (4.11) is that the equilibrium real exchange rate (RER*) is unobservable. However, it has been recognized in the literature (for example Edwards (1989) , Montiel (1999) , Dornbusch (1973) , Rodriguez (1989) and Elbadawi (1994)) that the equilibrium real exchange rate is determined by real factors only. Edwards (1989) derived these factors to be the terms of trade (TOT), level and composition of government consumption as a ratio of GDP (GCN), control on capital flows (CAPCON), exchange and trade controls (EXCHCON), technological progress (TECPRO) and capital accumulation as a ratio of GDP (I/GDP). In log linear form this is given as:

$$LnRER_t^* = \upsilon_0 + \upsilon_1 Ln(TOT)_t + \upsilon_2 Ln(GCN)_t + \upsilon_3 Ln(CAPCON)_t +$$
$$\upsilon_4 Ln(EXHCON)_t + \upsilon_5 Ln(TECPRO)_t + \upsilon_6 Ln(I/GDP)_t \qquad (4.12)$$

$$\upsilon_1, \upsilon_2, \upsilon_6 > 0 \text{ or } < 0,\ \upsilon_3, \upsilon_4, \upsilon_5 < 0$$

Substituting equations (4.12) in equation (4.11) and simplifying the resulting expression gives the following equation:

$$LnRER_t = \varpi_0 + \varpi_1 Ln(TOT)_t + \varpi_2 Ln(GCN)_t + \varpi_3 Ln(CAPCON)_t +$$
$$\varpi_4 Ln(EXCHCON)_t + \varpi_5 Ln(TECPRO)_t +$$
$$\varpi_6 Ln(I/GDP)_t + (1-\Psi) Ln(RER)_{t-1} -$$
$$\Omega(Z_t - Z_t^*)_t + \Phi\left(Lne_t - Lne_{t-1}\right) + U_{1t} \qquad (4.13)$$

$\varpi_1 >/< 0$, $\varpi_2 >/< 0$, $\varpi_3 < 0$, $\varpi_4 < 0$, $\varpi_5 < 0$, $\varpi_6 >/< 0$, $\Omega < 0$ and $\Phi > 0$.

Where the ϖ's are combinations of the υ's and Ψ and U_1 is an error term assumed to be identically and independently normally distributed.

A problem faced in the estimation of equation (4.13) is the determination of the components of inconsistent macro policy (Z-Z*). Excess supply of domestic credit (EXCRE) measured as the rate of growth of domestic credit minus lagged rate of growth of real GDP is used by Edwards to represent inconsistent monetary policy[15] while he used the ratio of fiscal deficit (FD) to high powered money (H) as a proxy for inconsistent fiscal policy.

Many studies on developing countries have used only excess domestic credit in their real exchange rate models to account for inconsistent macroeconomic policies (for example, Elbadawi, (1994), Parikh (1997) and Mungule (2004)). The basis of this is that fiscal deficits are mostly financed by seigniorage (printing money) in most developing countries. This serves to control for possible multicolliearity between inconsistent fiscal policy and monetary policy variables, given that fiscal deficits are often financed by seigniorage.

However, the inclusion of inconsistent monetary policy variables to captures inconsistent macroeconomic policies in the real exchange rate model is justified in the literature (pioneered by Edwards, 1989) on the grounds that such policies lead to higher inflation, thus appreciating the real exchange rate. Though this treatment assumes that the channel via which inconsistent macroeconomic policies affects the real exchange rate is through its impact on the price level, excess domestic credit rather than price level is used in previous real exchange rate models. This leaves out the indirect effect (on inflation), which is underscored in the theory. To capture this

[15] This measure of excess domestic credit assumes that the demand for domestic credit is unitary elastic with respect to income (Edwards 1989).

indirect effect it is therefore necessary to explicitly introduce the price level into the real exchange rate model, model the price level itself, and link the money supply behaviour to the price formation process.

Moreover, previous studies on the determinants of the dynamics of the short run real exchange rate use, *inter alia*, the nominal exchange rate as a regressor without controlling for the effect of inflation. However, a nominal depreciation is more often than not inflationary in the developing countries. This is the case in Sierra Leone since the country's import is dominated by capital goods, raw materials and the staple food (rice). Thus the role of inflation in the dynamics of the real exchange rate is essential. For one thing a nominal depreciation depreciates the real exchange rate, *ceteris paribus* but its inflationary effect appreciates the real exchange rate when the *ceteris paribus* assumption does not hold. Hence the nominal exchange rate has both direct and indirect effects on the real exchange rate. But previous studies have been capturing only the direct effect, leaving out the indirect effect (the inflationary effect), which opposes the direct effect.

This study resolves these two problems by including the price level in the real exchange rate model, modeling the price level and incorporating the money supply process of Sierra Leone as a component of the small macro model. This enables us to examine the link between fiscal deficit, money supply, price level and the real exchange rate.

Proxies are used for most of the variables in equation (4.13) because data is not available for them. In the case of technological progress, growth of real gross domestic product (Y_g) is the traditional variable used as proxy (Edwards 1989). This is done in order to test the Ricardo-Balassa effect[16]. This proxy is adopted here, in an effort to test the Ricardo-Balassa effect. To the extent that it is difficult to find a proxy for government expenditure on non-tradable goods total government expenditure as a ratio of GDP is used. Control on capital flow (CAPCON) is represented by capital flow (CAPFLO) which is net change in reserve minus trade balance scaled by GDP as there is no data on capital control. EXCHCON is represented by the closeness of the economy to international trade (CLOSE) as there is no data on exchange and trade control. The index of closeness is GDP divided by the sum of exports and imports

[16] The Ricardo-Balassa thesis states that improvement in technology, which is taken as increase in output, emanates from productivity growth in the tradable goods sector and this appreciates the equilibrium real exchange rate. Given that the variables that affect the equilibrium real exchange rate theoretically affect the actual real exchange rate, this variable is included in the short run real exchange rate model.

Hence, the empirical model explaining the dynamics of the short-run real exchange rate is give as follows:

$$LnRER_t = \varpi_0 + \varpi_1 Ln(TOT)_t + \varpi_2 Ln(G/GDP)_t + \varpi_3 Ln(CAPFLO/GDP)_t + \varpi_4 Ln(CLOSE)_t + \varpi_5 Ln(Y_g)_t + \varpi_6 Ln(I/GDP)_t + (1-\Psi) Ln(RER)_{t-1} - \Omega LnP_t + \Phi\left(Lne_t - Lne_{t-1}\right) + U_{1t} \quad (4.14)$$

$\varpi_1 >/< 0$, $\varpi_2 >/< 0$, $\varpi_3 < 0$, $\varpi_4 < 0$, $\varpi_5 < 0$, $\varpi_6 >/< 0$, $\Omega < 0$ and $\Phi > 0$.

Where P is the price level, Y_g is growth of real output, the ϖ's are combinations of the υ's and Ψ and U_1 is an error term assumed to be identically and independently normally distributed. In all the equations that follow the Ui's are error terms.

The real effective exchange rate (REER) is used to estimate the real exchange rate because it is weighted by the trade shares of exporting partners (thus controlling for third country effect). Moreover, most studies that have estimated real exchange rate models have used the notion of real effective (multilateral) rather than real bilateral exchange rate. The real effective exchange rate is computed as follows:

$$REER = \sum_{i=1}^{i=4} S_i \left(\frac{e_i CPI^*_i}{CPI}\right) \quad (4.15)$$

Where:

REER = real effective exchange rate

i = major export partner of Sierra Leone. Four major export partners are considered. (Belgium, Germany, U.K and U.S with trade weighte calculated to be 0.7,0.15, 0.1 and 0.5 respectively).

S_i = the weight of country i in the total export of Sierra Leone

CPI^*_i = the consumer price index of country i

e_i = the bilateral nominal exchange rate defined as leones per currency of country i

CPI = the consumer price index of Sierra Leone

4.1.2.1.2 The price level

The theoretical framework for modeling the price level is a simple model in which the price level is a weighted average of the price of tradable goods and non-tradable goods. This model has been applied in modeling the price level in other African countries, (for example, Ubide (1997) for Mozambique, Rutasitara (2004) for Tanzania and Bawumia (2002) for Ghana).

The overall price level (P) is a weighted average of the prices of tradable goods (P^T) and non-tradable goods (P^{NT}). That is:

$$LnP_t = \alpha(LnP^T{}_t) + (1-\alpha)(LnP_t^{NT}) \qquad 0 < \alpha < 1 \qquad (4.16)$$

The price of tradable goods is determined in the world market and depends on foreign price (P^f) and the nominal exchange rate (e). Assuming that the purchasing power parity (PPP) holds, that is:

$$LnP_t^T = Lne_t + LnP_t^f \qquad (4.17)$$

Equations (4.16) and (4.17) imply that nominal exchange rate depreciation or an increase in foreign price level will increase the domestic price level through an increase in the price of tradable goods[17].

The price of non-tradable goods is determined by the money market equilibrium condition (that is, real money supply (M^s/P) is equal to real money demand (M^d/P). Hence:

$$LnP_t^{NT} = \beta(LnM^s{}_t - LnM^d{}_t) \qquad (4.18)$$

Where β is a scale factor representing the relationship between economy-wide demand and the demand for non-tradable goods.

[17] This is referred to as the exchange rate pass-through effect.

Standard theories of money demand function[18] maintain that the demand for money is an increasing function of real income (y) and a decreasing function of interest rate (i).

In Linear form, the demand for money function is given as:

$$LnM_t^d = \gamma_0 + \gamma_1 LnY_t + \gamma_2 Lni_t \qquad (4.19)$$
$$\gamma_{1>0}, \gamma_{1<0}$$

Substituting equation (4.19) in equation (4.18) gives:

$$LnP_t^{NT} = \beta(LnM_t^s - \gamma_0 - \gamma_1 LnY_t - \gamma_2 Lni_t) \qquad (4.20)$$

Substituting equations (4.20) and (4.17) in equation (4.16) and holding foreign price level constant on the basis that it is out of the control of the domestic economy, the price equation is obtained as a function of domestic money supply, income , nominal exchange rate and interest rate. That is:

$$p = f(M^s, y, e, i) \qquad (4.21)$$

In linear form, the inflation model is therefore given as follows:

$$LnP_t = \lambda_0 + \lambda_1 LnM_t^s + \lambda_2 LnY_t + \lambda_3 Lne_t + \lambda_4 Lni_t + U_{2t} \qquad (4.22)$$
$$\gamma_1, \gamma_3, \gamma_4 > 0 and \gamma_2 < 0$$

4.1.2.2 Income determination

The income determination process is given by the traditional income determination identity. That is, income (Y) is demand driven and is determined by consumption (C) investment (I) and net exports (X- M). Where X is exports and M is imports. That is:

$$Y = C + I + X - M \qquad (4.23)$$

Aggregate consumption (C) is the sum of private consumption (Cp) and government consumption (Cg) and absorption (A) is the sum of aggregate consumption and aggregate investment. That is:

[18] The standard money demand functions are the Quantity Theory of money, Keynes demand function, Friedman's restatement of the Quantity Theory of Money and the Baumol-Tobin Model.

$$C = Cp + Cg \tag{4.24}$$

$$A = C + I \tag{4.25}$$

4.1.2.3 Consumption

4.1.2.3.1 Private consumption

The private consumption function draws from the inter-temporal optimizing model of consumption. This is because consumers are always faced with decision of how much of their resources to consume in the current period versus how much to consume in feature periods.

The inter-temporal model of consumption considers an individual that lives for T periods and has a lifetime utility that is additively separable. Thus the lifetime utility of the consumer is given as:

$$U = \sum_{i=1}^{T} U(C_t), \quad U'(Ct) \geq o \text{ and } U''(Ct) < o \tag{4.26}$$

Where U(Ct) is the instantaneous utility function and Ct is consumption in period t.

The consumer is considered to have an initial wealth of W_0, labour income of Y_t in period t and his life time resources is equal to total lifetime consumption. Thus, the budget constraint of the consumer is given as:

$$\sum_{i=1}^{T} C_t \leq W_o + \sum_{i=1}^{T} Y_t \tag{4.27}$$

This budget constraint is satisfied with equality under the assumption that there is no wastage of resources.

Suppose the instantaneous utility function is logarithmic. This ensures that the elasticity of substitution between consumption in one period and another is constant. Thus, U= lnCt. Hence the consumer's problem is:

$$\underset{C_t}{Max} U_t = \sum_{i=1}^{T} LnC_t$$
$$s.t: \sum_{i=1}^{T} C_t = W_0 + \sum_{i=1}^{T} Y_t \qquad (4.28)$$

The Lagrangean for the problem in (4.28) is given as:

$$L = \sum_{i=1}^{T} LnC_t + \lambda\left(W_0 + \sum_{i=1}^{T} Y_t - \sum_{i=1}^{T} C_t\right) \qquad (4.\ 29)$$

The first order conditions are:

$$\frac{\partial L}{\partial C_t} = \frac{1}{C_t} - \lambda = 0 \qquad (4.30a)$$

$$\frac{\partial L}{\partial C_{t+1}} = \frac{1}{C_{t+1}} - \lambda = 0 \qquad (4.30b)$$

. . .

. . .

. . .

$$\frac{\partial L}{\partial C_T} = \frac{1}{C_T} - \lambda = 0 \qquad (4.30c)$$

$$\frac{\partial L}{\partial \lambda} = W_0 + \sum_{i=1}^{T} Y_t - \sum_{i=1}^{T} C_t = 0 \qquad (4.32)$$

From the first order conditions in equations (4.30a) to (4.30c), consumption in any period is constant and is equal to the inverse of λ . This implies that:

$$C_t = C_{t+1} = C_{t+2} = ... = C_T \qquad (4.33)$$

Equation (4.33) implies that $\sum_{i=1}^{T} C_t = TC_t$ (4.34)

Substituting (4.34) in (4.32) and solving for consumption for period t gives:

$$C_t = \frac{1}{T}\left(W_0 + \sum_{i=1}^{T} Y_t\right) \qquad (4.35)$$

Equation (4.35) implies that consumption in any period, t, is equal to the average of life time resources. Friedman (1957) refers to this average income as permanent income. Hence the inter-

temporal optimizing model of consumption reveals that consumption does not depend only on actual/current income but on income over the entire lifetime (the permanent income).

The inter-temporal optimizing model of consumption is modified here by introducing current income, which is the determinant of consumption according to the absolute income hypothesis of Keynes.

In order to account for the role of interest rate in consumption decision, the rate of interest is included among the explanatory variables. This is predicated on the fact that individuals smooth out their consumption through borrowing and saving, which are affected by interest rate. The effect of interest rate on consumption is indeterminate, as it depends on the substitution and income effect for a net saver. An increase in interest rate has two opposing effects on consumption. On the one hand, it raises the rate of return on saving and produces a substitution effect in favour of saving, leading to less consumption. On the other hand, an increase in interest rate makes accumulation of a given sum of money easier (it is a source of increasing income). Savings is therefore reduced (this is the income effect) and consumption is increased. Hence the direction of the final effect is indeterminate at both the micro and aggregate levels.

The effect of an increase in price on the real value of consumers' liquid assets (for example, bank deposits) and purchasing power of money reduces consumption. This effect is also accounted for in the private consumption function. Thus the price level is introduced as an explanatory variable in the private consumption function.

Hence the private consumption function is given as:

$$\mathrm{LnCp_t} = \beta_0 + \beta_1 \mathrm{LnY_t} + \beta_2 LnP_t + \beta_3 LnY_{tt-1} + \beta_4 Lni_t + \beta_5 DWAR + U_3 \qquad (4.36)$$

$\beta_1, \beta_3 > 0$ and $\beta_2, \beta_5 < 0$ and $\beta_4 >/< 0$

Where, all variables are defined as earlier.

If both the coefficients of current and previous incomes are significant, then permanent income hypothesis holds. But if only the coefficient of current income is significant, then the absolute income hypothesis holds. If the coefficient of interest rate is significant, individuals smooth out their consumption through borrowing and lending from banks. That is, the life-cycle hypothesis holds.

4.1.2.3.2 Government consumption

The government consumption function is specified based on the Wagner's hypothesis. This draws from the fact that government consumption is a component of government expenditure and according to Wagner's Law of increasing state activities, as the economy grows, government expenditure increases and for a developing country, government expenditure is income elastic. Government expenditure is elastic with respect to income because the traditional functions of the state expand in terms of both intensity[19] and coverage [20] more rapidly than the expansion in the economy, as a developing country expands. Income which is a measure of the expansion of an economy is therefore the determinant of public consumption, with an elasticity which is greater than unity.

Based on the public finance literature, other variables are added as regressors of the government consumption function. Emanating from the growing role of the state in the socio-economic complexities of modern society, there is tendency for government consumption to increase over time. Historically, quantitative factors that are identified as the causes of the rise in government expenditure in most countries include population growth, inflation, interest rate on debt, exchange rate depreciation (it increases the repayment of external debt in domestic currency terms) and war. The public consumption function based on the Wagner's hypothesis is therefore modified to capture these factors. To the extent that governments spend out of their revenue, it is expected that public expenditure increases as government revenue increases. Hence government revenue is also included as an explanatory variable in the government consumption function. The government consumption function is therefore specified as follows:

$$LnCg_t = \varphi_0 + \varphi_1 LnP_t + \varphi_2 Lni_t + \varphi_3 Lne_t + \varphi_4 LnY_t + \varphi_5 LnGR_t + \varphi_6 DWAR_t + U_4 \qquad (4.37)$$

$$\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_6 > 0$$

Where Cg = government consumption, GR = government revenue, DWAR = war dummy with 0 for non-war period and 1 for war period. All the other variables are defined as earlier.

[19] For example, defense, justice and maintenance of law and order become more expensive
[20] For example, provision of social security for old age is introduced in government activities

4.1.2.4. Investment

The investment function is specified based on the accelerator principle. The choice is based on the fact that it underscores the role of output in investment decision. This is important in Sierra Leone as it is a developing country without a capital market. Hence, there is no information on the Tobin's q, which summarises information regarding the expected profitability of investment. Thus, the growth of the economy instead of the Tobin's q serves as an indicator of the expected profitability of investment.

The simplest view of the accelerator principle considers capital output ratio to be fixed. Hence capital and output are related as follows:

$$K_t^* = \alpha Y_t \tag{4.38}$$

Where K* is the desired capital stock, Y is output and α is the capital-output ratio. This implies that in the previous period, t-1, the capital stock is given as:

$$K_{t-1} = \alpha Y_{t-1} \tag{4.39}$$

But net investment, I , is the change in capital stock between periods. That is:

$$I_t = K_t^* - K_{t-1} \tag{4.40}$$

Substituting (4.38) and (4.39) in (4.40) gives:

$$I_t = \alpha(Y_t - Y_{t-1}) \tag{4.41}$$

Equation (4.41) means that net investment is proportional to the growth of output. This is the accelerator principle, implying that for net investment to be positive there must be an accelerator, which is growth of output.

Though the accelerator principle is theoretically appealing, it does not capture the importance of the user cost of capital in investment behaviour. Hence, given the fact that the use of capital has cost in the form of forgone interest earning (had the capital been sold and the income saved), interest rate is included as an explanatory variable in investment function. High user cost of capital implies an increase in the opportunity cost of using capital and this dampens investment

The theory of external debt posits that high external debt is interpreted by investors as higher future tax on their investment and this discourages private investment. This is the debt-overhang hypothesis in the external debt literature. Hence, the debt-overhang variable, the debt stock-GNP ratio is included in the investment model. External debt servicing by the government

is expected to reduce resources available for public investment. Therefore, the external debt service-GNP ratio is included in the aggregate investment function in order to account for the effect of debt servicing on investment. The price level is included in the aggregate investment model in order to capture the effect of price on investment. It is expected that higher price level leads to higher expected price level and this is interpreted as a signal of macroeconomic stability. Hence investment is reduced. Moreover, higher expected price level emanating from higher current price level reduces the real interest rate. Thus, saving and hence investment is reduced. An impulse dummy variable that captures the effect of the war on investment in Sierra Leone is also introduced into the investment model. It is expected that investment is lower in the war period than the non-war period.

The aggregate investment function is therefore given as follows:

$$LnI_t = \delta_0 + \delta_1 LnY_t + \delta_2 Lni_t + \delta_3 LnP_t + \delta_4 LnEDGNP_t + \delta_5 LnDSGNP_t + \delta_6 DWAR_t + U_5 \quad (4.42)$$

$$\delta_{1,} > 0 \text{ and } \delta_2, \delta_{3,} \delta_4, \delta_5, \delta_{6,} < 0$$

Where EDGNP is debt stock-GNP ratio, DSGNP is debt-service-GNP ratio, DWAR is the war dummy, taking a value of 0 in non-war period and 1 in the war period. All other variables are defined as earlier.

4.1.2.5 Government revenue

Government revenue is postulated to be a function of import and income. The use of imports in the government revenue function is based on the fact that import taxes have been the main source of tax revenue in Sierra Leone. Income is included as a determinant of government revenue because the higher the level of income, the better is the efficiency of the tax system and this increases government revenue. Grant has been a major source of government revenue in Sierra Leone. Hence it is introduced as an explanatory variable in the government revenue function.
The government revenue function is therefore given as follows:

$$LnGR_t = \gamma_0 + \gamma_1 LnM_t + \gamma_2 LnY_t + \gamma_3 LnGRANT + U_6 \quad (4.43)$$

$$\gamma_{1,} \gamma_2, \gamma_3 > 0 \text{ and } \gamma_4 < 0$$

Where GR = government revenue, GRANT is the size of grant and the other variables are defined as earlier.

4.1.2.6 Trade balance

The difference between exports (X) and imports (M) is the trade balance (TB)
That is:

$$T = X - M \tag{4.44}$$

4.1.2.7 Export Function

Exports of Sierra Leone are mainly primary products and on the average more than 50 % of export revenue comes from diamond. Moreover, the volume of diamond and other mineral exports is beyond the control of domestic exporters. This is because they are not determined by relative prices (real exchange rate) but by quota considerations. Aggregate export (X) is therefore divided into diamond export (DX), non-diamond mineral-export (NDMX)-rutile, bauxite, gold, iron ore and ilmenit- and non-mineral exports (NMX)-which is dominated by agricultural export. That is:

$$X = DX+NDMX+NMX \tag{4.45}$$

Where X = total exports, DX= diamond exports, NDMX= non-diamond mineral exports and NMX = non-mineral exports. Both diamond exports (DX) and non-diamond mineral-exports (NDMX) are considered to be exogenous in the model.

The theoretical framework for modeling Non-mineral export (NMX) is the traditional model of export demand and supply, where real exports are traditionally determined by demand and supply factors. On the demand side, real exports depend on a measure of foreign economic activity, which is normally a weighted average of the incomes of the trading partners of a country and the real exchange rate. An increase in foreign income is expected to increase export volume by increasing demand for export while a real depreciation of the domestic currency is expected to increase export volume since domestic goods becomes cheaper to residents abroad.

That is: $$X^d = X^d(Y^f, RER) \quad (4.46)$$

$$\frac{\partial X^d}{\partial Y^f} > 0, \frac{\partial X^d}{\partial RER} > 0$$

Where X^d , Y^f and RER are export demand , foreign economic activities and real exchange rate respectively.

On the supply side, the traditional model posits that the price of exports relative to that of domestic product (P_x/P_d) is the determinant of real exports. That is:

$$X^s = X^s(\frac{P_x}{P_d}) \quad (4.47)$$

$$\partial X^s / \partial(P_x/P_d) > 0$$

At equilibrium in the export market, supply and demand are equal. That is:

$$X^d = X^s = X \quad (4.48)$$

Hence the export function is given as:

$$X = X\left(Y^f, RER, P_x/P_d\right) \quad (4.49)$$

$$+ \quad + \quad +$$

Where, the signs below the variables are the *a priori* expectations.

The traditional export demand model is modified by including real exchange rate misalignment and volatility. The inclusion of real exchange rate misalignment is to capture the fact that overvaluation of domestic currency undermines export performance. The theoretical literature on the effect of exchange rate volatility on export is split. On the one hand, increase in risk associated with volatility leads to diversion of resources to less risky activities since it creates uncertainty on future export receipts in domestic currency. On the other hand, it has been argued that higher risk increases opportunity for profits and this increases exports (for example, De Grauwe, 1994).

In linear form, the non-mineral export function is therefore given as:

$$LnNMX_t = \tau_0 + \tau_1 LnY_t^f + \varepsilon_2 LnRER_t + \varepsilon_3 LnRMIS_t + \varepsilon_4 L\,n\left(\frac{P_x}{P}\right) + \varepsilon_5 RVOL + U_7 \quad (4.50)$$

$\tau_1, \tau_3 > 0$, $\tau_2 > 0$ and $\tau_4 >/< 0$.

Where X is real export, Y^f is trade weighted average of incomes of the major export partners of Sierra Leone (Four major trading partners are considered), RER is the real effective exchange rate, RMIS is real exchange misalignment, P is domestic price level, P_x is export price, RVOL is real exchange rate volatility.

Real exchange rate misalignment is calculated on a model based approach by first estimating the long run equilibrium real exchange rate and calculating the real exchange rate misalignment as the difference between actual and equilibrium real exchange rate, divided by the equilibrium real exchange rate (multiplied by 100). Unlike the actual real exchange rate, the (long-run) equilibrium real exchange rate is unobservable. Hence the long run equilibrium real exchange rate is modeled drawing on the idea in the literature, that the long run equilibrium real exchange rate is a function of real variables only, first developed by Dornbusch (1973) and later by Edwards (1989), Rodriguez (1989), Elbadawi (1994) and Montiel (1999). These variables, as suggested by the literature, include capital flow, terms of trade, trade policy, government consumption, capital accumulation and output growth. Given the sample size and the number of real variables of the equilibrium (long run) real exchange rate model, the static approach to the estimation of long run coefficients of the equilibrium real exchange rate rather than the Johansen Maximum Likelihood procedure is used. It is noted that the (long-run) equilibrium real exchange rate is that rate which ensures that there is internal and external balance given that the real exchange rate fundamentals are at their sustainable (trend) values. Hence, following the estimation of the long run equilibrium exchange rate, the real exchange rate fundamentals are decomposed into sustainable (trend) and cyclical components using the Hodrick-Prescott filter. The trend values are then substituted into the estimated long run model of real exchange rate to obtain the equilibrium real exchange rate. Given the values of the long run equilibrium real exchange rate and the actual real exchange rate the real exchange rate misalignment is then computed.

The measure of real exchange rate volatility is obtained by estimating a Generalised Autoregressive Conditional Heteroscedasticity (GARCH) model of real exchange rate (Bollerslev, 1986 gives a detailed discussion of measurement of volatility of a variable in the GARCH context).

4.1.2.8 Import Demand Function

The import demand function follows the traditional specification that import demand depends on income and the real exchange rate. The traditional import demand function posits that an increase in income increases import demand and an increase in the real exchange rate (real depreciation) leads to switching of expenditure from imports to domestic goods and import demand reduces. This is referred to as the relative price effect on import[21]. The traditional import demand function is modified by controlling for the role of exchange rate misalignment. The modification is to capture the fact that overvaluation of the domestic currency does not only reduce exports but it increases imports given that it provides wrong signals to investors (Ghura and Grennes 1993). According to Hemphill (1974), imports of developing countries are constrained by low foreign exchange. The Two-Gap model underscores this as a constraint to the development of the developing economies. This arises from the fact that they need foreign exchange to import raw material, capital goods and intermediate products for domestic production. Foreign exchange is therefore introduced into the import demand function to account for this phenomenon.

The import demand function is therefore given as follows:

$$LnM_t = \varepsilon_0 + \varepsilon_1 LnY_t + \varepsilon_2 Ln\left(RER\right)_t + \varepsilon_3 Ln\left(RMIS\right)_t + \varepsilon_4 Ln(FX) + U_{8t} \qquad (4.51)$$

$$\varepsilon_1\ \varepsilon_3,\ \varepsilon_4 > 0 \text{ and } \varepsilon_2 < 0$$

Where M = import, RER = real exchange rate, RMIS = real exchange rate misalignment, FX = the amount of foreign exchange and Y is domestic real income.

[21] It has been argued by proponents of the elasticity pessimism that the relative price coefficient is very low in developing countries since most of their imports are capital goods and raw materials. Hence they consider that a rise in relative price does not have significant effect on import reduction.

4.1.2.9 Overall balance of payments

The theories of balance of payments that came up before the 1970s (the relative price approach, the income approach, the Lausen-Metzler synthesis and the absorption approach) pay attention to only the goods sector and consider the trade balance to be the balance of payments. The monetary approach to the balance of payments (Johnson 1972 and IMF 1977) recognises the role of the monetary sector and considers the overall balance of payments position as the change in foreign reserve. The definition of money supply for an open economy gives the link between the balance of payments and the monetary sector of an open economy. That is, money supply is the sum of foreign reserve and domestic credit, assuming that the money multiplier is unity (for simplicity).

Sierra Leone has been having budget deficit since the early 1970s, and it has mostly been financed by government borrowing from the banking sector. The result of this is monetary expansion, which has inflation as a consequence. This increases disequilibrium in the money market with balance of payments deterioration as a consequence. Hence, the foreign reserve (which gives the balance of payments position in broad terms) function is specified on the framework of the monetary approach to the balance of payments (MABP).The MABP argues that disequilibrium in the balance of payments is a monetary phenomenon and not a real phenomenon. That is, balance of payments disequilibrium emanates from disequilibrium in the money market.

The MABP specifies a money supply identity, money demand function and uses the equilibrium condition in the money market to derive a reserve-flow equation in which the coefficient of domestic component of money supply is expected to be minus one. The structure of the model is as follows.

$$L = f(Y,i) \quad (4.52)$$

$$M^s = h.H \quad (4.53)$$

$$H = FR + DC \quad (4.54)$$

$L = M^s$ (4.55)

Where: L is demand for money, Y is real income, i is interest rate, M^s is money supply, h is money multiplier, H is high powered money, FR is International Reserve and DC is domestic credit.

Equation (4.52) is the demand for money function, equation (4.53) is the money supply identity, equation (4.54) is the high-powered money definition and equation (4.55) is the equilibrium condition in the money market.

Substituting (4.54) into (4.53) gives $M^s = h\ (FR+DC)$ (4.56)

By setting h = 1 for simplicity, this does not change the result of the model, equation (4.56) becomes: $M^s = (FR+DC)$ (4.57)

Substituting (4.52) and (4.57) in (4.55) gives:

$f\ (Y, i) = FR + DC$ (4.58)

Expressing this in flow terms and solving for change in reserve gives the fundamental equation of the monetary approach to the balance of payments, given in equation (4.59). It states that balance of payments disequilibrium is the result of divergence between growth of money demand and growth of domestic credit. Moreover, the domestic component of money supply is related one-for-one in opposite direction with the balance of payments. Furthermore, increase in factors that increase the demand for money improves the balance of payments while increase in factors that decrease the demand for money deteriorates the balance of payments.

$\Delta FR = \Delta f(Y,i) - \Delta DC$ (4.59)

The monetary approach to the balance of payments posits that the balance of payments is affected positively by factors that increase the demand for money and negatively by domestic credit. The traditional determinants of money demand are income and interest rate. The price level is included among the explanatory variables in order to account for the fact that in a high inflationary developing-economy, like Sierra Leone, inflation is an opportunity cost variable in the money demand function. An increase in price level reduces the demand for money in favour of physical assets.

The nominal exchange rate is included as an explanatory variable on the basis that nominal exchange rate depreciation encourages the sale of available foreign currency in hands of the private sector. Thus, the substitution of foreign currency holdings with domestic money increases and the demand for money increases. Therefore, ceteris paribus, the balance of payments improves. This is the direct effect of exchange rate on the overall balance of payments; it works through the money-market channel via currency substitution.

The balance of payments function is therefore given as follows:

$$LnFR_t = \eta_0 + \eta_1 LnY_t + \eta_2 Lni_t + \eta_3 LnP_t + \eta_4 Lne_{t+} + \eta_5 LnDC_{t+} + U_{9t} \quad (4.60)$$

$$\eta_1,\ \eta_4 > 0 \quad \text{and} \quad \eta_2,\ \eta_3,\ \eta_5 < 0$$

Where, all the variables are defined as earlier.

4.1.2.10 Money supply

The framework for the determination of the money supply process is the consolidated balance sheet of the monetary authorities (the central bank and the commercial banks) because it has been identified as superior to the money multiplier approach in most developing countries. For example, Fry (1985) posits that for countries where the central bank has not followed any macroeconometric model for monetary policy purposes and the interest rates are administratively fixed for long, the money multiplier approach is inappropriate for modelling money supply behaviour. Based on these observations in Nigeria, Ogun and Adenikinju (2005) have used this approach to determine the money supply behaviour for Nigeria. Sierra Leone falls under this category- interest rates were administratively determined by the government for long, until 1992. This provided cheap credit from the banking sector to the government. According to the monetary survey (the consolidated balance sheet of the banking system), money supply is the sum of three asset components minus a liability component. That is:

$$\Delta M_t^S = \Delta DCp_t + \Delta NDCg_t + \Delta NFA_t - \Delta NOI_t \quad (4.61)$$

This implies that $M_t^S = M_{t-1}^S + \Delta DC_t + \Delta NFA_t - \Delta NOI_t$ (4.62)

Where $\Delta DC_t = \Delta DCp_t + \Delta NDCg_t$ (4.63)

Net domestic credit to the government is given as net claims by the government.

That is: $\Delta NDCg_t = (G - GR)_t - NEB_t$ (4.64)

Where M^s is money supply (broadly defined), DC is total domestic credit, DCp is domestic credit to the private sector, NDCg is net domestic credit to the government, NFA is net foreign asset, NOI is net other items, which is the liability component of the monetary survey and (G-GR) is government fiscal deficit excluding grants. Substituting (4.64) into (4.63) and simplifying gives:

$$DC_t = DC_{t-1} + (G - GR)_t - NEB_t + \Delta DCp_t \quad (4.65)$$

4.1.3 The inherent logic of the macroeconomic model

The way the exchange rate works in the model, to affect the external sector, is discussed in this sub-section. Consider for example that there is depreciation in the nominal exchange rate. This depreciates the real exchange rate according to equation (4.14), which is the direct effect of nominal exchange rate depreciation on the real exchange rate. However, the depreciation of the nominal exchange rate raises the domestic price level in the exchange-rate pass-through sense, according to equation (4.22). The rise in the price level appreciates the real exchange rate according to equation (4.14). To the extent that the direct effect of the nominal exchange rate is contrary to the indirect effect the ultimate effect of the nominal exchange rate depreciation on the real exchange rate is indeterminate.

Suppose the nominal depreciation leads to real depreciation. This increases non-mineral exports according to equation (4.50) and total exports therefore increases according to equation (4.45) while total imports fall according to equation (4.51). Hence, the trade balance improves according to equation (4.44). The increase in trade balance increases income according to equation (4.23). The increase in price from the exchange rate depreciation decreases private consumption according to equation (4.36) while the increase in income, emerging from the improvement in the trade balance by expenditure switching, increases private consumption. Moreover, the increase in income reduces price level according to equation (4.22) and private consumption increases. Thus, the impact of the initial real depreciation on private consumption is

indeterminate since the price and income effects move in opposite direction and the positive income effect translates into price effect, which has negative effect on private consumption. The increase in income flowing from the improvement in the trade balance also increases government consumption according to equation (4.37) and both the nominal exchange rate depreciation and the increase in price that emanates from it increase government consumption according to equation (4.37). Hence the effect of the nominal exchange rate depreciation on aggregate consumption is indeterminate according to equation (4.24).

Since the effects of price and income on investment are opposite in sign, the effect of the nominal exchange rate depreciation on investment is indeterminate according to equation (4.42). To this end, the effect of the nominal depreciation on absorption is indeterminate according to equation (4.25). The increase in income increases imports according to equation (4.45) and the trade balance deteriorates according to equation (4.44). This effect is in contrast with the first round effect of the real depreciation on the trade balance, where export increased and imports reduced. Hence the ultimate effect of the nominal depreciation that led to real depreciation is ambiguous as it is a combination of both the first and second round effects.

To the extent that the effects of the nominal exchange rate depreciation on income and import are indeterminate, the effect of a nominal depreciation on government revenue is also indeterminate according to equation (4.43). If government revenue increases, given government expenditure, there will be a reduction of net domestic credit to the government according to equation (4.64), which reduces total domestic credit according to equation (4.63). Hence, money supply reduces according to equation (4.62). Thus, the price level reduces according to equation (4.22), and this leads to real depreciation, leading to another round of movement of the macro variables with ultimate effects on most of the variables being unknown a priori. The indeterminate results arise from the fact that both direct and indirect effects are involved in the transmission mechanism of the exchange rate changes. Suppose government revenue decreases, the increase in fiscal deficit increases net domestic credit to the government according to equation (4.64) and this increases total domestic credit according to equation (4.63). Hence money supply increases according to equation (4.62) and this increases the price level according to equation (4.22). Thus, the real exchange rate appreciates according to equation (4.14). This eventually has ambiguous ultimate effects on key macro-variables including the trade balance.

To the extent that a nominal exchange rate depreciation directly increases the price level while its ultimate effects on income and government revenue (and hence domestic credit) are ambiguous, its ultimate effect on the overall balance of payments (foreign reserves) is ambiguous according to equation (4.60).

The conclusion from the logic of the model is that a depreciation of the nominal exchange rate leads to an increase in price level, making the total effect on the real exchange rate ambiguous. If it brings real depreciation, income initially increases as a result of expenditure switching but its ultimate effects on consumption, investment, income, trade balance, overall balance of payments and government revenue are indeterminate. Moreover, if fiscal authorities use the monetary authorities to finance fiscal deficit, the real exchange rate will appreciate, when fiscal deficit increases, thus worsening an initial external-imbalance. This is referred to in the literature as the Twin-Deficit problem.

Figure 4.1 shows a schematic illustration of the inherent logic of the macroeconomic model while Tables 4.1 and 4.2 show the complete structure of the model and definition of variables respectively.

Figure 4.1: Flow Chart Showing the Inherent Logic of the Model

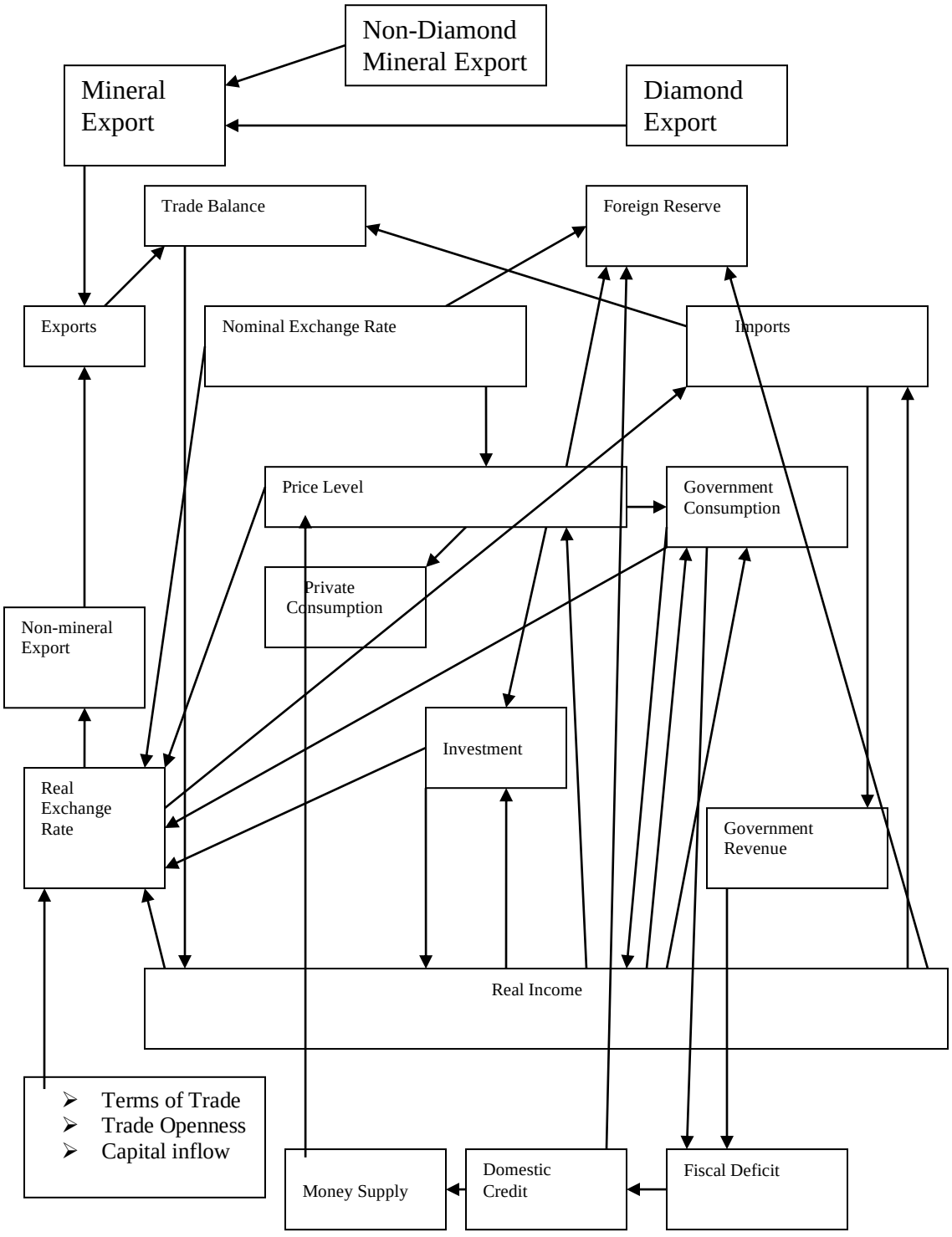


Table 4.1: The Complete Structure of the Macroeconomic Model

A. The Stochastic Equations

1. $LnP_t = \lambda_0 + \lambda_1 LnM_t^S + \lambda_2 LnY_t + \lambda_3 Lne_t + \lambda_4 Lni_t + U_{2t}$

   $\gamma_1, \gamma_3, \gamma_4 > 0 and \gamma_2 < 0$

2. $LnRER_t = \varpi_0 + \varpi_1 Ln(TOT)_t + \varpi_2 Ln(G/GDP)_t + \varpi_3 Ln(CAPFLO/GDP)_t +$
   $\varpi_4 Ln(CLOSE)_t + \varpi_5 Ln(Y_g)_t +$
   $\varpi_6 Ln(I/GDP)_t + (1-\Psi) Ln(RER)_{t-1} +$
   $\Omega LnP_t + \Phi\left(Lne_t - Lne_{t-1}\right) + U_{1t}$

   $\varpi_1 >/< 0,\ \varpi_2 >/< 0,\ \varpi_3 < 0,\ \varpi_4 < 0,\ \varpi_5 < 0, \varpi_6 >/< 0,\ 0 < \Psi < 1,\ \Omega < 0$ and $\Phi > 0$.

3. $\mathrm{LnCp}_t = \beta_0 + \beta_1 \mathrm{LnY}_t + \beta_2 LnP_t + \beta_3 LnY_{t-1} + \beta_4 Lni_t + \beta_5 DWAR + U_{3t}$

   $\beta_1, \beta_3 > 0$, β_2 , $\beta_5 < 0$ and $\beta_4 >/< 0$

4. $LnCg_t = \varphi_0 + \varphi_1 LnP_t + \varphi_2 Lni_t + \varphi_3 Lne_t + \varphi_4 LnY_t + \varphi_5 LnGR_t + \varphi_6 DWAR_t + U_{4t}$

   $\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_6 > 0$

5. $LnI_t = \delta_0 + \delta_1 LnY_t + \delta_2 Lni_t + \delta_3 LnP_t + \delta_4 LnEDGNP_t + \delta_5 LnDSGNP_t + \delta_6 DWAR_t + U_{5t}$

   $\delta_1 > 0$ and $\delta_2, \delta_3, \delta_4, \delta_5, \delta_6 < 0$

6. $LnGR_t = \gamma_0 + \gamma_1 LnM_t + \gamma_2 LnY_t + \gamma_3 LnGRANT + U_{6t}$

   $\gamma_1, \gamma_2, \gamma_3 > 0$ and $\gamma_4 < 0$

7. $LnNMX_t = \tau_0 + \tau_1 LnY_t^f + \tau_2 LnRER_t + \tau_3 LnRMIS_t + \tau_4 L\mathrm{n}\left(\frac{P_x}{P}\right) + \tau_5 RVOL + \tau_6 DWAR + U_{7t}$

   $\tau_1, \tau_2, \tau_4 > 0, \tau_3, \tau_6 < 0$ and $\tau_5 >/< 0$

8. $LnM_t = \varepsilon_0 + \varepsilon_1 LnY_t + \varepsilon_2 Ln\left(RER\right)_t + \varepsilon_3 Ln\left(RMIS\right)_t + \varepsilon_4 Ln(FX) + \varepsilon_5 DWAR + U_{8t}$

   $\varepsilon_1\ \varepsilon_3$, $\varepsilon_4 > 0$ and ε_2 , $\varepsilon_5 < 0$

9. $LnFR_t = \eta_0 + \eta_1 LnY_t + \eta_2 Lni_t + \eta_3 LnP_t + \eta_4 Lne_t + \eta_5 LnDC_t + U_{9t}$

   η_1 , $\eta_4 > 0$ and η_2 , η_3 , $\eta_5 < 0$

B. Identities

10. $Y = C + I + X - M$
11. $C = Cp + Cg$
12. $A = C + I$
13. $T = X - M$
14. X = DX+NDMX+NMX
15. $M_t^S = M_{t-1}^S + \Delta DC_t + \Delta NFA_t - \Delta NOI_t$
16. $\Delta DC_t = \Delta DCp_t + \Delta NDCg_t$
17. $\Delta NDCg_t = (G - GR)_t - NEB_t$

Table 4.2: The Description of the Variables in the Macroeconomic Model

Endogenous Variables

RER = Real Exchange Rate
P = Consumer Price index (2000=100)
Y = Aggregate income
C = Aggregate consumption
I = Aggregate Investment
A = Domestic Absorption
Cp = Private Consumption
Cg = Government Consumption
GR = Government Revenue
M = Import
NMX= Non-Mineral Exports
X = Aggregate Export
T = Trade balance
M^s = Money Supply (M2)
NDCg= Net Domestic Credit to the Government
DC = Domestic Credit
FR = Foreign Reserve

Exogenous Variables

e = nominal exchange rate
i = nominal interest rate
EDGNP = Ratio of total external debt to GNP
DSGNP = Ratio of debt service to GNP
DCp = Domestic credit to the private sector
DX= Diamond Export
G = Government expenditure
GRANT = Total Grant
NDMX = Non-diamond mineral exports
(G/GDP) = Share of government expenditure in GDP
(I/GDP) = Share of investment in GDP
(CAPFL/GDP)= Ratio of capital flow to GDP
CLOSE = Closeness of the economy to international trade
NFA= Net Foreign Assets
NOI= Net other items
NEB = Net external borrowing
(Px/P)= Ratio of export price to domestic price
RMIS = Real Exchange Rate Misalignment
FX = Foreign Exchange
RVOL = Real Exchange Rate Volatility
TOT = Terms of trade
Y^f = Foreign Income
DWAR = War Dummy

4.1.4 Estimation method for the macroeconomic model

Econometric estimation of a model using time series data requires that the data series be stationary. Estimation using non-stationary time series data results to misleading inferences since the standard errors of the coefficients estimated by Ordinary Least Squares (OLS) regression are biased. To address this problem, Engle and Granger (1987) have provided a standard technique. The idea is to test the variables of an equation for stationarity. If they are not stationary, tests for cointegration follows. This test determines whether a linear combination of the variables is stationary in spite of the fact that the individual series are not stationary. The existence of cointegration implies that there is a long run relationship between the dependent variable and the regressors. Hence, according to the Granger representation theorem, the short-run dynamics can be described by an error-correction model, which can be estimated using OLS. But if there is no cointegration, OLS is applied to the differences of the variables to obtain the short-run model.[22]

However, when an equation belongs to a system of simultaneous equation, the use of OLS for estimation becomes inappropriate since it will be biased and inconsistent (it overestimates the coefficients). To this end, the Three Stage Least Squares (3 SLS) is employed to estimate the system of equations after the tests for unit root and cointegration.

In a system of simultaneous equation model the effect of an exogenous variable on an endogenous variable often has both direct and indirect effects. Hence the ultimate or total effect of a change in an exogenous variable, on endogenous variables in a system of equation, is not determined by the signs and significance of the structural parameters. One way of determining this ultimate impact is by the estimation of the reduced form of the structural model using OLS. But this method does not reveal anything about the structural relationship between the variables in the model. Moreover, it leaves out the dynamic aspect of the impact of exogenous variables on endogenous variables. Based on these drawbacks, policy simulations following the estimation of structural models is more appropriate in determining the impact of exogenous variables on endogenous variables in a system. This captures both direct and indirect effects and also gives the dynamic impact of a variable on endogenous variables.

[22] The first difference form is used for variables that are integrated of order one but for variables that are integrated of order two, their second differences are used.

The estimation of the macroeconomic model follows these estimation issues. That is, both the issue of stationarity of variables and cointegration, and accounting for simultaneity bias are the cornerstones of the estimation of the open-economy macro model specified.

4.2 The equilibrium real exchange rate model

4.2.1 Theoretical framework for the equilibrium real exchange rate model

The previous four sub-sections of this chapter deal with the specification and method of estimation of the equations of the small macroeconometric model that is estimated and used for simulating the effects of some exogenous variables on the real exchange rate, trade balance and overall balance of payments. This sub-section explicitly deals with the determination of the (long run) equilibrium real exchange rate and real exchange rate misalignment. The idea is to investigate the factors that determine the equilibrium real exchange rate (and hence real exchange rate misalignment and assess the degree of overvaluation or undervaluation of the real exchange rate of Sierra Leone from the early 1970s to 2005.

The theoretical framework for investigating the determinants of the equilibrium real exchange rate is the basic tradable-non-tradable goods model of Elbadawi (1994) and earlier by Dornbusch (1973) and Rodriquez (1989). This choice is informed by the fact that other theoretical frameworks for modeling equilibrium real exchange rate (for example, Edwards, 1989, and Montiel, 1999) have the same prediction with this model, while this model is the earliest and is widely used as theoretical framework for modeling the equilibrium real exchange rate. The model predicts that the long run equilibrium real exchange is a function of only real variables, which have both domestic-policy aspect and foreign-factor aspect.

The tradable-non-tradable goods model (Elbadawi, 1994, Rodriquez, 1989 and Dornbusch, 1973) assumes a small country and considers the economy to have traded goods and non-traded goods. Traded goods are further disaggregated into exportables and importable. By assuming a given level of capital flow, it gives the equilibrium exchange rate that solves the equilibrium condition in the goods market with static expectation.

The model starts with the identity that private domestic expenditure (EXP_p) plus government domestic expenditure (EXP_G) is nominal domestic absorption (A). That is:

$$A = EXP_G + EXP_p \quad (4.66)$$

It considers government domestic expenditure to be a fixed ratio, g, of output (Y). That is:

$$EXP_G = g.Y \quad (4.67)$$

Government expenditure on nontradables (EXP_{GN}) is taken to be a fixed ratio of total government expenditure (EXP_G). That is:

$$EXP_{GN} = g_{N.}g_{.Y} \quad (4.68)$$

Unlike the case of government expenditure on nontradables relative to total government expenditure (EXP_{GN} / EXP_G), the private sector expenditure on nontradables relative to total private sector expenditure (EXP_{PN} / EXP_p) is endogenous and is a function of the domestic prices of exports (P_x), imports (P_m) and nontradables (P_N). That is:

$$\frac{EXP_{PN}}{EXP_P} = d_{PN}(P_X, P_M, P_N) \quad (4.69)$$

This implies that: $$EXP_{PN} = d_{PN}(P_X, P_M, P_N)\, EXP_P \quad (4.70)$$

From equations (4.66) and (4.67), equation (4.70) can be written as :

$$EXP_{PN} = d_{PN}(P_X, P_M, P_N)(A - g.Y) \quad (4.71)$$

The demand for nontradable goods is given as the sum of demand from the private sector and demand from the government sector for nontradable goods. That is:

$$EXP_N = EXP_{PN} + EXP_{GN} \quad (4.72)$$

From equations (4.71) and (4.68), equation (4.72) can be written as follows:

$$EXP_N = d_{pN}(P_X, P_M, P_N)[A - g.Y] + g_N.g.Y \quad (4.73)$$

The supply of nontradable goods (S_N) relative to output is considered to be a function of the three aggregate prices: price of exports (P_x), price of imports (P_M) and price of nontradable (P_N). That is:

$$\frac{S_N}{Y} = S_N(P_X, P_M, P_N) \quad (4.74)$$

Hence the supply of tradable goods is given as:

$$S_N = S_N(P_X, P_M, P_N).Y \quad (4.75)$$

The equilibrium condition in the nontradable goods market is that the total demand for non tradable goods (EXP_N) is equal to the supply of nontradable goods (S_N). This is obtained by equating equations (4.73) and (4.75) and dividing the result by Y. This gives:

$$S_N(P_X, P_M, P_N) = d_{PN}\left(P_X, P_M, P_N\right).\left[\frac{A}{Y} - g\right] + g_N.g \qquad (4.76)$$

The domestic price of exports and imports are given respectively as:

$$P_X = E\left(1 - t_X\right)P^*_X \qquad (4.77)$$

$$P_M = E\left(1 + t_M\right)P^*_M \qquad (4.78)$$

Where E is the nominal exchange rate, defined as foreign currency per unit of domestic currency, P^*_X and P^*_M are international prices of exportables and importables respectively and t_x and t_M are the net export and import tax rates.

Equations (4.77) and (4.78) imply that for a given set of exchange rate and commercial policies, the corresponding domestic prices, P_X and P_M are determined by P^*_X and P^*_M and these international prices are exogenous given the small country assumption in the model[23].

The real exchange rate (e) is defined in the model as the price of nontradables (P_N) relative to the price of tradables (P_T) .That is,

$$e = \frac{E.P_N}{P_T} \qquad (4.79)$$

The price of tradables is a weighted average of the price of export and the price of import since tradables constitute import and export. That is:

$$P_T = {P_X}^{*\alpha}\,{P_M}^{*(1-\alpha)} \qquad (4.80)$$

$$0 < \alpha < 1$$

Substituting (4.80) into (4.79) gives the real exchange rate to be given as:

$$e = E\left(\frac{P_N}{{P_X}^{*\alpha}\,{P_M}^{*(1-\alpha)}}\right) \qquad (4.81)$$

Equations (4.76) through (4.81) can be solved for the level of real exchange rate that yields instantaneous equilibrium in the non-traded goods market for given levels of the exogenous and policy fundamentals to obtain:

[23] A small country is one that does not affect the international prices of exportables and importables by changing its trade volume. Hence it faces exogenous international prices of exportables and importables.

$$e = e\left(\frac{A}{Y}, \frac{P_X^*}{P_M^*}, t_X, t_M, \frac{EXP_{GN}}{EXP_G}, \frac{EXP_G}{Y}\right) \qquad (4.82)$$

$$(+)\ (?)\ (+)\ (+)\quad (+)\qquad (?)$$

This theoretical model is modified in several ways to obtain the empirical equilibrium (long run) real exchange rate model. First, we define real exchange rate here as in Edwards (1989) where the real exchange rate is the price of tradables relative to the price of nontradables instead of the price of nontradables relative to tradables. Thus, an increase in the real exchange rate is depreciation while a decrease is an appreciation. Hence, the signs of the coefficients of the variables in equation (4.82) are opposite of those in our empirical model. Second, domestic absorption is disaggregated into aggregate investment and aggregate consumption but aggregate consumption is dropped in the model because it has not been used in empirical models that use domestic investment in equilibrium real exchange rate models. Third, supply side factors and capital flow are included in the empirical model since they are not controlled for in the tradable-non-tradable goods model. The importance of supply side factors on the equilibrium real exchange rate is to capture the Balassa-Samuelson effect. This states that improvement in technological progress, measured by growth in output and considered to take place in the tradable goods sector appreciates the equilibrium real exchange rate. Capital flows captures the relevance of the Dutch disease syndrome. According to the Dutch disease hypothesis, increase in capital inflow appreciates the equilibrium real exchange rate.

The choice of proxies for variables in the theoretical model is guided by the empirical literature. The foreign trade tax variables in the theoretical model are captured by the index of the closeness of the economy to international trade (that is, GDP as a ratio of the sum of export and import). To the extent that it is difficult to find proxy for government consumption of non-tradables in Sierra Leone, this variable is left out in the empirical model. The equilibrium (long run) real exchange rate model that is estimated is therefore given as:

$$LnRER^* = h_0 + h_1 Ln(I/GDP) + h_2 Ln(TOT) + h_3 Ln(CLOSE) +$$
$$h_4 Ln(G/GDP) + h_5 Ln(CAPFLO/GDP) + h_6 LnY_g + U \qquad (4.83)$$

Where (I/GDP) is share of investment in output, TOT is terms of trade (price of exports relative to imports), CLOSE is closeness of the domestic economy to international trade, (G/GDP) is ratio of government expenditure to output, CAPFLO/GDP is capital flow scaled by GDP, Y_g is growth of output (real gross domestic product) and U is the disturbance term, assumed to be identically and independently normally distributed with zero mean.

In what follows a discussion of the theoretical expectations of the variables in the empirical equilibrium real exchange rate model is given.

The expected sign of the coefficient of investment share (I/GDP) is ambiguous. It depends on whether investment takes place in the tradable sector or the nontradable sector. If investment is in the tradable goods sector the demand for tradable goods increases. Hence price of tradable goods increases and the equilibrium real exchange rate depreciates. If investment is in the nontradable goods sector, the demand for nontradable goods increases and the price nontradable goods increases. Thus, the equilibrium real exchange rate appreciates. According to Edwards (1989: 140), " the effect of investment on the equilibrium real exchange rate would depend on factor intensities and, consequently , on whether it took place in the tradables or nontradables goods sectors".

The expected sign of the coefficient of terms of trade (TOT) is ambiguous because an improvement in terms of trade has both income and substitution effects. The income effect of an improvement in terms of trade is that the price of exportables increases and export income increases. Thus, more is spent on all goods (that is, both nontradable goods and importables). This increases the price of nontradables and the real exchange rate appreciates. The substitution effect of an improvement in terms of trade is that the price of importables decreases. This increases import demand while the demand for nontradable goods falls. The fall in demand for nontradable goods decreases the price of nontradables. Hence, the equilibrium real exchange rate depreciates. If the income effect dominates the substitution effect, the equilibrium real exchange rate appreciates as result of the improvement in the terms of trade. Otherwise, the real exchange rate depreciates.

The expected sign of the coefficient of closeness of the economy to international trade (CLOSE) is negative. When closeness, which is a proxy for trade policy, decreases the demand for imports is expected to rise as import prices fall. This creates trade deficit. It is akin to reduction of tariffs or removal of quantitative restrictions when the economy is at external

equilibrium. To restore external balance, the relative price of tradable goods increases. Hence the equilibrium real exchange rate depreciates.

The expected sign of the coefficient of government expenditure (G/GDP) on the equilibrium real exchange rate is indeterminate. This variable measures the direct effect (real effects) of fiscal stance on the equilibrium real exchange rate. This impact is different from the indirect effect, whereby fiscal expansion leads to excess domestic credit through fiscal-deficit monetisation and increases in the general price level, thus appreciating the actual real exchange rate but not the long run equilibrium real exchange rate. Hence, unlike the indirect effect, the direct effect of fiscal policy (real effects) is connected to the equilibrium but not the actual (short run) real exchange rate. It is the real aspect of fiscal policy that affects the equilibrium real exchange rate (Edwards, 1989). An increase in government expenditure on tradable goods increases the demand for tradable goods (the importables but not exportables). This increases the price of tradable goods. The increase in the price of tradable goods depreciates the equilibrium real exchange rate. On the other hand, if the increase in government expenditure is on nontradable goods there will be excess demand for nontradable goods. This increases the price of nontradable goods. Hence the equilibrium real exchange rate appreciates.

The expected sign of the coefficient of capital flow (CAPFLO/GDP) is negative. Capital inflows lead to an excess supply of foreign currency under a floating exchange rate regime and the real exchange rate appreciates. Under a fixed exchange rate regime, capital inflow leads to an increase in money supply since money supply is domestic credit plus foreign reserve (foreign reserve increases as capital flow increases). The increase in money supply increases the price of non-tradables and the equilibrium real exchange rate appreciates. According to Fosu (1992), when an economy makes transfer to the rest of the world the current account deteriorates and real income decreases. This reduces expenditure on nontradables. Hence price of nontradables decreases and the real exchange rate depreciates. On the other hand, capital inflow leads to increase in real income, this increases expenditure on nontradable goods. Hence the demand for nontradable goods increases and the price of nontradable goods increases. Thus, the equilibrium real exchange rate appreciates.

The expected sign of the coefficient of output growth (Y_g) is indeterminate since growth of output could come from either tradable goods or nontradable goods. The Ricardo-Balassa effect assumes that growth of output represents technological progress and technological

progress takes place in the tradable goods sector. Hence a negative relationship is expected to exist between the growth of output and the equilibrium real exchange rate. The idea of the Ricardo-Balassa effect is that a productivity shock that increases production of tradable goods relative to nontradable goods appreciates the equilibrium real exchange rate. This is because as the output of the tradable goods increases the demand for labour in this sector increases. This increases real wage in the tradable-goods sector and there will be shift in labour from the nontradable goods sector to the tradable goods sector. Hence, output in the tradable goods sector expands, leading to a fall in the price of tradable goods while the price of nontradable goods increases. Hence, the equilibrium real exchange rate appreciates. Also, by increasing the production of tradable goods relative to nontradable goods, the productivity shock leads to a trade surplus and this requires real exchange rate appreciation in order to maintain the initial equilibrium. Hence, the equilibrium real exchange rate is expected to appreciate with an increase in productivity growth in the tradable goods sector relative to the non-tradable goods sector.

4.2.2 Estimation method for the equilibrium real exchange rate model

The long run equilibrium real exchange rate model is estimated by applying the Ordinary Least Squares to specified equilibrium real exchange rate model. This method is useful because the number of real variables in the specified model for a sample size of 36 makes the use of the Johansen Maximum Likelihood procedure impossible. This is basically because the latter is based on the estimation of a vector autoregressive (VAR) model, which requires sufficient number of observations.

The temporary (cyclical) components of the real exchange rate fundamentals are removed from their actual values to obtain the permanent (trend) components using the Hodrick-Prescott filter. This is done because the equilibrium real exchange rate requires that the fundamentals should be at their sustainable values. These sustainable values of the fundamentals are then substituted into the estimated long run model of real exchange rate to obtain the equilibrium real exchange rate. To the extent that the model is estimated in natural logarithm the values obtained based on the empirical model are the logarithm of the equilibrium real exchange rate. The

equilibrium real exchange rate is then obtained as the exponent of the model-based values of the logarithm of the equilibrium real exchange rate.

The misalignment of the real exchange rate is then calculated by using the formula:

$$MIS_t = \left(\frac{RER_t - RER^*_t}{RER^*_t} \right) X 100 \qquad (4.69)$$

Where RMIS is real exchange rate misalignment, RER* is equilibrium real exchange rate and RER is actual real exchange rate.

4.3 Data sources and transformation

Aggregate annual data from 1970 to 2005 were collected from International Financial Statistics CD-ROM 2007, World Development Indicators CD-ROM 2007 and Bank of Sierra Leone Bulletin, Various Issues.

The variables in the income determination identity (income, private consumption, government consumption, investment, imports and exports) are deflated by the consumer price index in order to obtain their real values. Thus, these variables enter the behavioral equations in real form. The natural logarithms of all the variables in the behavioural equations were taken and estimations were done in logarithmic form so that coefficients are interpreted as elasticities. Foreign income is calculated by taking a weighted average of the real incomes of the four major export partners of Sierra Leone: Belgium (weight of 0.7), Germany (weight of 0.15), U.S (weight of 0.1) and U.K (weight of 0.05). The weights are shares of exports to these countries[24]. The real exchange rate was calculated by using the trade weighted average of the bilateral real exchange rate between Sierra Leone and her four major trading partners (this gives the real effective exchange rate). Real exchange rate volatility was computed from a GARCH (1 0) model of real exchange rate[25] and real exchange rate misalignment was computed by using the (model-based) computed equilibrium real exchange rate and the actual real exchange rate.

[24] These weights are based on the average of exports over the period 1980 to 2005 and were obtained from World Fact Book.

[25] Appendix Table 2 shows the real exchange rate volatility model and trend.

CHAPTER FIVE

EMPIRICAL RESULTS

This chapter deals with the time series properties of the variables, the results of the estimated models, model validation and simulation exercises.

5.1 Time series properties of the variables

5.1.1 Tests for stationarity of variables

Given that the model deals with macroeconomic variables, there is need to test for the stationarity of each of the variables of the stochastic equations. The importance of this derives from the fact that estimation with non-stationary variables leads to unbiased and inconsistent estimates of the standard errors of the coefficients and this leads to misleading inferences .if appropriate technique is not applied to overcome this problem. The tests for stationarity were carried out using the Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The use of both the Dickey-Fuller class of test and the Phillips–Perron test rests on the ground that the former assumes that the residuals from the test regression are white noise while the latter makes no assumption about these residuals.

Table 5.1 and Table 5.2 show the results of the stationarity tests. The results of the Dickey–Fuller class of tests are consistent with those of the Phillips–Perron tests. The results show that real exchange rate misalignment, real income growth and debt-service-GNP ratio are stationary and the nominal exchange rate, price level and foreign income are stationary only after second differencing. All the other variables are stationary only after first differencing.

Table 5.1: Results of the Tests for Stationarity: Using Dickey- and Augmented Dickey-Fuller Tests[a]

VARIABLE		Dickey Fuller (DF) Test		Augmented Dickey Fuller (ADF) Test				CONCLUSION
				One-Lag Model		Two-Lag Model		
		With Drift	Drift and Trend	With Drift	Drift and Trend	With Drift	Drift and Trend	
Nominal Exchange Rate	Level	0.1996	-1.5600	-0.5673	-1.9847	-0.5610	-1.7293	I (2)
	ΔLevel	-2.9085	-2.8240	-2.8658	-2.7617	-1.8921	-1.7604	
	Δ^2Level	-6.2721**	-6.2192**	-6.3790**	-6.3721**	-4.6108**	-4.6708	
Real Exchange Rate	Level	-2.3050	-2.5172	-2.4536	-2.6846	-1.5429	-1.7870	I (1)
	ΔLevel	-5.8330**	-5.7941**	-5.6923**	-5.7101**	-3.5917*	-3.6978*	
Real Exchange Rate Volatility	Level	-3.1176*	-3.1766	-2.2299	-2.2944	-2.8008	-2.9189	
Real Exchange Rate Misalignment	Level	-5.7281**	-5.3330**	-4.3802**	-4.3055**	-2.7197	-2.6882	I(0)
Price Level	Level	-0.1767	-0.9117	-0.9496	-1.5136	-1.1703	-1.8135	I(2)
	ΔLevel	-2.5222	-2.4731	-1.9397	-1.9094	-1.5708	-1.5570	
	Δ^2Level	-7.4967**	-7.5036**	-5.5491**	-5.6780**	-4.4155**	-4.6408**	
Capital Flow-GDP Ratio	Level	-1.8441	-2.2079	-1.1548	-1.4452	-1.5111	-1.1747	I(1)
	ΔLevel	-8.3873**	-8.2802**	-3.9946**	-3.9328**	-3.7142**	-3.7130**	
Closeness	Level	-2.1314	-2.2855	-1.8640	-1.9382	-2.1782	-2.6160	I(1)
	ΔLevel	-6.7002**	-6.6750**	-3.7591**	-3.7821*	-3.8790**	-3.9775*	
Terms of Trade	Level	1.6517	0.1005	3.4783	1.7778	1.8788	1.3518	I(1)
	ΔLevel	-7.3815**	-10.2537**	-2.4331	-3.9649*	-1.4380	-2.9358	
Investment –GDP Ratio	Level	-2.9388	-3.1928	-1.5911	-0.9211	-1.6912	-1.6360	I(1)
	ΔLevel	-10.6514**	-10.8305**	-4.3002**	-4.3902**	-3.6240*	-3.7144**	
Government Expenditure –GDP Ratio	Level	-2.7974	-2.7655	-2.1345	-2.1152	-2.1247	-2.0873	I(1)
	ΔLevel	-7.2984**	-7.1810**	-4.4019**	-4.3258**	-4.3401**	-4.2688*	
Real Income	Level	-1.2909	-0.5432	-1.5267	-1.1549	-1.8345	-2.1468	I(1)
	ΔLevel	-4.4831**	-4.5982**	-2.6379	-2.7441	-2.7787	-2.9601	
Real Income Growth	Level	-4.4747**	-4.6213**	-2.6968	-2.8484	-2.7830	-2.9158	I(0)
Real Private Consumption	Level	-0.9485	-1.7763	-1.2187	-2.4174	-1.3285	-2.8381	I(1)
	ΔLevel	-4.2132**	-4.1305**	-3.0215*	-2.9444	-2.7555	-2.6730	
Real Government Consumption	Level	-1.4779	-1.3053	-1.2916	-0.8758	-1.7309	-1.3724	I(1)
	ΔLevel	-6.5974**	-6.7217**	-3.4531*	-3.5952*	-3.2283*	-3.5693*	
Real Investment	Level	-1.9279	-1.7227	-1.3322	-0.2230	-1.6105	-1.6195	I(1)
	ΔLevel	-8.6428**	-8.9262**	-3.3189*	-3.4437	-2.8699	-3.0112	
Government Revenue	Level	0.7694	-1.7097	0.0229	-2.1728	0.0596	-2.1530	I(1)
	ΔLevel	-3.1697*	-3.1833	-2.8602	-2.8839	-2.1116	-2.0839	

a ** and * indicate that the variable is stationary at the 1% and 5% level of significance respectively.

Table 5.1 continued: Results of the Tests for Stationarity: Using Dickey- and Augmented Dickey- Fuller Tests[b]

VARIABLE		Dickey Fuller (DF) Test Statistic		Augmented Dickey Fuller (ADF) Test Statistic				CONCLUSION
				One-Lag Model		Two-Lag Model		
		With Drift	Drift and Trend	With Drift	Drift and Trend	With Drift	Drift and Trend	
Real Import	Level	-1.6575	-1.4261	-1.4721	-1.0933	-1.8240	-1.8865	I(1)
	ΔLevel	-6.4607**	-6.5203**	-3.3191*	-3.3839	-3.5024*	-3.7103*	
Real Total Export	Level	-1.3398	-0.9283	-1.9028	-2.2718	-2.2052	-3.1176	I(1)
	ΔLevel	-3.7576**	-3.7832**	-2.7214	-2.7806	-2.6888	-3.1176	
Real Non-Mineral Export	Level	-0.0611	-1.5913	-0.6547	-2.4205	-0.4984	-2.1986	I(1)
	ΔLevel	-3.5240*	-3.4596	-3.3977*	-3.3402	-2.9705*	-2.9176	
Foreign Reserve	Level	-0.6630	-0.9526	-0.5794	-0.8047	-0.8349	-1.0463	I(1)
	ΔLevel	-5.8866**	-6.3097**	-3.3509*	-3.8627*	-2.7903	-3.4959	
Money Supply	Level	0.4294	-1.5257	-0..2819	-1.8372	-0.5528	-2.2272	I(1)
	ΔLevel	-3.1446*	-3.0693*	-2.1968	-2.1109	-1.9290	-1.8526	
Domestic Credit	Level	-0.8921	-1.5224	-0.9686	-1.2296	-1.1308	-0.6992	I(1)
	ΔLevel	-6.3249**	-6.3330**	-4.8612**	-4.9563**	-3.7419**	-3.8912*	
Debt-GNP Ratio	Level	-2.1095	-2.4534	-1.3681	-1.9613	-1.6937	-1.2829	I(1)
	ΔLevel	-6.2845**	-6.384**	-5.8695**	-6.0743**	-4.0302**	-4.2669**	
Debt-Service -GNP Ratio	Level	-4.2673**	-4.4673**	-2.9980*	-3.0570	-4.0964**	-4.3614**	I(0)
Grant	Level	0.1856	-2.7523	0.4351	-2.3787	-0.2953	-2.4721	I(1)
	ΔLevel	-7.3742**	-7.4222**	-4.2100**	-4.2537**	-3.7973**	-3.8732**	
Foreign Exchange Receipt	Level	-1.2105	-1.3063	-0.9312	-0.9771	-0.8371	-0.8801	I(1)
	ΔLevel	-6.3346**	-6.6135**	-4.1458**	-4.5328**	-3.5299*	-4.1500	
Foreign Income	Level	1.0631	-2.5590	-1.0264	-2.6533	-1.1523	-2.6304	I(2)
	ΔLevel	-2.6713	-2.4699	-2.4854	-2.2657	-2.7688	-2.5684	
	Δ^2Level	-3.5327*	-3.5696*	-2.6218	-2.7232	-1.5571	-1.6508	
Price of Exports Relative to Domestic Goods	Level	-0.7069	-0.7309	-0.8243	-0.9361	-1.1131	-1.6171	I(1)
	ΔLevel	-4.6691**	-4.6347**	-2.3748	-2.3862	-1.9563	-2.0283	
Price of Imports Relative to Domestic Goods	Level	-0.4751	-1.8255	-0.2245	-2.1483	-0.4436	-2.3216	I(1)
	ΔLevel	-3.1777*	-3.1581	-2.4267	-2.3806	-2.0076	-1.9010	
Interest Rate	Level	-1.7772	-2.3700	-1.8013	-2.4352	-1.5649	-1.9003	I(1)
	ΔLevel	-5.8416**	-5.7661**	-5.0369**	-4.9994**	-4.1267*	-4.1357*	

CRITICAL VALUES

	1%	5%
Auxiliary Regression with Drift	-3.6394	-2.9511
Auxiliary Regression with Drift and Trend	-4.2436	-3.5443

b ** and * indicate that the variable is stationary at the 1% and 5% level of significance respectively.

Table 5.2 Results of the Tests for Stationarity: Using Phillips-Perron Test[a]

VARIABLE		Phillips Perron Test Statistic		CONCLUSION
		With Drift	Drift and Trend	
Nominal Exchange Rate	Level	-0.147125	-1.915323	I(2)
	ΔLevel	-2.829664	-2.736458	
	Δ^2Level	-10.39575**	-13.53827**	
Real Exchange Rate	Level	-2.304985	-2.517244	I(1)
	ΔLevel	-6.129873**	-6.508672	
Real Exchange Rate Volatility	Level	-3.1688*	-3.1685	I(0)
Real Exchange Rate Misalignment	Level	-5.7323**	-5.6334**	I(0)
Price Level	Level	-0.349862	-1.647701	I(2)
	ΔLevel	-2.427801	-2.473054	
	Δ^2Level	-8.030880**	-11.93448**	
Capital Flow GDP Ratio	Level	-1.599487	-2.207894	I(1)
	ΔLevel	-8.335548**	-8.319022**	
Closeness	Level	-2.174088	-2.454470	I(1)
	ΔLevel	-6.813759**	-6.899971**	
Terms of Trade	Level	2.696447	0.868821	I(1)
	ΔLevel	-7.238805**	-9.558644**	
Investment –GDP Ratio	Level	-2.674635	-3.192774	I(1)
	ΔLevel	-10.55310**	-10.95700**	
Government Expenditure –GDP Ratio	Level	-2.764257	-2.729361	I(1)
	ΔLevel	-8.216906**	-7.801281**	
Real Income	Level	-1.488208	-1.089614	I(1)
	ΔLevel	-4.451951**	-4.598229**	
Real Income Growth	Level	-4.443331**	-4.621275**	I(0)
Real Private Consumption	Level	-1.150493	-2.097799	I(1)
	ΔLevel	-4.200980	-4.117838	
Real Government Consumption	Level	-1.433975	-1.240874	I(1)
	ΔLevel	-6.585338**	-6.723546**	
Real Investment	Level	-1.697590	-1.722650	I(1)
	ΔLevel	-8.466787**	-8.926160**	
Government Revenue	Level	0.331593	-1.951268	I(1)
	ΔLevel	-3.195422*	-3.218364	

a ** and * indicate that the variable is stationary at the 1% and 5% level of significance respectively.

Table 5.2Continued : Results of the Tests for Stationarity: Using Phillips-Perron Test[b]

VARIABLE		Phillips Perron Test Statistic		Conclusion
		With Drift	Drift and Trend	
Real Import	Level	-1.614545	-1.371275	I(1)
	ΔLevel	-6.429202**	-6.521380**	
Real Total Export	Level	-1.693367	-1.776335	I(1)
	ΔLevel	-3.757628**	-3.783240*	
Real Non-Mineral Export	Level	-1.186480	-2.090052	I(1)
	ΔLevel	-3.529671*	-3.365237	
Foreign Reserve	Level	-0.760340	-0.884159	I(1)
	ΔLevel	-5.886499**	-6.326840**	
Money Supply	Level	0.105675	-1.941203	I(1)
	ΔLevel	-3.043589*	-2.959991	
Domestic Credit	Level	-0.916659	-1.522372	I(1)
	ΔLevel	-6.385680**	-6.363040**	
Debt-GNP Ratio	Level	-2.422934	-2.442850	I(1)
	ΔLevel	-7.461749**	-12.46911**	
Debt-Service GNP Ratio	Level	-4.147327**	-4.276271**	I(0)
Grant	Level	0.4879	-2.6622	I(1)
	ΔLevel	-7.4785**	-7.6178**	
Foreign Exchange Receipt	Level	-1.151754	-0.970656	I(1)
	ΔLevel	-6.418576**	-7.979487	
Foreign Income	Level	1.348359	-1.631352	I(2)
	ΔLevel	-0.568353	-0.204178	
	Δ^2Level	-3.278445*	-3.246352	
Price of Exports Relative to Domestic Goods	Level	-0.837245	-1.372574	I(1)
	ΔLevel	-4.817786**	-4.775444**	
Price of Imports Relative to Domestic Goods	Level	-0.023210	-2.075290	I(1)
	ΔLevel	-3.069540*	-3.060770	
Inflation Uncertainty	Level			
Interest Rate	Level	-1.575336	-2.420587	I(1)
	ΔLevel	-6.721636**	-6.721636**	

CRITICAL VALUES

	1%	5%
Auxiliary Regression with Drift	-3.6394	-2.9511
Auxiliary Regression with Drift and Trend	-4.2436	-3.5443

b ** and * indicate that the variable is stationary at the 1% and 5% level of significance respectively.

5.1.2 Cointegration tests

Time series variables which are not stationary may have a linear combination of them that is stationary. In such a case, the variables are said to be cointegrated. This implies that there is a long-run relationship among the variables. To the extent that the tests for stationarity reveal that most of the variables are not stationary, cointegration tests are necessary. Both the Engle-Granger Two Steps (EGTS) procedure and the Johansen Maximum Likelihood approach were applied in the cointegration tests. The use of both methods is rooted on the fact that the results of one method can be used to confirm or reject the other one. Thus, the disadvantages of one method are overcome by the other. In the case where the results of the two methods are at variance, the error correction method of testing for cointegration was applied.

In the EGTS procedure, the static long-run regression was estimated for each stochastic equation and the residuals were saved and then tested for stationarity. A stationary residual implies that the variables of the equation generating that residual are cointegrated. Table 5.3 gives the results of the cointegration tests from the EGTS procedure.

In the case of the Johansen Maximum Likelihood procedure, tests for the optimal lag lengths of the related Vector Auto-regression (VAR) were first conducted. This is because the method is preceded by estimating a VAR model and the VAR must have the appropriate lag length. The Likelihood ratio test, Akaike Information Criterion, Schwartz Information Criterion, Hannan Quin test and Final Prediction Error test were used in the lag length selections. The lag length supported by more of the five criteria was chosen as the appropriate lag length. In order to save the degrees of freedom, the highest lag length in the testing–down procedure of the lag-length tests was taken to be three. The results of the cointegration tests via the Johansen methodology are shown in Table 5.4 and Appendix Table 3 shows the detailed results of the Johansen cointegration tests.

The results of the cointegration tests show that the EGTS procedure and Johansen method have the same conclusion for all the stochastic equations except one, the private consumption function. Cointegration exists among the variables of each of the other stochastic equations as established by both the EGTS and Johansen methods. The EGTS results show that cointegration does not exist among the variables of the private consumption function. The Johansen method shows that cointegration exists among the variables of this function. Hence the Error Correction

Model (ECM) method of testing for cointegration was also adopted to test for cointegration among the variables of the private consumption function. The procedure involves estimating an error correction model (ECM) of private consumption and testing whether the ECM term is significantly different from zero. A significant ECM term that lies between 0 and -1 implies cointegration exists. The results of the cointegration test for the private consumption function by using the ECM approach is shown in Table 5.5. The result shows that there is no cointegration among the variables of the private consumption function. This result is consistent with the result of the EGTS procedure while it is at variance with that of the Johansen method. We therefore conclude that there is no long run relationship among the variables of the private consumption function.

Table 5.3: Cointegration Test Results Using Engle-Granger Two-Step Procedure

STATIC MODEL RESIDUALS	Dickey Fuller (DF) Test Statistic	Augmented Dickey Fuller (ADF) Test Statistic		Phillips Perron (PP) Test Statistic	CONCLUSION
		One-Lag Model	Two-Lag Model		
Real Exchange Rate	-3.0084**	-3.1060**	-2.3823**	-3.0347**	Cointegrated
Price Level	-3.0844**	-3.2236**	-2.1815*	-3.0799**	Cointegrated
Private Consumption	-1.1300	-1.6366	-1.6795	-1.6777	Not Cointegrated
Government Consumption	-5.2506**	-3.3073**	-3.3507**	-5.2716**	Cointegrated
Investment	-5.1285**	-2.6347*	-2.3799**	-5.2457**	Cointegrated
Government Revenue	-3.3652**	-2.4745*	-2.6403**	-3.3937**	Cointegrated
Non-Mineral Export	-2.8567**	-2.7142**	-3.7739**	-3.0039**	Cointegrated
Import	-4.4791**	-3.2939**	-3.1943**	-4.4780**	Cointegrated
Foreign Reserve	-3.5218**	-3.4920**	3.9575**	-3.4717**	Cointegrated
	Critical Values 1% -2.6327 5% -1.9507				

Notes: (i) No deterministic component is introduced in the auxiliary regression because we do not know the data generating process (DGP) of the residuals.
(ii) ** (*) implies the residual is stationary at the 1% (5%) level of significance, implying cointegration

Table 5.4: Cointegration Test Results From Johansen's Maximum Likelihood Approach

Model	Optimal VAR Lag-Length Selected	Trace Statistic		Maximum Eugen Statistic		Conclusion
		Cointegration Rank	Level of Significance	Cointegration Rank	Level of Significance	
Real Exchange Rate	2	1	1%	2	5%	Cointegrated
Price Level	3	3	1%	1	1%	Cointegrated
Private Consumption	1	1	5%	1	1%	Cointegrated
Government Consumption	1*	2	1%	1	1%	Cointegrated
Investment	2	3	1%	2	1%	Cointegrated
Government Revenue	1	1	1%	1	1%	Cointegrated
Non-Mineral Export	1	1	1%	1	5%	Cointegrated
Import	1	0	-	1	5%	Cointegrated
Foreign Reserve	1*	1	1%	1	1%	Cointegrated

Note: * implies the optimal lag length is 3 but the number of observations could not allow for the estimation of the VAR. Hence lag length of 1 was used to increase degrees of freedom.

Table 5.5: Cointegration Test Using ECM Method: Private Consumption

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0.013391	0.012685	-1.055621	0.3002
ΔLnY	0.705361	0.115928	6.084450	0.0000
Δ^2LnP	-0.127426	0.073311	-1.738151	0.0932
Δ^2LnP(-1)	-0.113844	0.068666	-1.657954	0.1085
ECM(-1)	-0.108140	0.169615	-0.637563	0.5289
R-squared	0.694262	Prob(F-statistic)		0.000001
Adjusted R-squared	0.650586	Durbin-Watson stat		1.425411

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.506773	Probability	0.608265
Obs*R-squared	1.238158	Probability	0.538440

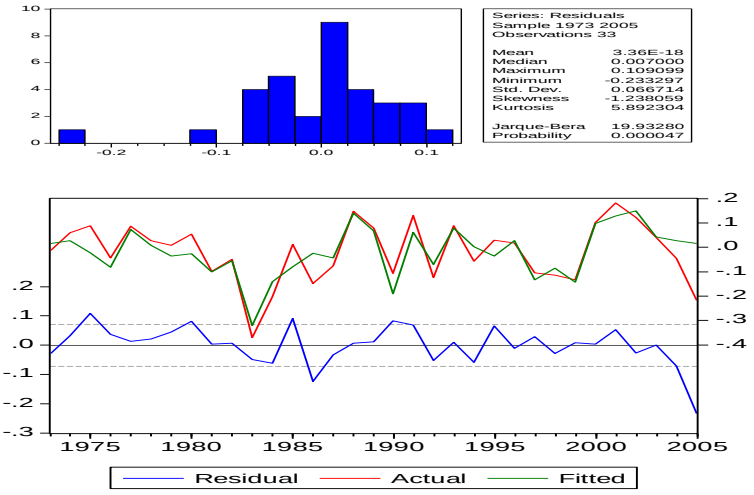
White Heteroskedasticity Test:

F-statistic	1.321761	Probability	0.280135
Obs*R-squared	10.09267	Probability	0.258582

ARCH Test:

F-statistic	0.813579	Probability	0.374249
Obs*R-squared	0.844904	Probability	0.357998

Jarque Bera Residual Normality Test



5.2 The dynamic macroeconomic model

5.2.1 Estimation issues

Most of the variables in the macroeconometric model are not stationary (From Tables 5.1 and 5.2) and most of the vectors of variables are cointegrated. Hence, the variables of most of the stochastic equations were estimated in the context of error correction model, in order to determine the short-run dynamics of the dependent variable of each stochastic equation (this flows from the Granger representation theory). In the case of private consumption, no long-run information (in the form of error correction) was incorporated in the estimation of the short-run dynamics. This was basically because cointegration does not exist among the variables of this equation.

The coefficients of the stochastic equations of a macroeconometric model are estimated before performing dynamic simulation experiments, to determine the dynamic effects of exogenous variables. Some right-hand-side variables are however normally correlated with the disturbance terms of the equations in which they appear. This is because these right-hand-side variables appear in other equations as dependent variables. To this end, the application of the Ordinary Least Squares (OLS) technique to estimate the equations of a macroeconometric model gives biased and inconsistent estimates of parameters. To overcome this problem in our model, simultaneous equation estimation techniques were used. The Three Stage Least Squares (3SLS) was used because it accounts for potential cross-equation serial correlation in residuals[26].

In single equation estimation of the short-run dynamics of a variable, the OLS is used to arrive at the error correction model. Thus, lags of the exogenous variables as well as the endogenous variables are also used as explanatory variables, in order to capture the dynamics in the data. However, in the case of the 2SLS and 3SLS, which are simultaneous equation estimation techniques, the inclusion of the lags of variables where number of observations is just 35 will greatly impair the accuracy of the results. This is because the right-hand-side endogenous variables are first regressed on all the predetermined variables (exogenous as well as lagged

[26] The 2SLS and 3SLS methods of estimation are simultaneous equation estimation methods in that both resolve the simultaneity bias. However, the 2SLS estimates the equations of the system one-by-one while the 3SlS estimates the equations of the system simultaneously and also accounts for cross-equation serial correlation in residuals. The Indirect Least Squares, which is another simultaneous equation estimation technique, is complex to apply to a model with many equations since it involves explicit derivation of the reduced form model from the structural model.

variables) of the whole system, to obtain the instrumental variables of right-hand-side endogenous variables. Hence, there is great loss of degrees of freedom as there are many variables in the instrumental variable regression. On this basis, the lags of the variables were not included in modeling the short-run dynamics except in cases where specific theories were tested, and in the case of government revenue, where previous government revenue was included in the model to test whether government uses its current revenue to generate more revenue.

When simulation (and forecasting) is the tool of analysis following an estimated macroeconometric model, the emphasis is always on the ability of the model to simulate values that are close to the historical data but not the conventional t-statistics or R^2 values, which are essential in building a structural model of an economy.[27] This study adopts this technique. However, we maintained some degree of parsimony in estimating the model by deleting variables with t-statistics less than unity. The only exception to this was the inflation variable in the real exchange rate model. Though the coefficient of this variable is less than one (0.69) it is maintained in the equation on the theoretical grounds that inflation is a key channel through which monetary policy influences the real exchange rate. Moreover, other macroeconometric models have been estimated whereby coefficients which are lower than this value are maintained in the model (for example, Iyoha, 2004, Ekpo et al, 2003, and Olofin 1985).

5.2.2 Estimates and interpretation of the macroeconomic model

5.2.2.1 The war dummy

The war dummy, which took value of zero in non-war period and one in war period, is insignificant in all but one of the equations in which it was included. The insignificance of the war dummy in the private consumption function, public consumption function, investment function and import demand function is however not surprising since income is significant in all of these equations. This implies that the decade old war (1991-2000) reduced real economic activities, which is essentially decline in income. As a result of this, the levels of private consumption, public consumption, investment and import reduced. Hence, including this step dummy in equations where income is an explanatory variable can be expected to yield

[27] This is emphasised in Pindyck and Rubinfeld, (1998).

insignificant effect. This implies that the effect of the war on key macroeconomic variables in Sierra Leone worked through its impact on economic activities. This suggests that the effects of the war on key macroeconomic variables were through supply side factors rather than demand side factors. This is manifested in the fact that the war dummy is significant in the non-mineral export function, in which domestic income is not a determinant. The war dummy has negative effect on non-mineral export of Sierra Leone. Hence, the level of non-mineral export was lower in the war period than the non-war period. This is not surprising since the agricultural sector was shrunk as the rebels intensified their activities in the rural areas, where the war lasted for long before it extended to urban areas and eventually to Freetown in May 1997 until February 1998 and then January 1999 until February 1999.

5.2.2.2 The inflation equation

Table 5.6 shows the result of the estimated inflation equation. The result of the inflation equation shows that inflation in Sierra Leone is determined by real income, money supply, nominal exchange rate, interest rate and previous inflation rate. Money supply, nominal exchange rate and interest rate have positive effects on inflation while real income and previous inflation have negative effects. The significance of the nominal exchange rate in the inflation equation implies that the nominal exchange rate has direct effect on the rate of inflation, which is a vindication of the existence of the phenomenon of exchange rate pass-through to domestic prices, at the aggregate level, in Sierra Leone. The fact that previous year's inflation rate has negative effect on current inflation rate implies that as the rate of inflation increases, monetary authorities become more committed to reducing it, thus leading to a lower inflation rate in the next period. This means that inflation is not a self-fulfilling prophecy in Sierra Leone. The speed of adjustment to disequilibrium from the inflation equation is 77.40 %. Thus, about 77 % of the disequilibrium between the short-run and long-run inflation rates is covered up within a year.

Table 5.6: The Inflation Equation

Variable	Coefficient	t-statistics
Constant	-0.015	-0.405
ΔLnMs	0.515	3.498
ΔLnY	-1.053	-5.240
Δ^2 Lne	0.130	1.487
ΔLni	0.070	1.485
ΔLnP(-1)	-0.482	-4.411
ECM(-1)	-0.774	-5.341
R^2 Adj R^2 DW	0.669 0.580 2.111	

5.2.2.3 The real exchange rate equation

Table 5.7 shows the result of the estimated real exchange rate equation. The real exchange rate equation shows that the actual (short-run) real exchange rate is determined directly by commercial policy, inflation rate and the nominal exchange rate. While the closeness of the economy to international trade and inflation have direct negative effect on the short run real exchange rate, the nominal exchange rate has direct positive effect. The error correction term shows that about 29.4 % of the deviation of the short-run real exchange rate from the long run is covered up within a year.

Table 5.7: The Real Exchange Rate Equation

Variable	**Coefficient**	**t-statistic**
Constant	0.018	0.587
ΔCLOSE	-0.364	-4.097
Δ^2 LnP	-0.094	0.689
Δ^2 Lne	0.266	2.512
ECM(-1)	-0.294	-2.805
R^2 Adj R^2 DW	0.469 0.394 1.831	

5.2.2.4 The private consumption function

Table 5.8 shows the results of the private consumption function. The private consumption function is the only equation estimated without an error correction term since there is no cointegration among the vector of variables in this function. The result of the private consumption function shows that both current and previous year's income have direct positive effect on private consumption of Sierra Leone, with current income having higher elasticity. The Wald test (which has a chi squared distribution) was used to test the joint significance of current and previous income. This is to test the permanent income hypothesis for private consumption in Sierra Leone. The result of this test is shown at the bottom of Table 5.8 and it shows that the coefficients on these two variables are jointly significant, suggesting the relevance of the permanent income hypothesis. The elasticities of private consumption with respect to current and previous incomes are 0.62 and 0.11 respectively. To the extent that the private consumption function shows that consumption depends on permanent income and the cointegration test shows that the average propensity to consume by private agents falls as income increases, fluctuations in income in Sierra Leone are dominated by transitory but not permanent income.

The rate of interest is not significant in the private consumption function. The insignificance of the rate of interest in the private consumption function implies that in Sierra Leone, the principle of intertemporal substitution in consumption through borrowing and lending (influenced by changes in interest rate), which takes place through the commercial banks, does not hold at the aggregate level. Thus, the life-cycle theory of consumption, which is predicated on the principle of intertemporal substitution, is rejected by the aggregate data from Sierra Leone. This rejection may be due to the fact that the income level of the people is low and given the underdevelopment of the financial sector, borrowing constraint is binding. The rate of inflation has negative effect on private consumption. Hence, as the inflation rate increases, the consumption of private agents decreases. This suggests that the rate of inflation is a source of welfare deterioration in Sierra Leone.

Table 5.8: The Private Consumption Function

Variable	Coefficient	t-statistic
Constant	-0.015	-1.253
ΔLnY	0.618	5.408
Δ^2 LnP	-0.169	-2.518
Δ LnY(-1)	0.112	1.370
R^2 Adj R^2 DW	0.645 0.608 1.571	

Wald Test for Joint Significance of Y and (Y_{t-1})

Test Statistic	Value	df	Probability
Chi-square	35.57796	1	0.0000

5.2.2.5 The government consumption function

Table 5.9 shows the government consumption function. The government consumption function reveals some interesting results. Unlike the private consumption function, government consumption function is not affected by pervious year's income. However, current year's income has positive effect on government consumption, with an elasticity of 1.56. This implies that government consumption in Sierra Leone follows the Absolute Income Hypothesis (the Keynes consumption function), in the sense that current but not permanent income determines government consumption.

The fact that government consumption is elastic with respect to income implies that Wagner's Law of increasing state activities holds in Sierra Leone. That is, as the economy expands, the role of the government expands such that government expenditure grows at a faster rate than the growth of the economy. While the rate of inflation has negative effect on private consumption, it has a positive effect on government consumption. Hence, increase in prices in Sierra Leone is a major factor behind increases in government consumption. Though the rate of interest is insignificant in the private consumption function, it has a significant negative coefficient in the government consumption function, with an elasticity of -0.15. This reflects the fact that as interest rate increases, government borrowing from the banking sector reduces and this reduces government consumption since the amount of fund available for government spending is lower. This might be a reason for the long use of interest rate fixing in Sierra Leone in the 1970s and 1980s. Government revenue has positive effect on government consumption though the elasticity is very low, a value of 0.09. This implies that government consumption decision in Sierra Leone is not strongly linked to government revenue. The direct effect of nominal exchange rate on government consumption is negative. The theoretical exposition underlying this is that government consumption includes *inter alia* expenditure on imports. Thus, a depreciation of the nominal exchange rate reduces government consumption expenditure on imports and total government consumption therefore falls. The error correction term shows that 66.4 % of the disequilibrium between the short-run and long-run government consumptions in covered up within a year.

Table 5.9: The Government Consumption Function

Variable	**Coefficient**	**t-statistic**
Constant	0.004	0.154
ΔLnP	0.483	4.269
ΔLni	-0.153	-3.618
Δ^2 Lne	-0.097	-1.259
ΔLnY	1.560	9.617
ΔLnGR	0.087	1.516
ECM(-1)	-0.664	-5.570
R^2 Adj R^2 DW	0.785 0.736 1.700	

5.2.2.6 The aggregate investment function

Table 5.10 shows the aggregate investment function. The investment equation shows that income has positive effect on aggregate investment, implying that the accelerator principle holds in Sierra Leone. The income elasticity of aggregate investment is 2.63. Hence, investment increases by more than the proportionate increase in income. The rate of interest has positive effect on aggregate investment. This is in contrast to the Keynesian theory of investment, which says that interest rate has negative effect on investment. This contradiction is basically because in Sierra Leone, interest rate was regulated for a long time and therefore, an increase in interest rate in this economy increases bank deposit, this makes more funds available for borrowing, and investment increases, despite the increase in cost of borrowing. This implies that in Sierra Leone, investment is constrained more by availability of fund than cost of funds. The interest elasticity of aggregate investment is 0.33. This implies that though interest rate has positive effect on investment, the response of investment to interest rate changes is low in Sierra Leone.

An interesting result of the aggregate investment function is the effect of inflation on investment. The rate of inflation has positive effect on aggregate investment. This result is contrary to the conventional wisdom that inflation reduces investment by acting as a sign of macroeconomic instability. The positive effect of inflation on aggregate investment is as a result of the fact that in Sierra Leone, investors pay more attention to short run when taking investment decisions. Hence, when the price level increases they increase their investment in order to take advantage of higher price level. Moreover, inflation could serve as a source of macroeconomic instability thus leading to lower output if high inflation is expected to bring higher inflation. But the inflation equation shows that high inflation is expected to bring lower inflation in the next period, reflecting monetary authorities commitment when inflation rate is high. Thus, an increase in the rate of inflation, which reduces expected inflation, increases investment.

Table 10: The Aggregate Investment Function

Variable	**Coefficient**	**t-statistic**
Constant	-0.155	-1.767
ΔLnY	2.629	6.011
ΔLni	0.328	3.511
Δ^2 LnP	0.536	2.261
ΔLnEDGNP	0.516	2.918
ΔLnEDSGNP	0.075	1.345
ECM(-1)	0.999	-7.209
R^2 Adj R^2 DW	0.670 0.594 1.930	

Both external–debt–GNP and external–debt–service–GNP ratios have positive effects on aggregate investment. The theoretical explanation of these results rests on the fact that the estimated model is aggregate investment but not private investment. Consider the case of external–debt-GNP ratio. On the one hand, an increase in external–debt reduces private investment via the debt–overhang hypothesis. The debt–overhang hypothesis states that high external debt deters private investment since the debt is interpreted by potential investors as a reason for high future tax. On the other hand, an increase in external debt increases public investment as more funds will be available to the government for investment purpose. Hence, the effect of total external debt on aggregate investment depends on which of the effects dominates. The positive effect of external–debt–GNP ratio on investment therefore implies that the public–investment effect outweighs the debt-overhang effect. However, aggregate investment is inelastic with respect to external–debt–GNP ratio (an elasticity of 0.52). This is expected to be case in Sierra Leone since public investment-GDP ratio is higher than private investment-GDP in the estimation period.

The result of the effect of external-debt-service on aggregate investment reveals that external-debt- servicing has positive effect on aggregate investment. This implies that unlike the case of total external debt, the private investment effect (which is positive) outweighs the public investment effect (which is negative). The idea is that an increase in external–debt-servicing acts as an indication of the ability of the government to establish a stable macroeconomic environment and this increases private investment. On the other hand, an increase in external–debt-servicing reduces public investment because the fund for servicing the debt could be used on government investment. Hence, the fact that external–debt-servicing has positive effect on aggregate investment implies that the private–investment effect outweighs the public–investment effect. However, the elasticity of aggregate investment with respect to external-debt-service ratio is very low (a value of 0.08). This implies that the positive effect of external–debt-servicing on private investment marginally offsets the negative effect on public investment. The error correction term shows that following an exogenous shock to aggregate investment, there is complete adjustment to the long-run equilibrium in a given year since the error correction coefficient is 0.999.

5.2.2.7 The government revenue function

Table 5.11 shows the result of the government revenue function. The government revenue equation shows that income and grant have positive effects on government revenue, with elasticities of 0.75 and 0.24 respectively. Also, previous government revenue has positive effect on current government revenue. This implies that the government spends out of an increase in government revenue to increase its revenue in the next period. The error correction coefficient shows that only 4 % of the disequilibrium between the short-run and long-run government revenue is covered up within a year. Hence, an exogenous shock to government revenue lasts longer than shocks to the other endogenous variables in the system. This may be due to the presence of tax collection lags.

Table 5.11: The Government Revenue Function

Variable	**Coefficient**	**t-statistic**
Constant	0.083	1.935
ΔLnY	0.754	2.528
ΔLnGRANT	0.240	5.917
Δ LnGR(-1)	0.418	4.403
ECM(-1)	-0.04	-1.984
R^2 Adj R^2 DW	0.622 0.568 1.919	

5.2.2.8 The non-mineral export function

Table 5.12 shows the result of the non-mineral export function. The result of the non-mineral export function shows that the real exchange rate has positive effect on non-mineral export. Real exchange rate volatility, foreign income and real exchange rate misalignment are not significant in the non-mineral export function. The insignificance of real exchange rate misalignment should be interpreted with caution since real exchange rate changes affect real exchange rate misalignment. This insignificance could be based on the fact that changes in real exchange rate misalignment are brought about by changes in the actual real exchange rate. Hence, having both in the same equation may lead to insignificance of real exchange rate misalignment. The insignificance of real exchange rate volatility implies that real exchange rate volatility is not an important source of risk for exporters of non-mineral products in Sierra Leone.

The insignificance of foreign income in the non-mineral export function implies that foreign income is not an important factor in the determination of non-mineral products of Sierra Leone, which are basically primary agricultural products and few manufacturing goods. This may be due to the fact that foreign income is considered to be the trade weighted average of incomes of Sierra Leone's first four trading partners, which are Belgium, Germany, U.K and U.S respectively. Given that these countries are industrialized economies and primary agricultural exports come from many other developing countries, an increase in their incomes cannot have significant effect on their demand for the primary agricultural-products and few manufacturing exports of Sierra Leone.

Table 5.12: The Non-Mineral Export Function

Variable	**Coefficient**	**t-statistic**
Constant	-0.015	-0.253
ΔLnRER	0.650	3.225
ΔLn(Px/P)	-0.122	-1.325
DWAR	-0.297	-3.088
ECM(-1)	-0.301	-3.075
R^2 Adj R^2 DW	0.393 0.306 1.283	

The price of exports relative to domestic goods has negative effect on the export of non-mineral products of Sierra Leone. This is in contrast to the traditional wisdom. The traditional wisdom is that an increase in the price of exports relative to domestic goods increases exports as it becomes more profitable to invest in exports than non-tradable goods (domestic goods). This contradiction could be due to two non-mutually exclusive reasons. First, the price of export constitutes not only the price of non-mineral exports but also price of mineral exports (diamond and non-diamond mineral exports). However, the estimated equation is for non-mineral export, which is only a component of total exports, whose price is used in the regression. Second, the exports of non-mineral products of Sierra Leone could be demand–driven in the sense that when its price increases, its demand falls and supply responds to this fall in demand. Hence, exports of this goods reduce.

The war dummy has a negative coefficient and is significant. This implies that the level of non-mineral export was lower in the war period than the non-war period. This is not surprising because the agricultural sector was shrunk as the rebels intensified their activities in the rural areas, where they recruited many people who were working in the agricultural sector. They also created an undesirable working environment for farmers. To the extent that a larger percentage of agricultural production takes place in the rural areas, such disruption is expected to reduce agricultural output and hence non-mineral export. The error correction term shows that 30 % of the disequilibrium between the short-run and long-run non-mineral export is covered up within a year.

5.2.2.9 The import demand function

Table 5.13 shows the result of the import demand function. The import demand function shows that both income and real exchange rate have positive effects on import. The income elasticity of import is about 2.4. Thus, when income increases by 1 % import increases by 2.4 %. The real–exchange–rate elasticity of import is found to be unitary. Hence when real exchange rate depreciates by 1 %, import increases by 1 %. The coefficient of foreign exchange is negative, though the elasticity is very low (a value of -0.09), and is not significant in the 2SLS estimates of the import demand function. Real exchange rate misalignment is insignificant in the import demand function. This is not surprising since real exchange rate changes affects real

exchange rate misalignment and the former is significant in the import demand function. The error correction term shows that about 86 % of the disequilibrium between the short-run and long-run import demands is covered up within a year.

Table 5.13: The Import Demand Function

Variable	**Coefficients**	**t-statistic**
Constant	-0.002	-0.067
ΔLnY	2.374	10.226
Δ LnRER	1.008	8.350
Δ LnFX	-0.092	-2.140
ECM(-1)	-0.861	-5.970
R^2 Adj R^2 DW	0.657 0.608 1.964	

5.2.2.10 The overall balance of payments equation

Table 5.14 shows the overall balance of payments equation. The overall balance of payments equation shows that interest rate, inflation rate and nominal exchange rate are the variables that have direct effects on the balance of payments. Interest rate and inflation rate have negative effects on foreign reserve while nominal exchange rate has positive effect. Both income and domestic credit do not have direct effects on foreign reserve since they are insignificant in the foreign reserve equation.

The insignificant of domestic credit in the foreign reserve equation is a rejection of the original Monetary Approach to the Balance of Payments (MABP). This states that an increase in domestic credit reduces the balance of payments one-for-one. However, the monetary–restraint implication of the original MABP is not rejected. This is because according to the structure of the model, an increase in domestic credit increases money supply and the inflation equation shows that the increase in money supply increases the rate of inflation, which reduces foreign reserve according to the foreign reserve equation. Hence, the effect of domestic credit on the overall balance of payments is indirect, according to the estimated macroeconomic model, but not direct as in the MABP. The insignificance of income in the foreign reserve equation does not also imply that income is not significant in determining the overall balance of payments. It only indicates that income does not have direct effect on the overall balance of payments. This is so because the result of the inflation equation shows that an increase in income reduces the rate of inflation and according to the overall balance of payments equation, reduction in inflation rate improves the balance of payments. Hence, income has indirect positive effect on the overall balance of payments, through the rate of inflation. The error correction term shows that 45 % of any disequilibrium between the short run and long run overall balance of payments is covered up within a year.

Table 5.14: The Overall Balance of Payments Equation

Variable	**Coefficient**	**t-statistic**
Constant	0.050	0.782
ΔLni	-0.442	-2.891
Δ^2 LnP	-0.403	-1.047
Δ^2Lne	0.391	1.539
ECM(-1)	-0.453	-4.110
R^2 Adj R^2 DW	0.250 0.143 1.722	

5.2.3 Validation of the macroeconomic model

The R^2 values from the estimated model ranged from 28 %, in the foreign reserve equation, to 78 %, in the government revenue function. This is reasonable as the variables in the model are stationary. It is important to note however that the R^2-values are suitable for the determination of the adequacy of the individual equations but not the system. The adequacy of the system is judged by the ability of the model to forecast values that are close to the historical series. Hence, dynamic historical simulation is undertaken for this evaluation.

Historical simulation, which is the conventional approach to evaluation of the forecasting performance of a macroeconometric model, was used to determine the forecasting performance of the estimated model. This includes an examination of the graphs of actual and simulated values and the use of summary statistics such as: the Theil's inequality coefficient and its decomposition, root mean squared error (RMSE) and the correlation coefficient between the actual and simulated values of the endogenous variables. Figure 5.1 shows the graphs of actual and simulated values of some endogenous variables. The figure shows that the time paths of the historical and simulated series are close and more importantly, turning points of the actual series are well tracked by the simulated series.

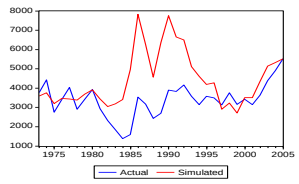
Table 5.15 shows the summary statistics of the model validation. For all the stochastic equations, the Theil's inequality coefficients range between 0.13 (for the import function) and 0.63 (for the non-mineral export function). A detailed analysis of the Theil's inequality coefficient requires knowledge of its decomposition. The bias proportions of the (Theil's) inequality coefficients are very low (zero for all the equations). This shows that the cause of the discrepancy between the actual and simulated values is not precipitated by the differences between their means. The variance proportions of this inequality coefficient are also low, though that for foreign reserve is a little above 0.5. This shows that the discrepancy between the simulated and actual series is not precipitated by differences between their variances. The covariance proportions show that the discrepancy between the actual and simulated series is due

to their imperfect covariance, and nothing can be done about this, in order to improve forecasting ability. This is expected for a model with good forecasting performance.

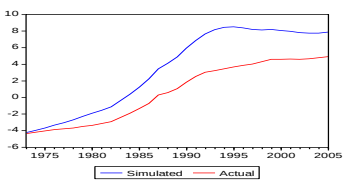
To the extent that a model is a good predictor of the historical series when both the bias and variance proportions are low and the covariance proportion is high, the estimated model is suitable for foretasting and policy simulation. This is also supported by the low root means squared errors (RMSE) and the high correlation coefficients between actual and simulated values. Appendix Table 4 shows the formulae used for calculating these summary statistics.

Figure 5.1: Graphs of Actual and Simulated Values of Some Endogenous Variables

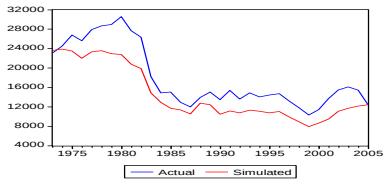
1.Real Exchange Rate



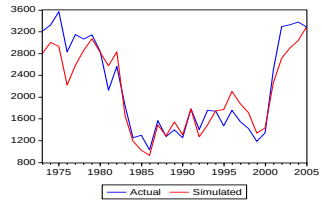
2. Price Level (In natural log)



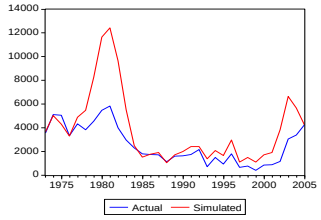
3. Private Consumption (Real)



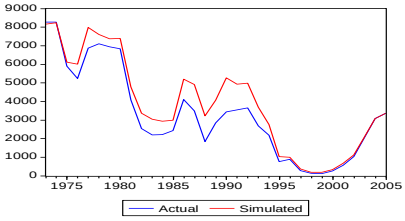
4. Government Consumption (Real)



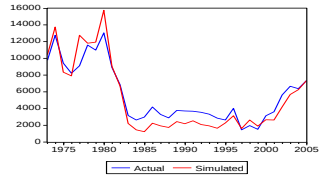
5. Investment (Real)



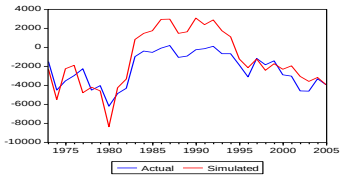
6. Aggregate Export (Real)



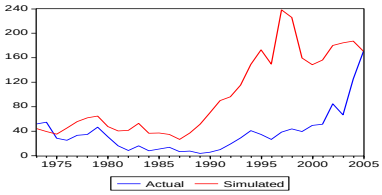
7. Import (Real)



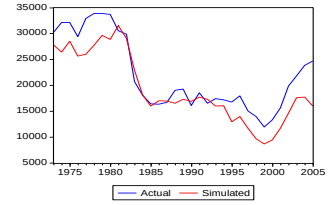
8. Trade Balance (Real)



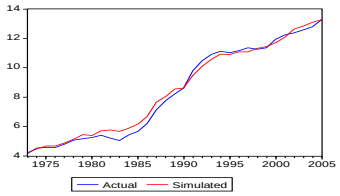
9. Foreign Reserves



10.Gross Domestic Product (Real)



11. Government Revenue (Natural Log)



12. Absorption (Real)

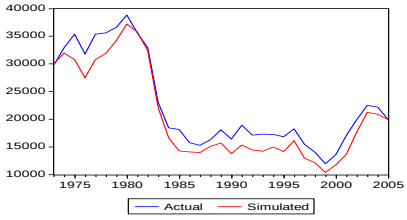


Table 5.15: Summary Statistics of Validation of the Macroeconomic Model

	Theil's Inequality Coefficient	Decomposition of Theil's Inequality			Root Mean Squared Error	Correlation Coefficient
		Bias Proportion	Variance Proportion	Covariance Proportion		
Real Exchange Rate	0.47	0.00	0.13	0.87	0.23	0.69
Inflation	0.45	0.00	0.05	0.95	0.13	0.87
Private Consumption	0.38	0.01	0.13	0.86	0.09	0.80
Government Consumption	0.16	0.00	0.03	0.97	0.13	0.89
Investment	0.22	0.00	0.17	0.83	0.35	0.83
Government Rvenue	0.57	0.00	0.05	0.95	0.21	0.77
Non-Mineral Exports	0.63	0.00	0.37	0.63	0.30	0.58
Imports	0.13	0.00	0.02	0.98	0.18	0.94
Foreign Reserve	0.62	0.00	0.53	0.47	0.48	0.50

5.2.4 Policy simulations

5.2.4.1 The effects of nominal exchange rate

Dynamic policy simulation in the counterfactual sense was carried out in order to determine the effects of nominal exchange rate on the real exchange rate, trade balance and overall balance of payments overtime. Counterfactual policy simulation asks the question: what would have happened to a set of macroeconomic variables if a particular policy had been implemented at a particular time. The relative positions of the baseline and the disturbed solutions of the macro variables of interest are then used to answer the policy question.

The simulation experiment for the nominal exchange rate starts by an examination of the exchange rate policies of Sierra Leone. In March 1989, the government devalued the Leone from Le 44.00 per U.S dollar to Le 65.00 per U.S dollar. By the end of 1989, the parallel market rate skyrocketed and the government then devalued the Leone by 85 % (to Le120.00 per U.S dollar) in January 1990. Following this, the managed floating exchange rate regime was adopted in April 1990. Hence, in the policy simulation, we asked the question: 'what would have been the effect on the real exchange rate, the trade balance and overall balance of payments if the 85 % devaluation of January 1990 had been implemented and maintained since 1982?' The year 1982 is selected here as the starting point for the dynamic simulation on the basis that the government chose a dual exchange rate regime in this year as a way of bolstering the external sector, which had become weak by the end of the 1970s. The nominal exchange rate was therefore increased such that the rate of depreciation would be 85 % starting from 1982 and the effects on key macroeconomic variables were then examined.

The results of this simulation experiment are presented in Table 5.16 and Figure 5.2. The results in Table 5.16 are in percentage deviation of disturbed solution from the baseline. Hence, a negative value implies a decrease in the endogenous variable and a positive value implies an increase. The results show that on the average, relative to the baseline, nominal exchange rate depreciation of 85 % increases the price level by 3.9 %, depreciates the real exchanges rate by 6.9 %, increases non-mineral exports by 117.1 %, aggregate exports by 47.8 %, income by 1.8 %, absorption by 0.4 %, imports 85.9 %, foreign reserve by 22.6 % and decreases the trade balance by 48.4 %. Moreover, in the first eleven periods of the simulation period, the trade

balance worsens but in the rest of the simulation period, the trade balance improves. This implies that the path of the trade balance of Sierra Leone following a depreciation of the nominal exchange rate follows the J-Curve effect (that is, the trade balance initially deteriorates and later improves).

A close examination of the results in Table 5.16 reveals interesting transmission issues. The depreciation of the nominal exchange rate increases non-mineral export (and hence aggregate export) over the entire period of the simulation but it continuously increases real income only for the first twelve periods of the simulation period. After the first twelve periods, real income decreases for most of the periods. The observed path of real income is traced to the fact that the increase in price level gets larger after the first eleven periods of the simulation period. Thus, decreasing aggregate demand and hence real output. The reduction in real income then leads to reduction in import and the trade balance starts to improve. This improvement continues in the rest of the simulation period. In the period of the increase in income (the early periods of the simulation period), absorption increases while in the period of decline in income, absorption falls. This suggests a positive effect of real income on absorption, as posited by the absorption approach to the balance of payments. Since part of the absorption is on import, import increases as absorption increases and as absorption decreases import falls. Hence, the period of improvement of the trade balance is consistent with the period of decline in income and absorption (as part of the absorption goes to import). This is the case in the second half of the simulation period.

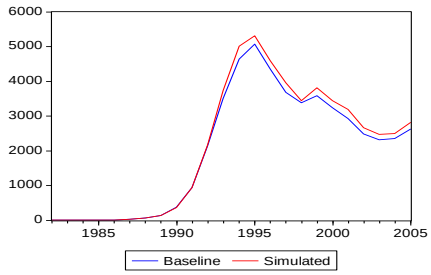
Table 5.16: Counterfactual Simulation Results for Key Macro-variables: from an 85 % Devaluation/Depreciation of the nominal Exchange Rate with Effect From 1982*

Year	Price Level	Real Exchange Rate	Non Mineral Export	Aggregate Export	Real GDP	Absorption	Import	Trade Balance	Foreign Reserve
1982	7.40	20.57	75.07	33.47	0.88	3.66	94.81	-5224.54	39.29
1983	2.55	-4.93	84.04	39.81	0.04	6.35	169.51	-2511.31	-1.00
1984	4.41	7.54	159.60	71.50	2.91	3.29	269.99	-1807.06	16.07
1985	-1.19	-7.03	183.13	89.36	4.96	3.46	299.27	-1023.05	-5.29
1986	-6.74	-8.54	133.84	63.65	5.66	4.70	225.80	-1758.29	-10.35
1987	-1.73	15.99	160.47	78.84	13.23	9.02	308.57	-2061.49	31.74
1988	8.99	25.58	182.51	112.98	9.81	0.12	174.51	606.84	37.81
1989	0.07	-12.28	164.82	67.56	4.94	3.60	133.04	-477.45	-12.16
1990	-4.00	-4.64	159.03	68.27	9.91	8.48	243.77	-1730.71	-2.34
1991	-0.68	11.61	170.53	58.28	7.77	4.82	167.37	-1375.39	24.08
1992	1.18	7.13	155.34	48.96	4.20	4.82	163.94	-975.88	13.77
1993	6.55	14.51	162.85	56.18	2.53	0.74	83.06	480.90	25.04
1994	7.87	8.34	160.36	46.64	-1.09	1.26	70.07	130.47	23.79
1995	4.84	2.03	112.01	65.47	0.37	-1.50	-16.20	1044.21	21.09
1996	5.58	11.63	121.57	45.48	-5.92	-4.17	-15.87	950.13	45.05
1997	7.44	13.31	80.90	48.64	2.10	-0.89	-21.43	527.14	45.63
1998	1.96	-0.29	49.75	39.32	7.13	-1.64	-45.40	1265.12	25.81
1999	6.34	18.07	63.09	40.53	3.99	-2.17	-33.64	712.52	50.85
2000	6.27	7.23	69.91	23.92	-6.42	-4.66	-46.25	1305.76	27.58
2001	9.07	13.29	83.55	18.10	-6.40	-5.40	-30.53	920.12	38.48
2002	7.56	4.84	79.46	13.54	-7.08	-6.07	-35.01	1615.94	25.10
2003	6.77	6.33	75.55	7.85	-6.41	-5.35	-17.72	1170.82	27.96
2004	6.38	6.84	65.44	4.53	-1.35	-5.01	-28.55	1921.38	27.83
2005	7.39	8.41	58.31	3.89	-1.54	-6.97	-52.17	3953.67	26.16
1982-2005	**3.93**	**6.90**	**117.13**	**47.78**	**1.84**	**0.44**	**85.87**	**-48.35**	**22.58**

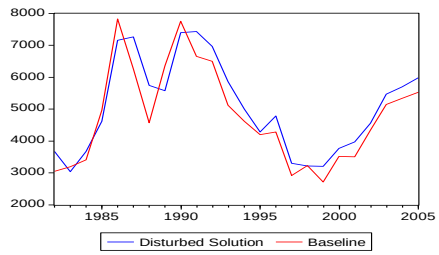
*The figures are in percentage deviation from the baseline. Hence, a minus sign implies a decrease and a positive sign implies an increase in the endogenous variable.

Figure 5.2: Counterfactual Simulation Results From an 85 % Nominal Exchange Rate Devaluation/Depreciation with Effect from 1982

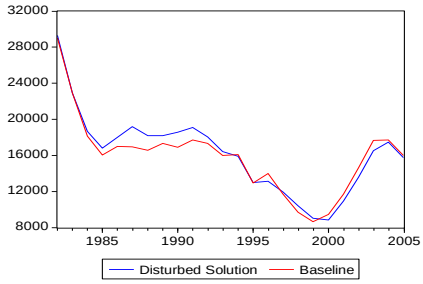
1. Price Level



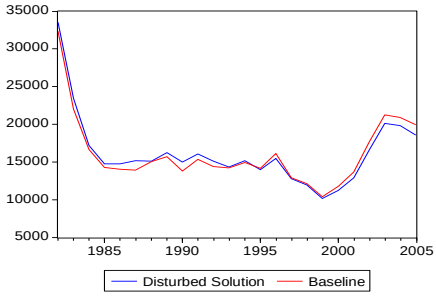
2. Real Exchange Rate



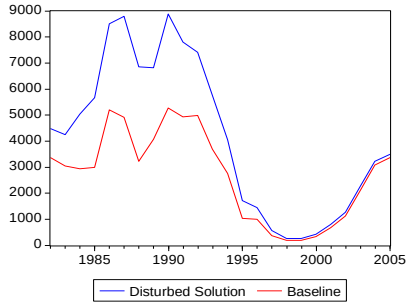
2. Real Income



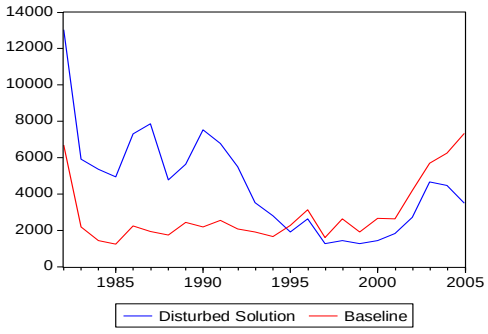
4. Absorption



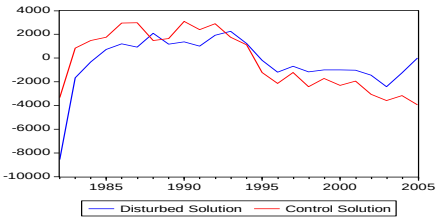
5. Export



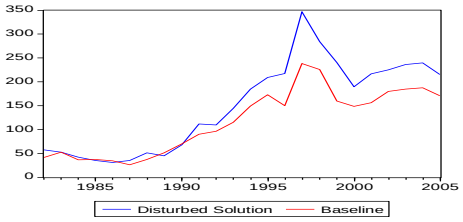
6. Import



7. Trade Balance



8. Foreign Reserve



5.2.4.1 The effects of fiscal and monetary policies on the real exchange rate

5.2.4.1.1 Case I: Maintaining budget deficit-GDP ratio at 5%

The dynamic effects of fiscal and monetary policies on the real exchange rate were also examined by counterfactual policy simulations. Three cases were considered in this context. The first case (referred to here as case I) is restricted to the effect of fiscal policy that is accommodated by monetary policy, on the real exchange rate. This type of fiscal policy is our interest in the simulation experiment given the structure of the macroeconomic model. That is, increase in fiscal deficit increases domestic credit and hence money supply. This reflects the fact that given low tax revenue in Sierra Leone, monetary policy is responsible for maintaining budgetary solvency.

In April 2000, Sierra Leone and five other countries in West Africa signed a declaration to form a monetary zone (yet to be established). One of the convergence criteria for the proposed West African Monetary Zone (WAMZ), as outlined in the Accra Declaration of April 2000, was that each member country should maintain the ratio of budget deficit to GDP to 5 % or less by the end of 2000. We therefore asked the question: 'what would be the effect of this policy on the real exchange rate had it been implemented and maintained earlier in Sierra Leone?' The year 1982 is chosen as the beginning of this policy and it is assumed that the budget deficit (excluding grant) as a ratio of GDP was maintained at 5 % from 1982 to 2005. The choice of 1982 as the beginning of the implementation of this policy is two-fold. First, it is to have the policy simulation in this case the same as the period of the exchange-rate simulation experiment. Second, in this year, the poor external sector performance of Sierra Leone became acute (judged by foreign reserve position and the trade balance). In this experiment, we set the ratio of budget deficit (excluding grant) to GDP at 5 % from 1982 to 2005 and obtained the government expenditure consistent with this deficit. The domestic credit and hence money supply consistent with the hypothesized budget deficit were then obtained. These were obtained from the process describing the money supply behaviour in the model structure.

The simulated price level, rate of inflation and real exchange rate under this policy were then obtained from the estimated model. These disturbed solutions were then compared with the baseline solutions. Table 5.17 and Figure 5.3 show the results of this simulation as case I. The results show that fiscal restraint brought by reduced government expenditure, leading to

reduction in domestic credit and hence reduction in money supply, reduces the price level in the entire period of the simulation. This is the case over the entire simulation period (1982-2005). But the effect on inflation is negligible. Moreover, the impact of this policy on the rate of inflation is not one-sided. In the first 14 periods of its implementation, it increases inflation rate for most of the periods. In the 15^{th} to 17^{th} periods it has no effect on inflation, and in the 18^{th} to 21^{st} period it reduces the rate of inflation while in the 22^{nd} to 24^{th} period (the last three periods of the simulation) the rate of inflation increases.

However, the real exchange rate appreciates in the entire period of the simulation. The appreciation of the real exchange rate following a reduction in government expenditure (in order to maintain government deficit-GDP ratio at 5 %) is in contrast with the traditional wisdom. The traditional wisdom is that a reduction in government expenditure that reduces monetary financing of budget deficit depreciates the real exchange rate by reducing inflation. This result obtains because though the policy reduces the price level, its impact on the rate of inflation is negligible. Moreover, the inflation rate is not stationary (as the price level is integrated of order two). The first difference of the rate of inflation is therefore higher under the disturbed solution than the control solution and this is the only possibility for the observed contradiction with the traditional wisdom. This implies that when the rate of inflation is so high that the rate of inflation is not stationary, it is not just reduction of the price level that can lead to real exchange rate depreciation but sustained reduction of the rate of inflation (rate of change in the price level) such that the first difference (under an I(1) scenario)of the rate of inflation is also reduced (. This is the case because the growth rate of the money supply obtained from the model structure by maintaining budget deficit–GDP ratio at 5 % from 1982 to 2005 has a growth rate of 44 %, which is higher than the growth rate of the historical series for money supply in the same period (a value of 41 %). Thus, to obtain a depreciation of the real exchange rate, it is not just reduction of money supply that matters but reduction of the growth of money supply. That is, when there is tight fiscal policy and hence tight monetary policy, it is the growth effect of money supply but not the level effect that matters for real depreciation.

Table 5.17: Counterfactual Simulation Results: Response of Price Level, Inflation and Real Exchange Rate to Fiscal and Monetary Policy Restraints

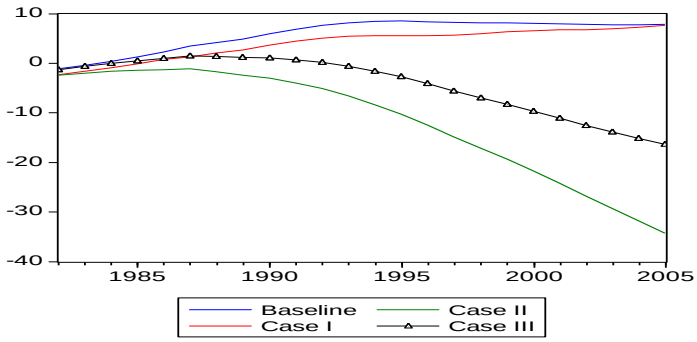
Year	Log of Price Level*			Inflation Rate*			Real Exchange Rate**		
	Case I	Case II	Case III	Case I	Case II	Case III	Case I	Case II	Case III
1982	-1.13	-1.26	-0.12	-0.07	-0.16	-0.12	-14.07	6.53	-0.35
1983	-1.26	-1.61	-0.26	-0.07	-0.16	-0.09	-14.49	6.39	-0.92
1984	-1.32	-2.02	-0.42	0.03	-0.14	-0.06	-15.16	6.81	-0.98
1985	-1.39	-2.64	-0.74	0.04	-0.28	-0.19	-15.61	8.59	0.23
1986	-1.48	-3.52	-1.27	0.05	-0.41	-0.31	-16.78	10.02	1.10
1987	-2.12	-4.58	-1.94	-0.43	-0.40	-0.30	-11.15	14.59	4.82
1988	-2.08	-5.81	-2.72	0.17	-0.37	-0.27	-16.13	14.00	3.83
1989	-2.17	-7.26	-3.68	0.11	-0.41	-0.31	-15.45	17.48	6.51
1990	-2.24	-8.93	-4.81	0.11	-0.43	-0.33	-16.07	19.69	8.04
1991	-2.41	-10.82	-6.11	0.01	-0.45	-0.35	-14.84	23.47	10.95
1992	-2.58	-12.79	-7.45	-0.04	-0.31	-0.21	-15.40	23.06	10.09
1993	-2.74	-14.79	-8.78	0.01	-0.20	-0.10	-15.47	23.69	10.17
1994	-2.88	-16.77	-10.03	0.03	-0.08	0.02	-13.80	26.11	11.82
1995	-2.93	-18.78	-11.26	0.01	-0.06	0.03	-12.07	28.90	13.79
1996	-2.82	-20.85	-12.51	0.00	-0.10	0.00	-10.23	32.39	16.35
1997	-2.54	-23.05	-13.85	0.00	-0.18	-0.08	-10.71	33.32	16.64
1998	-2.18	-25.24	-15.12	0.00	-0.08	0.02	-9.98	34.26	16.94
1999	-1.84	-27.53	-16.45	-0.08	-0.14	-0.04	-10.61	33.50	15.76
2000	-1.51	-29.81	-17.71	-0.07	-0.06	0.03	-11.59	31.64	13.64
2001	-1.24	-32.17	-19.02	-0.04	-0.12	-0.02	-11.29	33.05	14.35
2002	-1.03	-34.60	-20.34	-0.07	-0.13	-0.03	-10.84	33.95	14.61
2003	-0.75	-37.06	-21.65	0.01	-0.10	0.00	-11.10	34.56	14.62
2004	-0.48	-39.55	-22.93	0.01	-0.08	0.02	-11.37	34.56	14.11
2005	-0.20	-42.11	-24.25	0.02	-0.11	-0.01	-12.50	34.00	13.13
1982-2005	**-1.81**	**-17.65**	**-10.14**	**-0.01**	**-0.21**	**-0.11**	**-13.20**	**23.52**	**9.55**

*Figures are in deviation from the baseline

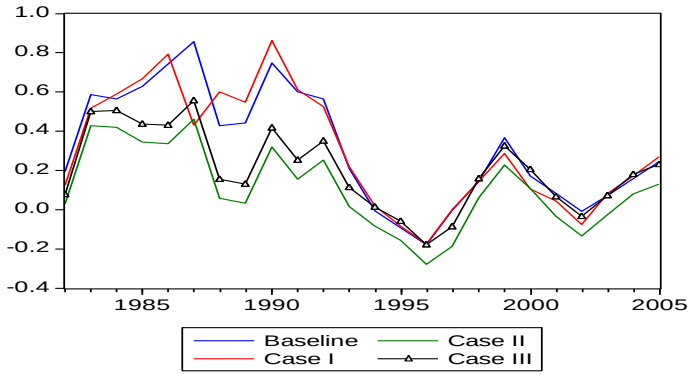
** Figures are in percentage deviation from the baseline. Hence, a negative value indicates a decrease in the endogenous variable and a positive value indicates an increase.

Figure 5.3: Counterfactual Simulation Result: Effects of Fiscal and Monetary Policies

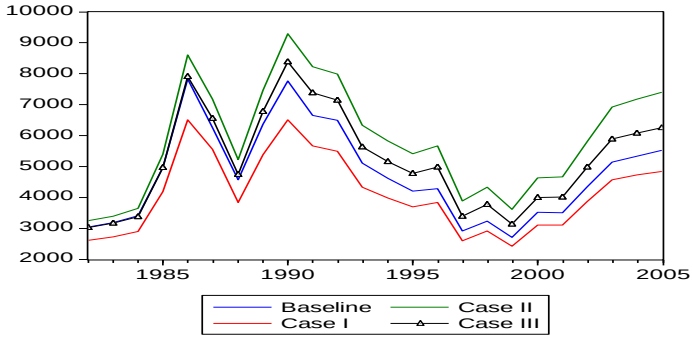
1. Price Level



2. Inflation



3. Real Exchange Rate



5.2.4.1.2 Case II: Maintaining broad money supply growth at 14%

Two other cases of policy simulations are investigated. These two cases deal with the effects of monetary contraction whose quantitative values are chosen arbitrarily but not derived from fiscal consideration that is based on the model structure. These two cases are akin to monetary contraction that is rooted from increased external borrowing to finance an unchanged government deficit. The first of these two cases (referred to as case II) is the scenario where money supply is reduced relative to its historical values, over the period 1982-2005. The reduction is done such that the growth of broad money is maintained at 14 % from 1982 to 2005. This percentage was the growth of broad money in Sierra Leone from 1970 to 1974, a period when the country experienced very low rates of inflation, with an average of 6 % and fiscal deficit (excluding grant) as a ratio of GDP was less than 5 % in each of the years, with an average of 2.1 %. The growth of broad money in this case (14 %) was lower than the growth of the historical series for broad money over the period 1982-2005 (41%). The result of this experiment is given in Table 5.17 and Figure 5.3 as case II. The result shows that in the entire period of the simulation, the policy reduces both the price level and the rate of inflation and the real exchange rate depreciates. This implies that monetary contraction that has high effect on the growth of money supply depreciates the real exchange rate since it reduces both the price level and the rate of inflation.

5.2.4.1.3 Case III: Maintaining broad money supply growth at 25 %

The last of the three cases of the monetary-policy simulation, referred to here as case III, is when broad money supply is reduced relative to the historical values such that its growth rate is kept at 25 % over the period 1982 to 2005. This percentage was the growth of broad money over the period 2000-2005, the only period with low rates of inflation since the end of 1974, with an average inflation rate of 5.30 %. The budget deficit (excluding grant) as a ratio of GDP was however higher in this period than any other period in the history of the country, with an average of 14.1%. Interestingly, this period had the least average inflation but the highest ratio of budget deficit to GDP since 1970. Moreover, deficit was financed more from external sources than

domestic sources in this period. The result of this experiment is given in Table 5.17 and Figure 5.3 as case III. The result shows that as a result of the monetary contraction both the price level and the rate of inflation reduce and the real exchange rate depreciates.

A comparison of the quantitative results of Cases II and III shows that the case where money supply growth is kept at 14 % (case II) has larger impact on the price level, inflation rate and the real exchange rate depreciation than the case where money supply growth is kept as 25 % (case III). This implies that the lower the growth of money supply, the lower the rate of inflation will be and the higher the real exchange rate depreciation will be.

5.3 The equilibrium real exchange rate model estimates and real exchange rate misalignment

5.3.1 The determinants of the equilibrium real exchange rate

The (long run) equilibrium real exchange rate equation was obtained based on the idea that only real factors affect the equilibrium real exchange rate, unlike the short run real exchange rate which is determined by both real and nominal factors. It would have been interesting to obtain the equilibrium real exchange rate model by the Johansen Maximum Likelihood procedure since it assumes that all the variables are potentially endogenous. However, since the sample size is 36 and there are many variables in the specified model, this method could not be applied because our degree of freedom is low for this method. Thus, the Ordinary Least Squares was applied to the static long run model, in the spirit of the Hendry's general– to– specific modelling.

In the overparametised static long run model, capital flow, the ratio of government expenditure to GDP and growth of output were not significant. These variables were therefore deleted. Appendix Table 5 shows the result of the overparameterised model of the long run equilibrium real exchange rate. The parsimonious model obtained from the deletion of the insignificant variables is shown in Table 5.18. However, while this model passes diagnostic tests such as homoscedasticity, Gaussian residuals, autoregressive conditional heteroscdasticity (ARCH), functional form misspecification and stability tests there is evidence of serial

correlation in the residuals. This is observed from the autocorrelations, partial autocorrelations, Ljung-Box Portmanteau Q-statistics, the Durbin-Watson statistic and the Breusch-Godfrey serial correlation LM test based on the model. Appendix Table 6 shows these diagnostic tests.

This serial correlation was corrected by the application of autoregressive moving average (ARMA) modeling. In order to save the degree of freedom the order of the ARMA model was initially chosen to be ARMA (1 1). The autoregressive (AR) term was insignificant in the ARMA (1 1) model. To this end, the AR term was dropped and the model was estimated with MA (1) instead of ARMA (1 1) errors[28]. Only the result of the model with ARMA (0 1) errors is shown here. Table 5.18 shows the results of the parsimonious equilibrium real exchanges rate model estimated with ARMA (0 1) errors. Appendix Table 7 shows the diagnostic test results from this model. The tests show that the model is satisfactory since it passes these diagnostic tests.

The result of the equilibrium real exchange rate model shows that terms of trade, exchange and trade restriction measures (which are proxied by the index of closeness to international trade), and investment share in GDP are the determinants of the equilibrium real exchange rate of Sierra Leone. An improvement in the terms of trade depreciates the equilibrium real exchange rate. The fact that the terms-of-trade has positive effect on the equilibrium real exchange rate implies that the substitute effect of a change in terms of trrade in Sierra Leone dominates the income effect. The closeness of Sierra Leone to international trade has negative effect on the equilibrium real exchange rate. Hence, trade liberalization measures depreciate the equilibrium real exchange rate of Sierra Leone. An increase in investment share in GDP appreciates the equilibrium real exchange rate since investment–GDP ratio has negative effect on the equilibrium real exchange rate. The negative coefficient implies that in Sierra Leone investment takes place more in the non-tradable sector than the tradable sector since this is the situation under which investment has negative effect on the equilibrium real exchange. When investment takes place in the non-tradable goods sector, the demand for non-tradable goods increases and the price of non-tradable goods increases. Hence, the relative price of non-tradable goods decreases and the equilibrium real exchange rate decreases (appreciates).

[28] An MA (1) model is an ARMA (0 1) model. This means that the ARMA model has no AR term.

Table 5.18: The Parsimonious Equilibrium Real Exchange Rate Model: Without ARMA Errors

Dependent Variable: LnRER
Method: Ordinary Least Squares (OLS)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.972247	0.311233	22.40205	0.0000
LnTOT	0.223893	0.056464	3.965210	0.0004
LnCLOSE	-0.475120	0.140084	-3.391671	0.0019
Ln(I/GDP)	-0.315347	0.129593	-2.433366	0.0207

R-squared	0.424648	Mean dependent var	8.078223
Adjusted R-squared	0.370709	S.D. dependent var	0.284116
S.E. of regression	0.225383	Akaike info criterion	-0.037589
Sum squared resid	1.625524	Schwarz criterion	0.138357
Log likelihood	4.676609	F-statistic	7.872708
Durbin-Watson stat	0.928972	Prob(F-statistic)	0.000451

Table 5.19: The Parsimonious Equilibrium Real Exchange Rate Model: With ARMA (0 1) errors

Dependent Variable: LnRER
Method: Ordinary Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnTOT	0.257310	0.074854	3.437482	0.0017
LnCLOSE	-0.446543	0.094221	-4.739332	0.0000
Ln(I/GDP)	-0.207858	0.072923	-2.850378	0.0077
C	7.067588	0.372379	18.97955	0.0000
MA(1)	0.964317	0.065105	14.81179	0.0000

R-squared	0.660488	Mean dependent var	8.078223
Adjusted R-squared	0.616680	S.D. dependent var	0.284116
S.E. of regression	0.175904	Akaike info criterion	-0.509508
Sum squared resid	0.959211	Schwarz criterion	-0.289575
Log likelihood	14.17114	F-statistic	15.07691
Durbin-Watson stat	2.160209	Prob(F-statistic)	0.000001

Inverted MA Roots	-.96

The insignificance of growth of output in the equilibrium real exchange rate model is a rejection of the Ricardo-Balassa effect in Sierra Leone. The Ricardo-Balassa effect states that technological progress, which is assumed to take place in the tradable goods sector and is represented by growth of output, appreciates the equilibrium real exchange rate. This result should however be taken with caution since in a developing country growth of output, which is negative in Sierra Leone for a number periods, cannot serve as a good proxy for technological progress. The insignificance of capital flow in the equilibrium real exchange rate model implies that the Dutch disease syndrome does not hold in Sierra Leone. The Dutch disease syndrome states that increase in capital inflow appreciates the equilibrium real exchange rate. The insignificance of government- expenditure-GDP ratio in the equilibrium real exchange rate model may be due to the fact that government expenditure is a component of aggregate investment and aggregate investment is significant in the model.

The coefficient of the MA (1) term is 0.96. Hence, the MA process is invertible (an autoregressive representation can be obtained from the MA process) since the coefficient of the moving average term is less than unity. The F– statistic shows that the regressors of the model jointly explain the equilibrium real exchange rate and the R^2 shows that 66 % of the variation in the equilibrium real exchange rate is explained by the explanatory variables.

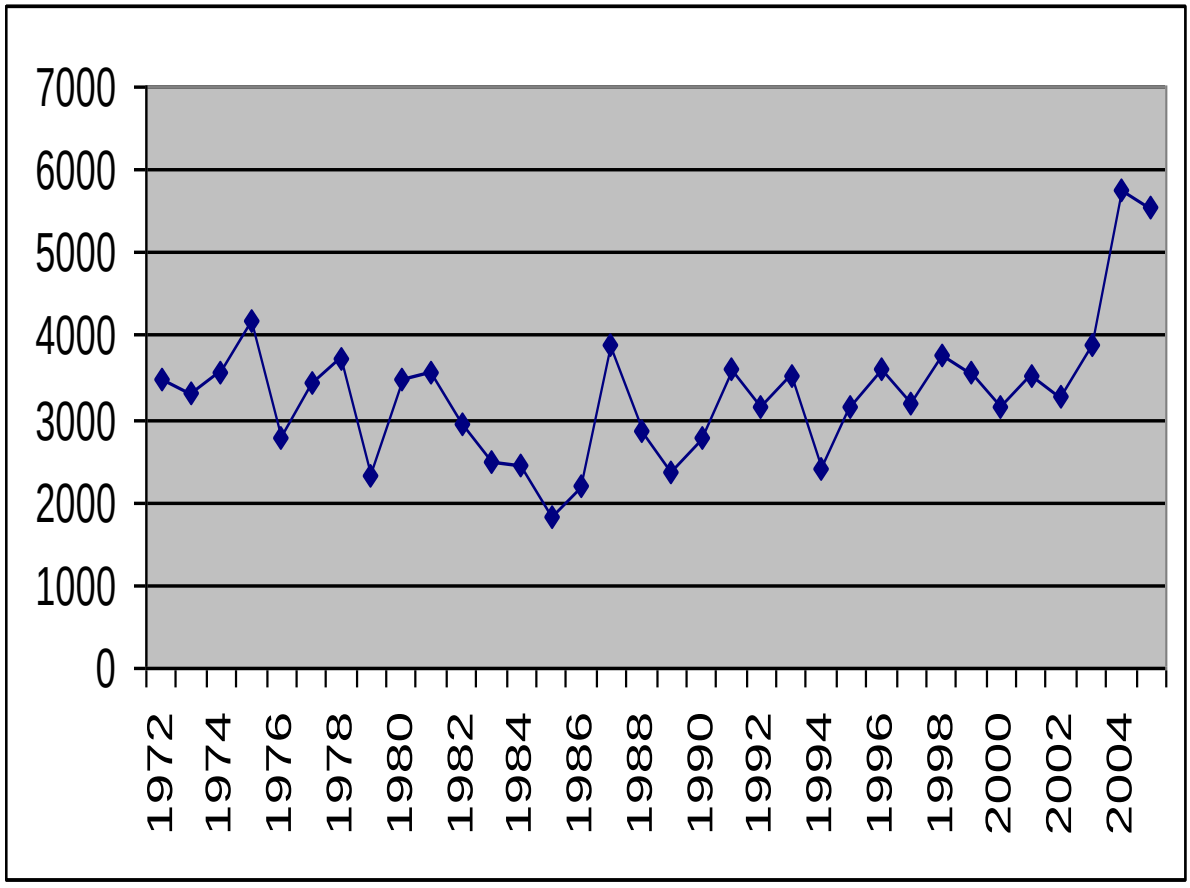
5.3.2 The model–based equilibrium real exchange rate

Following the determination of the fundamentals of the real exchange rate is the computation of the equilibrium real exchange rate. The coefficients of the estimated equilibrium real exchange rate model and the sustainable values of the real exchange rate fundamentals are then used to obtain the equilibrium real exchange rate of Sierra Leone from the early 1970s to 2005. To the extent that the equilibrium real exchange rate requires the fundamentals to be at their sustainable values these fundamentals were decomposed into their permanent and cyclical components by using the Hodrick–Prescott filter. The permanent components, which are the sustainable values of the fundamentals, were then substituted into the equilibrium real exchange rate model to obtain the equilibrium real exchange rates. Figure 5.4 shows the equilibrium real exchange rate from 1972 to 2005. The figure shows that the trend in the equilibrium real exchange rate of Sierra Leone was not unidirectional. A close observation of the figure shows

that the equilibrium real exchange rate appreciated in the years of the oil shocks (1973 and 1979). This reveals that the increases in the price of oil, which increased import price, deteriorated the terms of trade of Sierra Leone (a non-oil producing country) and the equilibrium real exchange rate appreciated in these periods.

The computed equilibrium real exchange rate values further reveals that the equilibrium real exchange rate appreciated consistently in the first half of the 1980s (1981-1985). This was a period when Sierra Leone relied heavily on inward-looking orientation policies. Hence, trade restrictions increased the price of imports, which translated into higher domestic prices. Coupled with the expansionary monetary policy in this period, price of non-tradables rose and the price of tradable relative to non-tradable goods (the equilibrium real exchange rate decreases). In the other periods it is observed that the equilibrium real exchange rate depreciations lasted for one or two years, thereafter appreciation took place for about the same number of periods. The volatility of the equilibrium real exchange rate is observed to be higher over the period 1986-1989 than the period 1990-2003 (the managed floating exchange rate regime). In 2004 and 2005 the equilibrium real exchange rates were very high compared to previous periods. These results reveal that the equilibrium real exchange rate is not an immutable value but changes as the fundamentals change. Hence the purchasing power parity (PPP) approach to measuring real exchange rate misalignment, which assumes that the equilibrium real exchange rate is an immutable value, is rejected in the case of Sierra Leone.

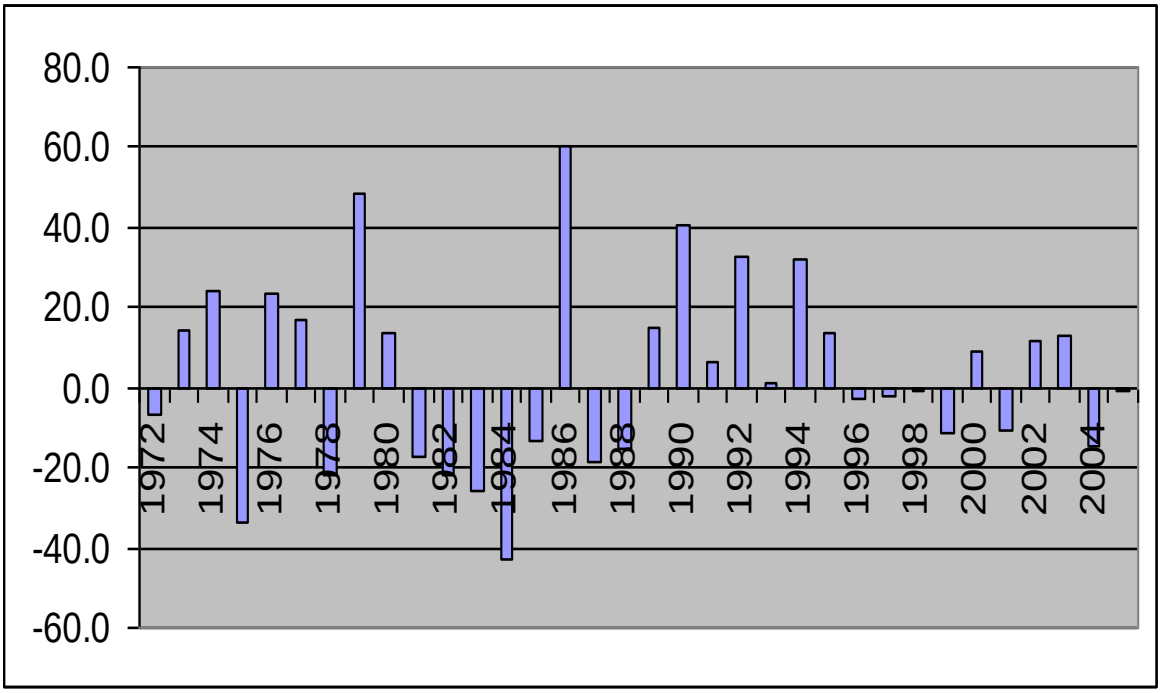
Figure 5.4: The Computed Equilibrium Real Exchange Rate for Sierra Leone



5.3.3 Real exchange rate misalignment

Having computed the equilibrium real exchange rate the real exchange rate misalignment, which is the sustained deviation of the actual real exchange rate from the equilibrium real exchange rate, is then computed. Figure 5.5 and Table 5.20 present the computed real exchange rate misalignment. The estimates are in agreement with those of Edwards (1989), Elbadawi in (1994) and Elbadawi and Soto (1997) in the sense that the real exchange rate misalignments of non-oil exporting countries in their samples were high in the oil shocks of 1973 and 1979. The result shows that the real exchange rate of Sierra Leone was misaligned from the early 1970s to 2005. Moreover, the 1980s which was a period of fixed exchange rate regime, inconsistent fiscal and monetary policies and high trade restrictions in Sierra Leone had more episodes of real exchange rate overvaluation than the 1970s and 1990s. Furthermore, the period of the fixed exchange rate regime (early 1970s to end of the 1980s) had higher real exchange rate misalignment than the managed floating exchange rate regime (1990 to 2005). The results further show that real exchange rate misalignment was very low between 1996 and 2005. This was a period of low money supply growth, comparative to previous periods, and high nominal exchange rate depreciation.

Figure 5.5: Real Exchange Rate Misalignment in Sierra Leone*



* Negative implies overvaluation while positive implies undervaluation

Table 5.20: Real Exchange Rate Misalignment in Sierra Leone

YEAR	Equilibrium RER (ERER)	Actual RER (RER)	RER Misalignment (RERMIS) *	
1972	3479.58	3235.20	-7.0	**Overvaluation**
1973	3298.43	3779.91	14.6	
1974	3569.16	4432.11	24.2	**Undervaluation**
1975	4163.74	2760.34	-33.7	**Overvaluation**
1976	2762.77	3404.92	23.2	
1977	3456.52	4038.80	16.8	
1978	3725.66	2911.17	-21.9	
1979	2299.45	3418.73	48.7	
1980	3462.63	3927.92	13.4	**Undervaluation**
1981	3553.60	2936.07	-17.4	
1982	2959.96	2319.09	-21.7	
1983	2478.99	1841.98	-25.7	
1984	2432.22	1382.63	-43.2	
1985	1839.25	1590.63	-13.5	
1986	2208.96	3541.20	60.3	
1987	3897.61	3169.92	-18.7	
1988	2870.84	2427.35	-15.4	**Overvaluation**
1989	2356.80	2703.64	14.7	
1990	2771.68	3899.47	40.7	
1991	3603.46	3826.44	6.2	
1992	3143.38	4169.44	32.6	
1993	3540.10	3580.82	1.2	
1994	2388.56	3148.11	31.8	
1995	3156.22	3582.46	13.5	**Undervaluation**
1996	3598.17	3494.55	-2.9	
1997	3199.00	3124.46	-2.3	
1998	3784.08	3753.26	-0.8	
1999	3561.68	3155.65	-11.4	
2000	3136.06	3425.62	9.2	
2001	3531.62	3147.17	-10.9	**Overvaluation**
2002	3255.67	3637.09	11.7	
2003	3891.80	4393.66	12.9	**Undervaluation**
2004	5738.65	4900.05	-14.6	
2005	5565.78	5523.30	-0.8	**Overvaluation**

$$* \; RERMIS = \left(\frac{RER - ERER}{ERER} \right) * 100$$

5.4 Synthesis of empirical results and study objectives

Objective I:

To investigate the effects of the nominal exchange rate on the real exchange rate, trade balance and overall balance of payments in Sierra Leone.

This was achieved by developing and estimating a small macroeconometric model, which captures the links among fiscal, monetary and exchange rate policies. The model was then solved under control and disturbed scenarios over the period 1982-2005. The results show that an increase in the nominal exchange rate depreciates the real exchange rate, deteriorates the trade balance and improves the overall balance of payments. The deterioration in the trade balance arises from the fact that income and hence imports increases when the nominal exchange rate depreciates.

Objective II:

To investigate the determinants of the actual (short-run) and equilibrium (long-run) real exchange rates in Sierra Leone.

The determinants of the short-run real exchange rate were obtained by estimating the short run real exchange rate equation simultaneously with the other equations of the short-run macroeconometric model and simulating the effects of nominal exchange rate depreciation, fiscal and monetary contractions on the short-run real exchange rate. The results show that the closeness of the economy of Sierra Leone to international trade is the only real variable that affects the short-run real exchange rate (it has a negative effect on the real exchange rate). Nominal exchange rate depreciation as well as reduction in the growth of money supply, which emanates from contraction of government expenditure or reliance on external sources to finance government deficit, depreciates the real exchange rate.

The investigation of the determinants of the equilibrium real exchange rate was achieved by estimating the static long run real exchange rate model, through the application of Ordinary Least Squares (OLS), with moving average errors. This was done in the spirit of the Hendry's general–to– specific modeling. The result shows that the equilibrium real exchange rate of Sierra

Leone is determined by terms of trade (positively), closeness of the economy to international trade (negatively) and investment share of GDP (negatively).

Objective III:

To obtain a model–based equilibrium real exchange rate and characterise the nature of real exchange rate misalignment in Sierra Leone, from the early 1970s to 2005.

The model–based equilibrium real exchange rate was obtained by substituting the sustainable values of the determinants of the equilibrium real exchange rate into the estimated equilibrium real exchange rate model. These sustainable values were obtained by decomposing the determinants of the equilibrium real exchange rate into their permanent (sustainable) and cyclical components using the Hodrick–Prescott filter. The results show that the equilibrium real exchange rate appreciated in the periods of the two oil shocks (1973 and 1979) and consistently appreciated from 1981 to 1985. After 1985, it was appreciating and depreciating with no consistent pattern over a long period. However, it had lower volatility between 1990 and 2003 (the managed floating exchange rate regime period) than the years before 1990 (the fixed exchange rate regime period). The years 2004 and 2005 had very high equilibrium real exchange rates compared to previous periods.

The real exchange rate misalignment was calculated as the deviation of the equilibrium real exchange rate from the actual real exchange rate (as a percentage of the equilibrium real exchange rate). The computed real exchange rate misalignment shows that the 1980s was a period of real exchange rate overvaluation in Sierra Leone. Moreover, the first half of the 1990s was episodes of undervaluation. Furthermore, real exchange rate undervaluation was common in the 1970s. Also, real exchange rate misalignment was lower in the managed floating exchange rate regime than the fixed exchange rate regime.

CHAPTER SIX
SUMMARY, CONCLUSION AND LESSONS FOR POLICY

6.1 Summary and conclusion

Slow growth of output, price stability (low and stable inflation rate) and poor external sector performance have been characteristics of many developing countries since the early 1980s, though some others had developed these undesirable features before the 1980s. Good external sector performance does not only have virtuous effects on the attainment of economic growth and price stability but it also forms a virtuous cycle with them. Drawing from this, the attainment of healthy external sector has been critical to both national central banks and the International Monetary Fund. The adjustment of real exchange rate through nominal exchange rate devaluations/depreciations, changes in exchange rate regime and demand management policies (fiscal and monetary policies) have been common in the attempts at resolving weak external sector performance in many developing countries, including Sierra Leone. However, the external sector performance of most of the developing economies, particularly in sub-Saharan Africa, including Sierra Leone is still weak and this coexists with slow growth of output and non-achievement of the price stability objective. In order to have a profound arrest of the problem in a particular economy, it is imperative to allow the data to provide the empirical reality.

In the light of these considerations the study sought to examine the following issues in Sierra Leone, a country whose external sector performance has been poor since the early 1980s. (i) To investigate the effects of the nominal exchange rate on: the real exchange rate, trade balance and overall balance of payments. (ii) To investigate the determinants of both the actual (short-run) and equilibrium (long-run) real exchange rates. (iii) To obtain a model–based equilibrium real exchange rate and characterise the nature of real exchange rate misalignment from the early 1970s to 2005.

In order to address these objectives, annual aggregate data from 1970 to 2005 were used to estimate a small macroeconomic model, which was developed by taking into consideration the

interactions among exchange rate, monetary and fiscal policies. The Three Stage Least Squares (3SLS) was used to estimate the system of simultaneous equations in the spirit of short-run dynamics, with error correction consideration. Counterfactual policy simulations were then carried out over the period 1982-2005 to determine the effects of nominal exchange rate depreciation on the real exchange rate, trade balance and the overall balance of payments. Moreover, the policy simulation experiments involved the determination of the effects of fiscal and monetary policies on the real exchange rate. The equilibrium real exchange rate model was estimated by the application of OLS with moving average errors to the static long-run model, in the spirit of the Hendry's general–to–specific modeling. The equilibrium real exchange rates from the early 1970s to 2005 were also derived. This involved two stages in which in the first stage, the sustainable values of the determinants of the equilibrium real exchange rate were obtained by applying the Hodrick–Prescott filter to the historical values of these fundamentals. In the second stage, these sustainable values were substituted into the estimated equilibrium real exchange rate model to compute the equilibrium real exchange rate. The real exchange rate misalignment was consequently computed given the values of the computed equilibrium real exchange rate and the actual real exchange rate series.

A number of important results were obtained. Among these are the effects of the nominal exchange rate. Nominal exchange rate depreciation is inflationary and initially increases output but later contracts it. The inflationary effect increases as the nominal exchange rate depreciation is sustained. Though the depreciation of the nominal exchange rate is inflationary it depreciates the real exchange rate. Thus, aggregate exports increase through increase in non-mineral exports of Sierra Leone. The increase in income emanating from increased export and hence aggregate demand, increases imports but as income falls later imports fall. Hence, the trade balance initially deteriorates but eventually improves. On the average, the trade balance deteriorates, arising from the increased import that follows the increase in income. In the case of the overall balance of payments, a deprecation of the nominal exchange rate leads to an improvement on impact and over time. On the average and relative to the baseline, a sustained increase in the nominal exchange rate by 85 % increases the price level by 3.9 %, the real exchange rate by 6.9 %, non-mineral export by 117.1%, aggregate exports by 47.8% , income by 1.8 %, absorption by 0.4 %, imports by 85.9 % and foreign reserves by 22.6 % while the trade balance decreases by 48.35 %.

Moreover, the simulation exercise shows that reduction of money growth depreciates the actual real exchange rate. The real exchange rate model shows that increase in the closeness of Sierra Leone to international trade appreciates the real exchange rate. The long run (equilibrium) real exchange rate model shows that the equilibrium real exchange rate depreciates with improvement in the terms of trade but appreciates with increase in closeness to international trade and increase in investment share in GDP.

The computed equilibrium real exchange rate shows that the equilibrium real exchange rate appreciated in the periods of the two oil shocks (1973 and 1979) , confirming the negative effects of the terms of trade deterioration on the equilibrium real exchange rate. It also shows that the equilibrium real exchange rate appreciated continuously in the first half of the 1980s, a period of inward-looking orientation approach to development in Sierra Leone. Real exchange rate misalignment was found to be lower in the managed floating exchange rate regime introduced in 1990 than the fixed exchange rate regime of the 1970s and 1980s.

6.2 Lessons for policy

The findings of the study reveal some lessons for policy consideration. Nominal exchange rate depreciation leads to real exchange rate depreciation and improvement in export performance. This suggests that the monetary authorities can use exchange rate management to develop the external sector of Sierra Leone, via the non-mineral sector. However, the study finds that nominal exchange rate depreciation is inflationary and inflation has negative effect on the real exchange rate. Moreover, loose monetary policy leads to higher inflation. It is therefore necessary for the monetary authorities to adopt monetary restraint in the event of using nominal exchange rate depreciation to achieve real exchange rate depreciation, in the interest of external sector development. This is to ensure that high inflation rate does not prevent the real exchange rate from depreciating. To achieve this goal fiscal restraint should not be excluded in the program, as it contributes to the success of monetary restraint.

Another consideration for policy is the fact that when income increase from development of the export sector or otherwise, such increase in income should not be considered to be permanent to the extent of not controlling spending on imports. Otherwise, the increase in

imports nullifies the positive effect of the growth of export on the trade balance and the trade balance would deteriorate.

The results also have implication for commercial policies in Sierra Leone. The government should encourage trade liberalization measures since these policies depreciate the actual and equilibrium real exchange rates, thus improving competitiveness to international trade. To the extent that increase in the investment share of GDP appreciates the equilibrium real exchange rate, implying that investment takes place more in the non-tradable goods sector, it is recommended that the government increases investment in the tradable sector and implement policies that encourage private sector investment in this sector so that the equilibrium real exchange rate can depreciate with increase in investment.

The study also has implication for the exchange rate regime in Sierra Leone. To the extent that the period of the fixed exchange rate regime had higher real exchange rate misalignment than the period of the managed floating exchange regime, it is recommended that the current floating exchange rate regime be sustained.

6.3 Limitations of the study and suggestions for future research

Although the macroeconometric model developed, estimated and solved under different scenarios addresses the study objectives, it is not devoid of issues for improvement. The model is essentially predicated on the aggregate demand (Keynesian) phenomenon in that changes in output is driven by changes in aggregate demand. An extension of the model by introducing the production sector and labour market will do more justice to the reality than this study. Moreover, the model is characterised by aggregation. Disaggregating investment into private and public, and government revenue into import duties, mineral revenue and other government revenue are interesting disaggregations to be made. Furthermore, introducing the monetary sector in a way that the fiscal dominance principle is empirically tested by stochastically modeling high powered money and money supply rather than appearing as identities is useful.

Also, modeling with a larger sample size will be an improvement on the current study. This can be done by using quarterly data, in which case the interpolation of quarterly series for variables without quarterly data will be useful. The use of larger sample size also ensures that the

Johansen Maximum Likelihood technique rather than the static long run approach is used to arrive at the equilibrium real exchange rate model.

These suggestions are expected to provide a more detailed examination of the role of exchange rate in balance of payments adjustment.

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APPENDICES

Appendix Table 1: Summary of Exchange Rate Adjustment Policies in Sierra Leone

TIME	POLICY
November 1967	The first devaluation of the domestic currency (the Leone) and pegging of the leone to the British pound
November 1978	The leone was de-linked from the British pound and set at the rate of Le2.25 per SDR
December 1982	Dual exchange rate regime was adopted under the Modified Exchange Rate Arrangement.
July 1986	The exchange rate was Unified (The dual exchange rate regime) was abandoned
August 1987	The leone was revalued from le53.00 to le23.00 per U.S dollar
March 1989	The leone was devalued from le 44.00 to le 65.00 per U.S dollar
January 1990	The leone was devalued from le 65.00 to le 120.00 per U.S dollar
April 1990	The managed floating exchange rate regime was adopted

Appendix Table 2: Real Exchange Rate Volatility in Sierra Leone

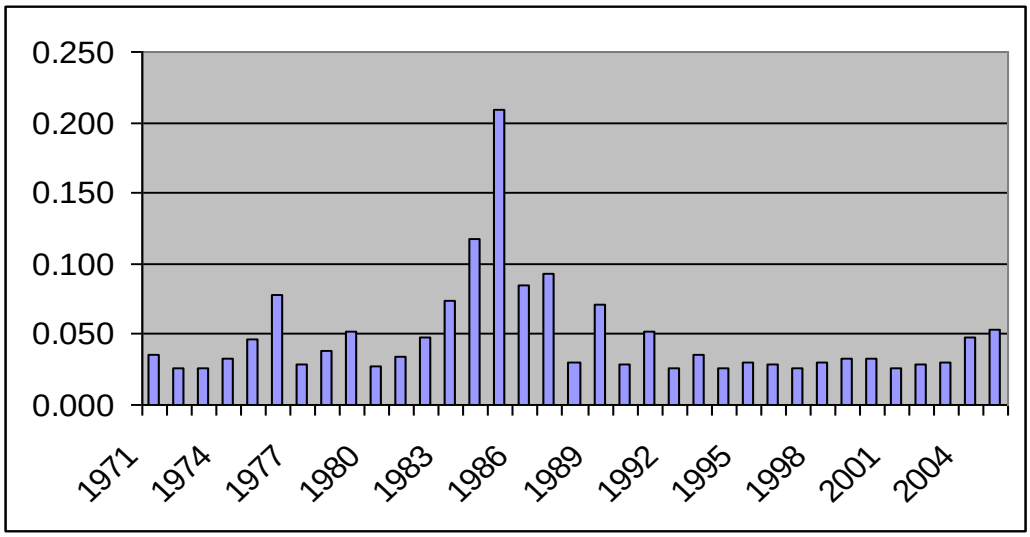
A. The GARCH (0 1) Model

Variable: LnRER

	Coefficient	Std. Error	z-Statistic	Prob.
C	4.424119	1.256945	3.519739	0.0004
LnRER(-1)	0.456720	0.152730	2.990368	0.0028
Variance Equation				
C	0.025336	0.010396	2.437200	0.0148
ARCH(1)	0.468521	0.288973	1.621330	0.1049

R-squared	0.363240	Mean dependent var	8.082996
Adjusted R-squared	0.301618	S.D. dependent var	0.286796
S.E. of regression	0.239673	Akaike info criterion	-0.168256
Sum squared resid	1.780738	Schwarz criterion	0.009498
Log likelihood	6.944473	F-statistic	5.894645
Durbin-Watson stat	1.321671	Prob(F-statistic)	0.002637

B. The Volatility Trend*



***Real Exchange Rate Volatility was high over the period 1982-1989

Appendix Table 3: Detailed Results of the Johansen Cointegration Tests

1. Real Exchange Rate Model

Unrestricted Cointegration Rank Test (Series: LnRER ln(I/Y) lnclose lnTOT

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.604259	59.69620	47.21	54.46
At most 1	0.501940	29.10535	29.68	35.65
At most 2	0.153325	6.103176	15.41	20.04
At most 3	0.018337	0.610723	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.604259	30.59085	27.07	32.24
At most 1 *	0.501940	23.00218	20.97	25.52
At most 2	0.153325	5.492453	14.07	18.63
At most 3	0.018337	0.610723	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

2.Price Model

Unrestricted Cointegration Rank Test (Series: LnP LnMS LnY Lne Lni)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.750971	113.5967	68.52	76.07
At most 1 **	0.615964	69.11077	47.21	54.46
At most 2 **	0.507232	38.48613	29.68	35.65
At most 3 *	0.342933	15.83921	15.41	20.04
At most 4	0.072262	2.400182	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 4 cointegrating equation(s) at the 5% level
Trace test indicates 3 cointegrating equation(s) at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.750971	44.48590	33.46	38.77
At most 1 *	0.615964	30.62464	27.07	32.24
At most 2 *	0.507232	22.64692	20.97	25.52
At most 3	0.342933	13.43903	14.07	18.63
At most 4	0.072262	2.400182	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 3 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 1% level

Appendix Table 3 Continued: Detailed Results of the Johansen Cointegration Tests

3.Private Consumption Model

Unrestricted Cointegration Rank Test: (Series lnCp lnY lnp lni)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.650926	50.18068	47.21	54.46
At most 1	0.260137	14.39668	29.68	35.65
At most 2	0.113851	4.152827	15.41	20.04
At most 3	0.001271	0.043240	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at the 5% level
Trace test indicates no cointegration at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.650926	35.78400	27.07	32.24
At most 1	0.260137	10.24385	20.97	25.52
At most 2	0.113851	4.109587	14.07	18.63
At most 3	0.001271	0.043240	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

4. Government Consumption Model

Unrestricted Cointegration Rank Test (Series: LnCg LnY LnP LnGR LnE Lni)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.764332	134.7249	94.15	103.18
At most 1 **	0.678124	85.58358	68.52	76.07
At most 2	0.445963	47.04160	47.21	54.46
At most 3	0.317409	26.96383	29.68	35.65
At most 4	0.275366	13.98063	15.41	20.04
At most 5	0.085251	3.029607	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.764332	49.14133	39.37	45.10
At most 1 *	0.678124	38.54197	33.46	38.77
At most 2	0.445963	20.07778	27.07	32.24
At most 3	0.317409	12.98320	20.97	25.52
At most 4	0.275366	10.95102	14.07	18.63
At most 5	0.085251	3.029607	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 1% level

Appendix Table 3 Continued: Detailed Results of the Johansen Cointegration Tests

5. Investment Model

Unrestricted Cointegration Rank Test (Series: LnI LnY LNP Lni LnDGNP LnDSGNP)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.759539	142.9604	94.15	103.18
At most 1 **	0.707685	95.92891	68.52	76.07
At most 2 **	0.550141	55.34141	47.21	54.46
At most 3	0.425764	28.98034	29.68	35.65
At most 4	0.275512	10.67473	15.41	20.04
At most 5	0.001185	0.039137	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 3 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.759539	47.03149	39.37	45.10
At most 1 **	0.707685	40.58750	33.46	38.77
At most 2	0.550141	26.36107	27.07	32.24
At most 3	0.425764	18.30561	20.97	25.52
At most 4	0.275512	10.63559	14.07	18.63
At most 5	0.001185	0.039137	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels

6. Government Revenue Model

Unrestricted Cointegration Rank Test (Series: LnGR LnY LnM LnGrant)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.644716	54.80014	47.21	54.46
At most 1	0.322221	19.61568	29.68	35.65
At most 2	0.164312	6.391908	15.41	20.04
At most 3	0.008462	0.288923	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.644716	35.18446	27.07	32.24
At most 1	0.322221	13.22377	20.97	25.52
At most 2	0.164312	6.102985	14.07	18.63
At most 3	0.008462	0.288923	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Appendix Table 3 Continued: Detailed Results of the Johansen Cointegration Tests

7. Non-Mineral Export Model

Unrestricted Cointegration Rank Test (Series: LnNMX LnRER RERMIS LnPxP LnRERVOL LnY^f)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.726512	111.2788	94.15	103.18
At most 1 *	0.632332	69.79089	68.52	76.07
At most 2	0.492567	37.77247	47.21	54.46
At most 3	0.225828	16.06398	29.68	35.65
At most 4	0.179445	7.873233	15.41	20.04
At most 5	0.047118	1.544460	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at the 5% level
Trace test indicates 1 cointegrating equation(s) at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.726512	41.48793	39.37	45.10
At most 1	0.632332	32.01842	33.46	38.77
At most 2	0.492567	21.70849	27.07	32.24
At most 3	0.225828	8.190746	20.97	25.52
At most 4	0.179445	6.328773	14.07	18.63
At most 5	0.047118	1.544460	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

8. Import Demand Model

Unrestricted Cointegration Rank Test (Series: LnM LnY LNRER RERMIS LnFX)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.660211	67.42990	68.52	76.07
At most 1	0.411619	32.88811	47.21	54.46
At most 2	0.250306	15.91595	29.68	35.65
At most 3	0.186298	6.697065	15.41	20.04
At most 4	0.003117	0.099899	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.660211	34.54179	33.46	38.77
At most 1	0.411619	16.97216	27.07	32.24
At most 2	0.250306	9.218885	20.97	25.52
At most 3	0.186298	6.597166	14.07	18.63
At most 4	0.003117	0.099899	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

Appendix Table 3 Continued: Detailed Results of the Johansen Cointegration Tests

9. Foreign Reserve Model

Unrestricted Cointegration Rank Test (Series: LnFR LnY LnP Lne Lni LnDC)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.795844	126.2260	94.15	103.18
At most 1 *	0.580620	72.20431	68.52	76.07
At most 2	0.408843	42.65905	47.21	54.46
At most 3	0.348439	24.78617	29.68	35.65
At most 4	0.210507	10.22110	15.41	20.04
At most 5	0.062235	2.184709	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at the 5% level
Trace test indicates 1 cointegrating equation(s) at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.795844	54.02168	39.37	45.10
At most 1	0.580620	29.54526	33.46	38.77
At most 2	0.408843	17.87288	27.07	32.24
At most 3	0.348439	14.56507	20.97	25.52
At most 4	0.210507	8.036387	14.07	18.63
At most 5	0.062235	2.184709	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Appendix Table 4: Formulae for Evaluating Forecasting Performance of the Macro Model

1. Theil's Inequality Coefficient (U^2)

$$U^2 = \frac{\sum (P_i - A_i)^2 / n}{\sum A_i^2 / n}$$

2. Bias Proportion (U_m)

$$U_m = \frac{\left(\overline{P} - \overline{A}\right)^2}{\sum (P_i - A_i)^2 / n}$$

3. Variance Proportion (Us)

$$Us = \frac{(S_P - S_A)^2}{\sum (Pi - Ai)^2 / n}$$

4. Covariance Proportion (Uc)

$$Uc = \frac{2(1 - r_{pA}) S_p S_A}{\sum (Pi - Ai)^2 / n} = 1 - (Um + Us)$$

5. Root Mean Squared Error (RMSE)

$$RMSE = \sqrt{\frac{\sum (Pi - Ai)^2}{n}}$$

Where: P_i = Predicted (forecast) change in the dependent variable
A_i = Actual (realised) change in the dependent variable
n = number of observations
$\overline{P}$ = Mean of predicted change in the dependent variable
$\overline{A}$ = Mean of actual change in the dependent variable
S_p = Standard deviation of predicted change in the dependent variable
S_A = Standard deviation of actual change in the dependent variable
r_{pA} = Correlation coefficient between predicted and actual changes in the dependent variables

Appendix Table 5: The Overparametised Equilibrium Real Exchange Rate Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.892273	0.414788	16.61638	0.0000
Ln(I /GDP)	-0.300851	0.133073	-2.260796	0.0312
LnTOT	0.184669	0.084381	2.188496	0.0366
Ln(G/GDP)	-0.122261	0.158494	-0.771391	0.4465
CAPFLO	0.789008	0.958872	0.822850	0.4171
LnCLOSE	-0.486669	0.143752	-3.385487	0.0020

R-squared	0.439670	Mean dependent var	8.078223
Adjusted R-squared	0.346282	S.D. dependent var	0.284116
S.E. of regression	0.229716	Akaike info criterion	0.047066
Sum squared resid	1.583083	Schwarz criterion	0.310986
Log likelihood	5.152816	F-statistic	4.707973
Durbin-Watson stat	0.973888	Prob(F-statistic)	0.002720

Appendix Table 6: Diagnostic Tests from the Parsimonious Equilibrium RER Model without ARMA errors

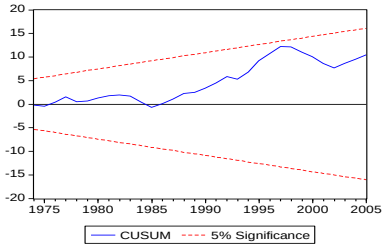
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |**** |	. |**** |	1	0.519	0.519	10.526	0.001
. |* . |	.**| . |	2	0.116	-0.209	11.072	0.004
. | . |	. |* . |	3	0.018	0.076	11.085	0.011
. *| . |	. *| . |	4	-0.103	-0.178	11.536	0.021
. | . |	. |* . |	5	-0.045	0.146	11.625	0.040
. | . |	. *| . |	6	-0.020	-0.108	11.643	0.070
.**| . |	.**| . |	7	-0.193	-0.204	13.401	0.063
.**| . |	. *| . |	8	-0.253	-0.076	16.539	0.035
.**| . |	. | . |	9	-0.204	-0.050	18.640	0.028
.**| . |	.**| . |	10	-0.251	-0.195	21.953	0.015
.**| . |	. *| . |	11	-0.246	-0.123	25.253	0.008
. *| . |	. | . |	12	-0.144	-0.025	26.434	0.009
. | . |	. | . |	13	-0.038	0.037	26.519	0.014
. | . |	. *| . |	14	-0.004	-0.131	26.520	0.022
. |* . |	. |* . |	15	0.098	0.099	27.146	0.028
. |* . |	. | . |	16	0.151	0.010	28.706	0.026

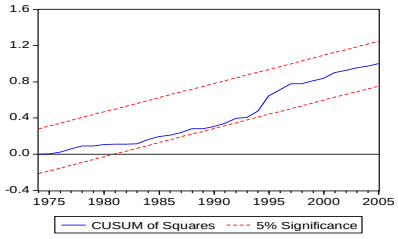
ARCH Test:			
F-statistic	5.466148	Probability	0.025599
Obs*R-squared	4.973598	Probability	0.025737
Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	6.999450	Probability	0.003200
Obs*R-squared	11.45393	Probability	0.003257
White Heteroskedasticity Test:			
F-statistic	1.027735	Probability	0.427441
Obs*R-squared	6.312580	Probability	0.389101
White Heteroskedasticity Test:			
F-statistic	0.931145	Probability	0.515251
Obs*R-squared	8.775111	Probability	0.458287

Ramsey RESET Test:			
F-statistic	1.324194	Probability	0.281121
Log likelihood ratio	3.045532		0.218108

Normality

Jarque Bera: $\chi^2(2) = 4.005791\ (0.134944)$





Appendix Table 7: Appendix Table 6: Diagnostic Tests from the Parsimonious Equilibrium RER Model with ARMA (0 1) errors

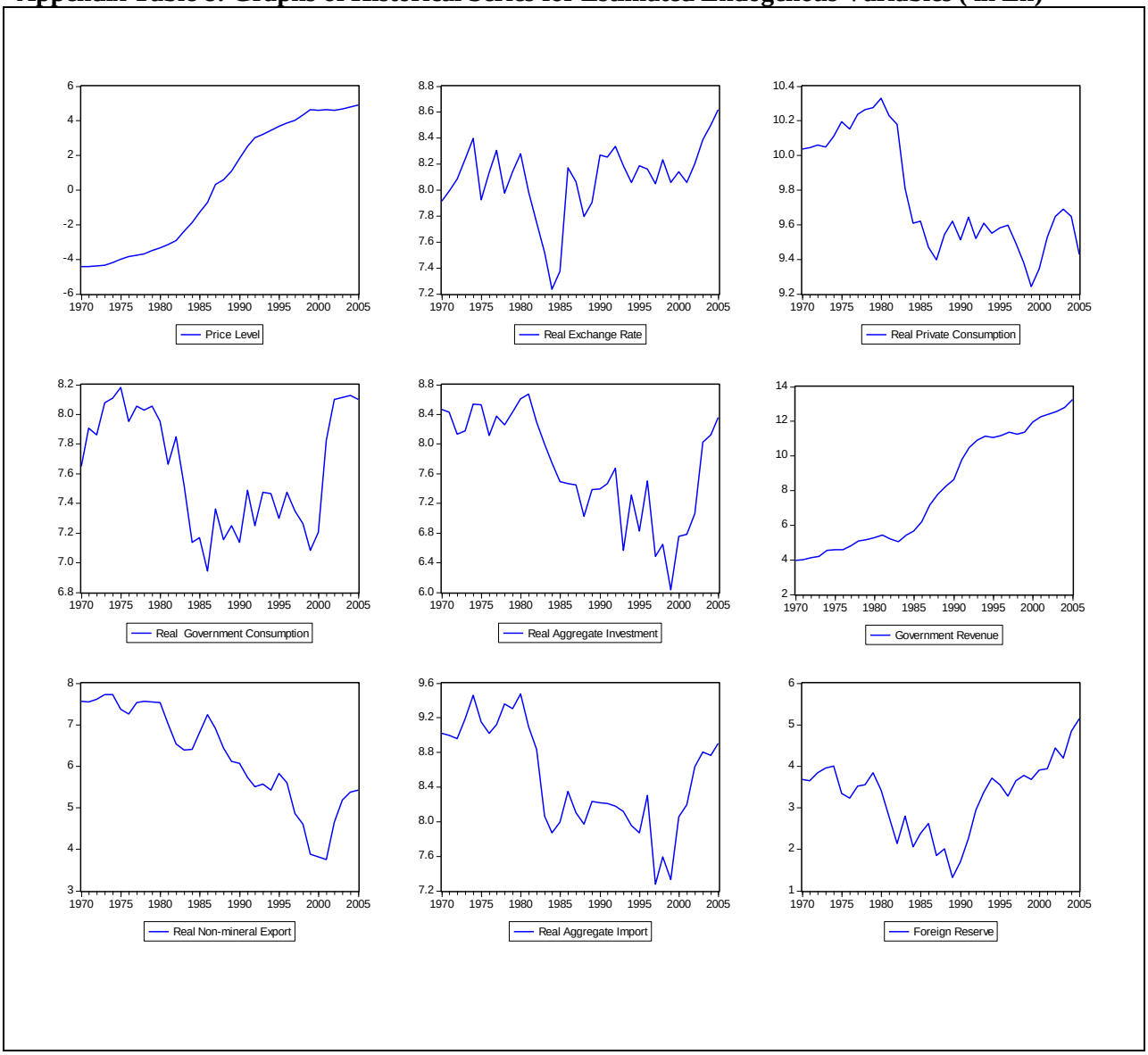
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. *| . |	. *| . |	1	-0.091	-0.091	0.3264	
. |**. |	. |**. |	2	0.263	0.257	3.1191	0.077
. | . |	. | . |	3	-0.018	0.025	3.1327	0.209
. | . |	. *| . |	4	-0.004	-0.077	3.1335	0.371
. | . |	. | . |	5	-0.019	-0.029	3.1498	0.533
. | . |	. | . |	6	-0.020	-0.001	3.1676	0.674
. | . |	. | . |	7	-0.025	-0.016	3.1978	0.784
.**| . |	.**| . |	8	-0.288	-0.311	7.2466	0.404
. | . |	. | . |	9	0.048	0.017	7.3645	0.498
.**| . |	. *| . |	10	-0.267	-0.124	11.126	0.267
. | . |	. *| . |	11	-0.033	-0.099	11.187	0.343
. *| . |	. *| . |	12	-0.165	-0.131	12.747	0.310
. | . |	. | . |	13	0.004	0.006	12.748	0.388
. *| . |	. | . |	14	-0.061	-0.012	12.976	0.450
. | . |	. *| . |	15	0.000	-0.063	12.976	0.528
. |* . |	. | . |	16	0.098	0.030	13.627	0.554

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.478149	Probability	0.244738
Obs*R-squared	3.327026	Probability	0.189472
ARCH Test:			
F-statistic	0.290219	Probability	0.750110
Obs*R-squared	0.624908	Probability	0.731649
White Heteroskedasticity Test:			
F-statistic	0.859155	Probability	0.536085
Obs*R-squared	5.433402	Probability	0.489542
White Heteroskedasticity Test:			
F-statistic	0.700804	Probability	0.702415
Obs*R-squared	7.028161	Probability	0.634187
Ramsey RESET Test:			
F-statistic	3.713639	Probability	0.036651
Log likelihood ratio	8.208793	Probability	0.016500

Normality

Jarque Bera: $\chi^2(2) =$ 1.933109 (0.0.380391)

Appendix Table 8: Graphs of Historical Series for Estimated Endogenous Variables (in Ln)*



* The figure shows that the means of the variables are not constant. Hence, all the variables have trends and are therefore not stationary.

Appendix Table 9: Data Sources and Description

Variable	Symbol	Description	Source
Nominal Exchange Rate	e	Period Average of the price of one U.S dollar in Leones	International Financial Statistic (IFS) CD-ROM
Real Exchange Rate	RER	Calculated as the real effective exchange rate-the trade weighted average of the bilateral real exchange rates between Sierra Leone and her trading partners	Calculated by author
Real Exchange Rate Volatility	RVOL	Calculated from a GARCH (1 0) model of Real Exchange Rate	Calculated by author
Real Exchange Rate Volatility Misalignment	RMIS	Calculated as the percentage by which the Actual Real exchange rate deviates from the Equilibrium Real Exchange Rate	Calculated by author
Price Level	P	The Consumer Price Index with 2000 as the base year	International Financial Statistics CD-ROM
Nominal Income	GDP	Gross Domestic Product at Current Market Price	International Financial Statistics
Real Gross Domestic Product	Y	Nominal Income divided by the consumer price index	Calculated by author
Output Growth	Yg	Percentage Change in Real Gross Domestic Product	Calculated by author
Private Consumption	Cp	Total Private Consumption	International Financial Statistics CD-ROM
Government Consumption	Cg	Total Government Consumption	International Financial Statistics CD-ROM
Aggregate Investment	I	Gross Fixed Capital Formation	International Financial Statistics CD-ROM
Absorption	A	Calculated as the sum of Private Consumption , Government consumption and Aggregate Investment	Calculated by author
Government Revenue	GR	Total Government Revenue	International Financial CD-ROM
Non-Mineral Export	NMX	Total Non-mineral Export	Government Gold and Diamond Office (GGDO) and International Financial Statistics CD-ROM

Appendix Table 9 Continued: Data Sources and Description

Variable	Symbol	Description	Source
Diamond Export	DX	Total Diamond Export	Government Gold and Diamond Office (GGDO) International Financial Statistics CD-ROM
Non-Diamond Mineral Export	NDMX	Total mineral export, excluding diamond	Government Gold and Diamond Office (GGDO) International Financial Statistics CD-ROM
Aggregate Export	X	Total Export	International Financial Statistics CD-ROM
Aggregate Import	M	Total Import	International Financial Statistics CD-ROM
Trade Balance	TB	Aggregate Export Minus Aggregate Import	International Financial Statistics CD-ROM
Money Supply	M^s	Broad money supply-that is, narrow money supply plus quasi money	International Financial Statistics CD-ROM
Foreign Reserve	FR	Foreign Reserve, excluding gold	International Financial Statistics CD-ROM
Domestic Credit	DC	The sum of Net Domestic Credit to the government and domestic Credit to the Private Sector	International Financial Statistics CD-ROM
Government Expenditure	G	Total government expenditure	International Financial Statistics CD-ROM
Capital Inflow	CAPFLO	Calculated as net change in reserve minus trade balance, Scaled by GDP	Calculated by author from International Financial Statistics CD-ROM
Closeness to International Trade	CLOSE	Calculated as the sum of Export and Import, Scaled by GDP	Calculated by author from International Financial Statistics CD-ROM
Price of Export	P_x	Export Unit Value	World Development Indicators

Appendix Table 9 Continued: Data Sources and Description

Variable	Symbol	Description	Source
Price of Import	P_m	Import Unit Value	World Development Indicators
Terms of Trade	TOT	Calculated as the ratio price of export to price of import	Calculated by author
Nominal Interest Rate	i	Treasury Bill Rate	International Financial Statistics CD-ROM
Debt-GNP Ratio	DGNP	Ratio of external debt stock to GNP	World Development Indicators CD-ROM
Debt Service GNP	DSGNP	Ratio of total debt service to GNP	World Development Indicators CD-ROM
Grant	Grant	Total grant received	International Financial Statistics CD-ROM
Foreign Income	Y^f	Trade average of incomes of Sierra	Calculated by author
		Leone's four major export partners. Weighted by export ratio.	from World Development Indicators and World Fact Book
Foreign Exchange	FX	Total Foreign Exchange Receipt	International Financial Statistics CD-ROM
Net Foreign Assets	NFA	Net Foreign Assets	International Financial Statistics CD-ROM
Net Other Items	NOI	Net other Items of the monetary survey	International Financial Statistics CD-ROM
Net External Borrowing	NEB	Net External Borrowing	International Financial Statistics CD-ROM