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ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
FACULTY OF BUSINESS AND ECONOMICS



**OUTPUT GROWTH, MONEY SUPPLY AND INFLATION IN A
WAR-TORN ECONOMY: EVIDENCE FROM SIERRA LEONE**



A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES IN
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ALIMAMY KAMARA
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School of Graduate Studies

Output Growth, Money Supply and Inflation in a War-Torn Economy:
Evidence From Sierra Leone



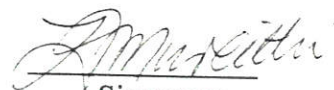
By
Alimamy Kamara
Faculty of Business and Economics

Approval by Board of Examiners:

Dr. Assefa Admassie
Advisor


Signature

Professor L. Mureithi
Examiner


Signature

Prof. Teshome Mulat
Examiner


Signature

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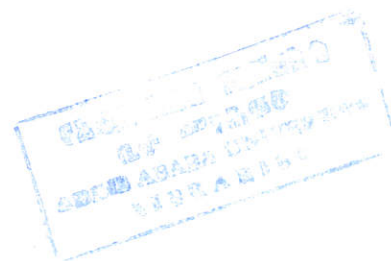
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DEDICATION

This work is dedicated to Ya Bomwara (my mother), Pa Abu (my Dad), Isatu, Kadi and all war victims in Africa.

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ABSTRACT

Using annual time series data from 1966 to 1994 for a war-ravaged economy like Sierra Leone, the paper attempts to establish, via the direct Granger approach, a relationship between money and output on the one hand, and between each of these macroeconomic variables and prices on the other. From the econometric results, it is apparent that a positive feedback relationship exists between money growth and inflation, while a one-way causal relation exists between output growth and inflation with the strand of causation running from output to prices. It is suggested that the feedback which occur between money growth and inflation is attributable to the lags in revenue collection which allow the government to prompt the monetary authorities to create further money. The additional money created results in excess demand and a rise in general prices of goods and services. Consequently, this rise in general prices leads to increased fiscal deficits which the government finance by creating additional money. In addition, output growth granger-causes money growth and money growth granger-causes output growth in the economy. The later, however, occurs without a definite pattern indicating a divergence between the results of this study and those obtained by Barro (1978).

Apart from investigating the casual relation among output, money and prices, this paper also examines the behaviour of these macroeconomic variables with the aid of the Engle-Granger (1987) two-step estimation procedure. The effect of unanticipated money growth on output growth in the long-run and short-run was also considered in the analysis. Our findings with regards to the effect of unanticipated money growth on output do not lend support to Barro's (1978) claim that output increases with an increase in unexpected money growth. The impact of the rebel war on real output growth and general prices of goods and services was examined via the use of a dummy. From the empirical results it was observed that the rebel war contributes to the rising prices of goods and the stifling of real economic activities, albeit insignificantly. The stifling of real economic activities arises from the massive outflow of capital and the collapse of investment activities due to insecurity. Policies which focus on reducing insecurity so as to boost domestic investment and output growth were therefore suggested.

With the aid of the DF and ADF tests, this study also attempts to examine the nature of the inflation series in Sierra Leone. The findings suggest that inflation follows a trend-stationary process rather than a difference-stationary process implying that shocks, both domestic and external, have a temporary effect on inflation.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND RESEARCH PROBLEM

Economists have, over the years, attached empirical importance to the relationship among output growth, money and prices in both developed and developing countries. Indeed, a large number of these economists indicate the presence of a causal relationship between money and output. Some, including Barro (1978), argue that only the money surprise term in the reduced-form output equation formulated for the United States was responsible for fluctuations in output. In other words, this is taken to mean that the causal relationship between money and output is one-way with the strand of causation running from money to output.

Proponents of the neoclassical synthesis contend that an unanticipated increase in money supply in the face of temporary price rigidity reflects increased output or economic growth that fades away over time with a rise in general prices. This argument may not be valid if the temporary price rigidity is due to the stickiness of the level of wages. In this case, a monetary acceleration need not produce output gains so long as price expectations correctly anticipate the monetary acceleration (Chadha *et al*, 1992). In Sub-Saharan African countries, monetary expansion has been one of the expansive policies adopted to finance huge budget deficits. Whether this increases prices, output or enhances economic growth in African countries remains a big question that requires empirical justification. Infact, the control of monetary expansion to ease the pressure on prices has most recently been the main preoccupation of policy analysts in many Sub-Saharan

African countries currently implementing structural adjustment programmes.

As Hyuha (1991) pointed out, many war-torn countries in Africa have a common economic problem viz macroeconomic imbalance. The imbalance is ascribed partly to policies producing export disincentives such as overvalued exchange rates, man-made calamities¹ and poor economic management like the excessive printing of money to finance government budget deficits; and partly to the 3 major oil price hikes, declining real commodity prices, the rise in world interest rates in the early 80s, the rising debt problem, world economic recession as well as the concomitant weakening of the terms of trade.

The macroeconomic imbalances do not only reflect an overall deficit on the external payment position of less developed countries but also widespread inflationary pressures and steep drops in output growth. Output growth in developing countries showed a downward trend as the growth rate fell from 3.2 percent in 1989 to 2.8 percent in 1990². In Africa, similar events occurred though not as pronounced as those which occurred in developing countries in general. As regards inflation, Uganda (one of the countries worst affected by war in the 70s and early 80s) recorded an inflation rate of about 260 % in 1987, Angola 289.4 % in 1988, Sierra Leone 170 % in 1991 and Zaire 198.2 % in 1988 respectively³.

Persistent inflationary pressures create large economic and social costs especially

¹ These include widespread social unrest, civil wars and ethnic conflicts. The instability caused by civil wars led to the shrinking of business confidence and a massive outflow of capital.

² See Survey of Economic and Social Conditions in Africa 1993-1994.

³ Ibid.

for those individuals living in unstable economies. In the limit, governments in these economies find it extremely difficult to cope with the demands for spending due to the overall resource constraints especially those imposed by their inability to collect taxes in conditions of hyperinflation (Leijonhufvud, 1991). In a way, the low rate of tax collection is attributed to the inertia associated with regimes of poor indexation.

Wars and other civil conflicts have compounded and aggravated the macroeconomic imbalances leading to persistent economic instability in the war-torn Sub-Saharan African countries. The negative impact of these on prices and output is obvious. Cases of economic decline and widespread hyperinflation have been observed in most of the war-torn economies, of which Sierra Leone is no exception.

The civil war which broke out in Sierra Leone in 1991 did not only hinder output growth but also resulted in a collapse of investment and massive outflow of capital. It has been argued that in periods of civil war, investment activities do not flourish because of too much uncertainty. In particular, physical assets seem to carry an abnormal disadvantage while liquid assets carry an abnormal advantage (Collier, 1995). However, economic recovery from brief civil wars could be rapid, especially when there is no fear of micro and macro insecurity.

Unlike Kenya and Botswana, Sierra Leone's growth has fallen drastically and in per capita terms has barely assumed a positive value since the first oil price hike of 1973. Infact, the aftermath of the first OPEC price revolution witnessed a new wave of economic problems in Sierra Leone. These included deteriorating terms of trade, perpetual decline in output growth, worsening balance of payments, huge government deficits, rising

debt burden and hyperinflation. Average annual rates of inflation, for instance, stood at 120 % over the period 1980 through 1990⁴ with 1987 recording about 181 % . The spiral inflation which occurred during this period was partly due to the fact that the competing monetary claims on output exceeded actual output and partly because the institutional arrangements allowed the Bank of Sierra Leone to finance one or more parties whose claims exceeded their incomes⁵. As Kallon (1993) observed, the high level of inflation in Sierra Leone has perverted the reward structure of the economy to an extent that capital accumulation and the production of real wealth have been overshadowed by non-productive and rent-seeking activities. To put it more succinctly, the corrupt practices⁶ seen among Sierra Leoneans in all walks of life have in one way or the other contributed to the economic decadence of the country. Indeed, what seems more plausible is that while the country's strong natural resource base seems capable of uplifting the economy to higher heights, reports on its economic performance indicate a downward trend.

The question of whether macroeconomic imbalances such as hyperinflation, decline in output growth, fiscal deficits and balance of payments deficits in developing countries are due to factors within the jurisdiction of domestic policy makers has been widely debated in the analysis of both inflation and economic growth in Sierra Leone. Whereas some studies ascribe the fluctuations in output and hyperinflation of the country to monetary expansion, others argue that exchange rate devaluations, domestic and external

⁴ Kallon (1993) argued that the inflation rate recorded during this period appear to underestimate the actual inflation rate because of the extensive price and other administrative control on very important goods and services.

⁵ The excess money injected into the system as a result of these activities resulted in widespread liquidity in both commercial banks and the central bank in the country.

⁶ According to Collier (1995), a way out of this problem is for the government to create visibly elite groups within the civil service which are given a greater incentive (in the form of high salaries) not to be corrupt or opportunistic.

shocks⁷ are responsible for Sierra Leone's economic problems.

Weeks (1992) and Kallon (1993) have recognised these problems in their latest publications. However, it came as a big surprise that none of these published works sought to address these problems by testing the structure of the causal patterns. A knowledge of the causal patterns might help domestic policy makers in designing policies geared towards economic growth and development.

The current economic problems of Sierra Leone do not only reflect missed opportunities for growth, but also raise three possible questions that require empirical response. First, does the increase in money supply resulting from money creation by the government over the past decades actually trigger inflation or does the increase in general prices force the central authorities to increase money supply in the economy? Second, does the increase in money stimulate output or economic growth? Third, did the ongoing rebellion play any role in stifling economic activities leading to increased prices of goods and services, and declining output growth? These are the type of questions that one needs to consider at this trying time of our country's economic history.

In response to the above questions, the present study will, among other things, examine the relationship among output growth, money and prices with the aid of data obtained for a small open economy like Sierra Leone. In line with this investigation the endogenous response of prices and output to a sudden domestic shock (in this case the rebel war) will be considered in the analysis.

⁷ The major domestic shock considered in this study is war.

1.2 RESEARCH OBJECTIVES

The principal objective of this study is to examine the causal relationship among output growth, money and prices with the aid of Sierra Leonean data. To achieve this objective, the Granger estimation procedure was used to determine the line of causation.

Specifically, the study will attempt:

- (i) to examine the effect of a monetary shock on output growth in the economy.
- (ii) to investigate the extent to which domestic prices and output growth have been adversely influenced by an exogenous domestic shock such as the rebel war.
- (iii) to examine the nature of the inflation series for the period under review. In this case the DF (Dickey-Fuller) or ADF (Augmented Dickey-Fuller) tests were used to determine whether inflation in Sierra Leone follows a trend stationary process or difference stationary (random walk) process.
- (iv) to analyse the behaviour of prices, money and output.

In order to achieve the aforementioned objectives, time series multiple regression analysis was used and an error correction model developed with the aid of the Engle-Granger (1987) procedure. Ordinary least squares (OLS) and instrumental variable (IV) estimation were used as tools for the analysis.



1.3 HYPOTHESES TO BE TESTED

In Sierra Leone, monetary policy has always been one, among the many policy options of the government to disinflate the economy. As was documented in the literature, these disinflationary efforts depend on the relationship among money, output and prices⁸. This relationship will be investigated empirically with the aid of three hypotheses.

First, a one-way causation between money and prices exists and that the strand of causation is from money to prices. This hypothesis is derived from the notion that money is neutral. If money is non-neutral so that real income increases in response to monetary expansion, then the growth in the money supply itself generates a demand for additional money balances in order to finance a higher real value of transactions. Hence excess money supply in the economy spill over in the form of excess demand leading to a slight increase in prices.

The next hypothesis for the present study is that the inflation series in Sierra Leone follows a random walk process. This hypothesis is derived from the belief that inflation is temporarily unresponsive to variations in monetary growth in the short-run (Everaert, 1992). Assuming inertial inflation, a monetary contraction, say, would lead to a fall in the real money supply as inflation adjusts less than the monetary contraction. This adjustment results in a rise in the real interest rate, a real appreciation of the exchange rate and a decline in capacity utilization.

The final hypothesis is that an unexpected increase in money results in wide

⁸ This is explored in Reinhart et al (1991).

fluctuations in output. This hypothesis which is derived from the neoclassical synthesis⁹ predicts that unanticipated monetary increase is normally associated with a temporary sharp increase in output, but in the long run this increased output will decline with an increase in the general price level.

1.4 SIGNIFICANCE OF THE STUDY

Many empirical studies on inflation, especially in developing countries, have been carried out. For instance, Sowa and Kwakye (1993) on Ghana, Saini (1982) on six Asian countries, Tegene (1989) on six African countries, London (1989) on Africa, Weeks (1992) and Kallon (1993) on Sierra Leone and a host of others. However, few of these empirical works attempt to examine the interaction of domestic prices, output and money. In particular, as far as I know, none of the empirical studies on Sierra Leone has attempted to investigate vividly the causal relation among output growth, money and prices. The neglect of this issue raises several important issues that need to be addressed.

First, given the dearth of empirical studies on the causal relation of output, prices and money in Sierra Leone and the growing importance of the subject it would be useful to explore the issue and come up with cogent results that would help in the ongoing adjustment process in the country.

Second, the significance of the study and its contribution to policy formulation stems from the fact that it seeks to address the issues relating to one of the major

⁹ This neoclassical synthesis is represented by models incorporating forward-looking agents planning their spending decisions in a situation of temporary rigid prices.

economic problems in Sierra Leone (hyperinflation) which had troubled not only the average Sierra Leonean, but also the policy makers in the past two decades.

Finally, the study will provide a possible guideline to the authorities in their drive towards stabilisation.

1.5 SCOPE AND LIMITATIONS OF THE STUDY

1.5.1 SCOPE OF THE STUDY

The scope of the present study includes the behaviour of prices, money as well as output in the post-independence period. The analysis will be limited to the relationship among output growth, monetary growth and inflation. A 29-year period of inflationary development was covered. The period begins in 1966, a date chosen not only because of the appearance of dark spots on the economy but also because 1966 marks the beginning of the country's attempt at stabilisation; and ends in 1994, a date chosen because of the availability of data.

1.5.2 LIMITATIONS OF THE STUDY

The present study was not carried out without problems regarding data collection. One of such problems is the compilation of the parallel market exchange rate figures which were not available for some years. However, with the aid of the average black

market premia formula, efforts were made to obtain some of the missing parallel exchange rate figures by extrapolation¹⁰. In this regard, future users of this work are advised to treat these figures with caution.

Moreover, an index of consumer prices that incorporates items consumed by both urban and rural dwellers was not available and so we used the Freetown consumer price index as a measure of inflation in this study.

1.6 ORGANISATION OF THE STUDY

This paper is apportioned into five chapters. Following this introduction, Chapter II presents a review of the existing literature regarding the subject. A brief overview of socio-economic conditions and policies together with recent economic developments in Sierra Leone are presented in Chapter III.

The penultimate chapter embodies the model for the analysis, examines the time series properties of the data and provide empirical analysis for the estimated results. Included in this chapter is the research methodology and a discussion of the theoretical rationale behind the inclusion of the variables into the model.

Finally, Chapter V summarizes the paper and proffer some policy prescriptions that might be useful to policy makers of the country.

¹⁰ This method will be explained in chapter IV of the Thesis.

CHAPTER II

LITERATURE REVIEW

This chapter is designed to provide a review of the existing literature on the subject. Much of the discussion here centres around the monetarist-structuralist debate regarding the proximate causes of inflation, an evaluation of the line of causation among output growth, monetary growth and prices; and the relationship between economic growth and inflation. As a preamble to the discussion, we will begin by examining the cause and effect of changes in the major macroeconomic variables considered in the study.

2.1 INTERACTION OF OUTPUT GROWTH, MONEY GROWTH AND INFLATION

This section attempts to provide a literature review or survey regarding the interaction of output growth, money growth and inflation. A deep understanding of this phenomenon is of particular interest to economic policy makers in both developed and developing countries in the design and implementation of the right policy.

2.1.1 MONEY-PRICE CORRELATION

Variations in money supply may in the long run induce output and price responses. An increase in money wages increases the supply of money which in turn provokes an increase in general prices in the product market. Quite recently, a good number of studies have argued that the expansion in money supply is itself a result of ongoing inflation and at the same time a cause of inflation (Aghevli *et al*, 1977). The explanation of this

argument is simple: an expansion in money supply increases aggregate demand for goods in the economy, which will require either the expansion of output or prices. The increase in prices as a result of the monetary expansion results in an inflated government budget deficit which the central authorities will have to finance by creating additional money. Clearly, this argument reveals the existence of a feedback (two-way causation) between money and prices. Such a feedback seems to have been well documented by Aghevli and Khan (1977) and recognised by Sargent and Wallace (1973).

In economies where the effective labour force is growing evenly, increased money supply may create output expansion instead of increase in prices. In the monetary sector if the price level is exogenously determined, say, by wage movements, then an unusual money growth may be a prelude to a decline in output if the price accelerated even further (Davidson *et al*, 1973).

Nevertheless, it must be noted that accelerations in monetary growth are not usually autonomous whims of central bankers. In most classic wartime money-fueled inflations, the role of the monetary authority has been passively to finance deficits emanating from the unwillingness of politicians to finance expenditures via conventional taxation. On a similar note a cost-push inflation caused by trade unions must be ratified periodically by the monetary authority if inflation is to continue.

2.1.2 MONEY-OUTPUT RELATIONSHIP

The relationship between money and output growth has been well documented by

Barro (1978), Glezakos *et al* (1979) and others for both developed and developing countries. Barro's model comprises two major equations. The first equation deals with the relationship between money growth and macroeconomic variables readily observable by the public such as lagged money growth, current fiscal policy and lagged unemployment. Barro obtained the fitted values of this regression and used them to compute the residuals, which he referred to as the money surprise or unanticipated money growth in the economy. The money surprise was uncorrelated with the innovations to aggregate output and monetary factors of aggregate demand. The second equation draws the relationship between output growth in the economy and money surprise and government expenditures.

Short run fluctuations in money growth are associated with similar fluctuations in real GDP (output). The presence of a causal relation between money and output was supported by Barro with the view that the causal link runs from monetary growth to growth in real output. In addition to Barro, Friedman *et al* (1963) also provided a further detailed evidence for the United States on the money- output relationship. According to them, variations in the inflation rates are attributed to variations in monetary growth. Changes in the latter was attributed to variations in economic activity.

2.1.3 OUTPUT-PRICE RELATIONSHIP

Changes in the equilibrium configuration of prices and output reflect variations in both demand and supply. The sign of the correlation between output and prices depend largely on the significance of the shift in both demand and supply. If demand shift is highly significant, there is every likelihood that output and prices will exhibit a positive

relationship. On the other hand, if supply shifts overrides demand shifts, then the relationship will be negative. Sheehey (1986) provides evidence for the relationship between output and prices by employing a Lucas-type supply function. His findings corroborates the hypothesis of the existence of a negatively sloped Phillips curve for 16 Latin American countries implying that output and unexpected inflation are negatively related. By contrast, Glezakos *et al* (1982) provide evidence for the presence of a positively sloped Phillips curve for some Latin American countries in the Short-run.

2.2 INFLATION AND ECONOMIC GROWTH



Even though numerous studies on inflation have been undertaken by economic researchers, especially in least developed countries, only a handful of them succeeded in establishing an empirical relationship between economic growth and inflation. Infact, the few studies which delved into the relationship between economic growth and inflation pursued their analysis with the aid of naive research methods¹¹. The naivety of these methods has provoked widespread criticism regarding the importance of the relationship between economic growth and inflation. Harberger (1964), for instance, acknowledged the fact that there is no intimate relation between the rate of inflation and the rate of growth of the economy. On a similar note, Mikesell (1969) argued that the economic indicators do not in themselves provide satisfactory explanation of either the causes or the consequences of inflation.

Though the relative importance of the relation between economic growth and

¹¹ The only exception, perhaps, are the studies carried out by Glezakos (1978) and Johnson (1984).

inflation has been the subject of heated debate over the past two decades, recent studies, however, revealed that the investigation of this relationship has been facilitated by the use of international cross-section data (Glezakos, 1978). Some studies on inflation mentioned the pattern of inflation as a quintessence in theoretical or descriptive studies on growth and inflation. According to Johnson (1966) inflation might hinder growth in developing countries because it does not proceed at a steady and well expected rate but proceeds randomly with large politically determined variations in the rate of price increase. The negative impact of inflation on growth was further emphasized by Sang-Woo Nam (1984) who stated that:

As inflation heightened, it became evident that sustained economic growth is simply impossible without stemming it. Weakening export competitiveness, unproductive activities of businesses preoccupied with inflationary gains and the increasing frustration of workers facing a widening disparity in the distribution of income and wealth all showed that economic growth potential was being seriously hindered by persistent inflation.

In some quarters, it has been argued that expected rates of inflation impair economic growth because they deprive an economy of the positive redistributive effects of unexpected inflation¹². In contrast, the structuralists viewed the relationship between economic growth and inflation as positive¹³, at least up to a certain rate of inflation. The main thrust of their argument was that various rigidities and inelasticities in the economic environment of the developing countries result in a build up of inflationary pressures from the real side during the growth process and that the banking system must validate such pressures if output losses are to be avoided.

On *a priori* grounds, if a relatively steady rate of inflation persists in an economy,

¹² Some researchers have acknowledged the fact that the redistributive effects of unexpected inflation are negligible, especially in periods of prolonged inflation.

¹³ In the 70s and 80s, the resurgence of inflation in some Latin American countries, like Brazil, Peru, Argentina and Mexico, was associated with economic expansion.

some of its alleged detrimental effects would more likely be ameliorated as the rate of inflation is more or less accurately anticipated. Even accurately anticipated inflation can cause some waste of economic resources to the extent that people try to hedge against inflation by substituting inventories of real goods and foreign exchange reserves for idle cash balances (Glezakos, 1978). Such behaviour might be relatively more common in developing countries where the development of the financial sector is still in its teething period.

As Glezakos (1978) pointed out, even in such cases of rudimentary financial markets the losses in allocative efficiency as a result of anticipated inflation might not be extensive due to the limited degree of monetization in developing countries. On the other hand, the economic costs of unanticipated inflation may be considerably greater. If the rate of inflation cannot be predicted, the possibility of successful hedging against inflation by both businessmen and wage earners is reduced and the economic risks and social disruption associated with widely fluctuating inflation rates are significantly increased. The increased risk from future uncertainty would discourage long-term private investments and thus impair economic growth.

According to McKinnon (1973), if inflation rates could be anticipated correctly, savings and lending activities might not be curtailed severely since nominal interest rates can be arranged so as to avoid the undesirable transfer of assets from creditors to debtors. This in turn can conceivably improve the existing bad situation of fragmented capital markets, a condition inherent in most developing economies, and possibly increase their investment efficiency. Such increase in efficiency could come about from the fact that under steady inflation rates it would be more advantageous to small businessmen and

farmers to accumulate funds for relatively sizeable or worthwhile investments.

2.2.1 REVIEW OF EMPIRICAL STUDIES ON ECONOMIC GROWTH AND INFLATION

In developing countries, inspite of the difficulty in getting accurate or consistent data for analysing economic problems empirically, some economists and practitioners have attempted to explore the link between growth in GDP and changes in the rates of inflation. Dorrance (1966), for instance, studied forty-eight countries and arrived at results which support the argument for mild inflation. This simply means that falling prices seemed to have a link with low rates of economic growth. According to Dorrance, once inflation exceeded a certain level, any rise in price tends to discourage economic growth and development.

A study by Wallich (1969) on forty-three countries over the period 1956 through 1965 reveals the existence of a significant negative correlation between current inflation and economic growth. He casts a stricture on the quality, distribution and cost of investment for the effect of inflation on economic growth in all the economies included in the study.

Thirlwall (1974), undertook a study on inflation and growth with the aid of data obtained for fifteen Southern Cone countries spanning from 1958 through 1968. According to his findings, it seems as if there exists a negative relation between inflation and growth. Given the very high inflationary episodes which the Latin American countries have

experienced at the time the study was carried out, Thirlwall warned that people should not jump to the hasty conclusion that these countries experience provides evidence that inflation is a hindrance to growth.

In a similar study by Wachter (1976), with the aid of quarterly data on four developing countries, it was observed that the results of the study were in firm agreement with the notion that "a positive relation exists between inflation and the change in the relative price of food".

Johnson (1984), also undertook a study on inflation and growth in developing countries. His main area of concern was the exploration of the nature of the economic arguments relating inflation and growth. In his analysis of the research problem, he arrived at the conclusion that inflation up to a certain point can be beneficial to growth in developing countries.

Earlier, Hanson (1980) had used a rational expectations approach to study inflation and growth in five Latin American countries over the period 1950 through 1974. His findings were consistent with the dogma that a positive correlation exists between unanticipated inflation and economic growth. X

From the above empirical evidence, one can safely infer that there is no common agreement on the relationship between inflation and economic growth. Whereas some studies identified a negative correlation, others confirmed the presence of a positive relationship between inflation and growth.

2.3 MONETARIST-STRUCTURALIST DEBATE

Many economists have formulated models of inflation for both developed and developing countries. These models differ because of the differences of the proposed path of inflation in these economies. In particular, inflation in Third World countries has generated a great deal of theoretical and empirical attention. One major concern particularly in Latin American countries has been assessing the relative importance of monetary versus structural factors. While the monetarist theories enjoyed considerable support throughout much of the 1970s, Baer *et al* (1987) have noted in the latter part of the 1980s that the failure of certain monetarist stabilisation experiments began to undermine the notion of inflation being merely a monetary phenomenon. This re-ignited the monetarist-structuralist debate concerning the causes of inflation.

The monetarists argue that a fiscal expansion, financed by money creation, generates inflation. Inflation, according to them, will be reduced if the government embark on a contractionary monetary and fiscal policy. In particular, the monetarists propose that central banks should not allow government and business to finance spending via credit creation. By contrast, the structuralists viewed credit creation and changes in government spending as symptoms of inflation and not the cause of it.



In addition, the structuralists contend that the existence of structural bottlenecks like foreign exchange constraint arising from weak export receipts in developing countries result in structural rigidities which in turn push prices up. This is true for countries pursuing development programmes aimed at improving the industrial sector. In this case, a currency depreciation may not improve the foreign exchange earnings but intensifies the

pressure on prices (London, 1989). Inflation is, therefore, a result of cost push factors (food prices, wage or exchange rate changes) sustained by an increase in money supply. This is in contrast with the monetarist view that cost push factors only cause a shift in the price level and so cannot explain how these factors translate into sustained inflation.

The debate does not only dwell on the proximate causes of inflation but also extends to policy. Whereas the monetarists called for restriction on bank credit and on government borrowing from the banking system, some structuralists believe that revolution is a basic pre-requisite for dismantling the inelasticities in agriculture which are known to generate inflationary pressures.

From the issues mooted above, one can conclude that the monetarist-structuralists debate is an argument on differences between the two theories in their analysis of the proximate causes of inflation and of remedial measures to combat the inflationary episode in developing countries.

2.3.1 REVIEW OF EMPIRICAL STUDIES IN DEVELOPING COUNTRIES INCLUDING SIERRA LEONE.

The theoretical and empirical literature on inflation and output growth emphasizes on the trade-off between inflation and output growth and the causes of inflation. Argy (1970), for instance, investigated structural inflation for some 22 LDCs and arrived at results which rejected the significance of some structural variables. However, when monetary variables are used as controls they turned out to be significant. Argy noted that

a major problem of the structuralist theses is that they can hardly be quantified.

Saini (1982) employed the Harberger-type monetarist model to analyse the experience of six Asian countries. His findings were not consistent with the monetarist dogma that inflation is everywhere a monetary phenomenon. The growth of money stock was not the primary source of inflation in these countries. Saini argued that the failure of the monetarist model to explain the behaviour of prices in Asian countries may be due to the monetization of these economies which excludes the impact of the various domestic and external cost pressures.

Earlier, Aghevli *et al* (1978) developed structural equations to demonstrate the two-way causation between budget deficit and inflation in developing countries. In their research, they arrived at the conclusion that government expenditures respond faster to inflation than revenues thereby generating an inflated budget deficit which in turn leads to an inflationary spiral.

London (1989), using both cross-sectional and time series data on 23 African countries for the period 1974 through 1985, arrived at results which were consistent with the conception that exchange rate adjustments and monetary growth exert a significant influence on skyrocketing prices of goods and services.

Tegene (1989) considered a group of six African countries and employed the Granger-Pierce causality tests on monetary growth and inflation. In his findings, monetary expansion seemed to granger-cause inflation in the sample of six African countries.

Onis and Ozmucur (1990) employed a four variable vector autoregression model to examine the impact of exchange rates and money supply on inflation in Turkey. They attributed the endogenous nature of monetary base and the strong impact of exchange rate devaluation on the Turkish inflation to the satisfactory ex-post performance of the model and the contemporaneous relationships between the variables under investigation. Clearly, the conclusion of their paper is consistent with Saini's findings that non-monetary factors exert great pressure on prices.

In his study of the Ugandan inflation process, Elbadawi (1990) confirmed that inflation in Uganda is as a result of rapid growth in money supply and the depreciation of the parallel exchange rate. According to him, the official exchange rate has no significant influence on inflation.

Probably motivated by the findings of Elbadawi, Mbire (1992) also carried out a study on exchange rate policy and inflation in Uganda. The results of her findings suggest that over the medium term monetary expansion is highly responsible for high inflation. Whereas devaluation of the official exchange rate appeared not to have any significant influence on price formation, devaluation of the parallel rate seemed to exert great pressure on prices. These results suggest complete agreement with Elbadawi's findings.

Everaert (1992) examined inflation stabilization process in Turkey with the aid of a revised RMSM-X model. Everaert's findings suggest that scenarios that do not incorporate strong fiscal action do not succeed in permanently lowering inflation. According to Everaert, inflation in the Turkish context is costly because it reduces not only the level of productive investment but also its efficiency.

Using a simplified model, Sowa *et al* (1993) explained the inflation process in Ghana with the aid of time series data. In their findings, supply factors seem to have a greater impact on prices than monetary factors.

In Sierra Leone, very little work had been done to explore the behaviour of prices, money and output. Among the few studies that had been done, the works of Weeks (1992) and Kallon (1993) are available for our review. Weeks conducted a rather sketchy empirical study on the causes of inflation in Sierra Leone. A simple model was used with the aid of both annual and quarterly time series data. His findings tend to follow the structuralists line of argument that non-monetary factors are the main causes of the inflationary push. Kallon (1993), used a simple open economy IS-LM and adaptive expectations models to analyse the inflation process in Sierra Leone with the aid of quarterly data from 1967 to 1987. Like Weeks, Kallon's results were not in support of the monetarists thesis that inflation is a monetary phenomenon in the short run. However, in the long run the results turned out to support the monetarist assertion that monetary growth results in an equal change in the inflation rate. In addition, he emphasized that most of the inflation which occurred in Sierra Leone over the past two decades were due to the massive importation of goods into the country.

With the exception of Tegene, Onis *et al*, Everaert and Aghevli *et al*, the studies reviewed so far have all employed traditional econometric techniques to estimate structural economic models. These techniques are prone to specification errors and invalid restrictions. The current study will try to avoid some of these problems by using modern econometric techniques such as the ECM (error-correction) approach to estimation.

CHAPTER III

A SURVEY OF SOCIO-ECONOMIC CONDITIONS IN SIERRA LEONE

In the previous chapter, we made an attempt to review the existing literature on the subject at hand. Here, our main preoccupation is to provide background information regarding macroeconomic performance and policies in Sierra Leone during the post-independence period. This will help to provide a clear picture about the workings of the economy before and during the rebel war.

3.1 THE SIERRA LEONEAN ECONOMY: AN OVERVIEW OF MACROECONOMIC PERFORMANCE AND POLICIES IN THE POST- INDEPENDENCE PERIOD.

Sierra Leone is a small, non-oil producing country with an estimated population of 4.5 million and an average GDP per capita of 152 US\$ in 1992. The population is split between the majority African groupings, of which the Temne and the Mende are the largest, and others including the Creoles, the Limbas and the Lebanese. The country's largest sector, the agricultural sector, is largely subsistence employing approximately 75 percent of the working force and contributing an average of 40 % to GDP. Notwithstanding its low contribution to GDP, the potential of the agricultural sector is substantial. While only 13 % of arable land is cultivated, agriculture contributes 40 % to export earnings¹⁴. Major export crops include cocoa, coffee, piassava and palm kernel.

¹⁴ See Bank of Sierra Leone Economic Review September 1975.

The country does not only depend on the agricultural sector, but also on the production for export of diamonds, bauxite, iron ore, rutile and gold in the mining sector which is believed to be providing the largest share of foreign exchange earnings. Sales of rutile, bauxite, diamonds and gold, for instance, contribute approximately 60 % of the country's export earnings. Tourism, though contributing marginally to export earnings, is also an important source of foreign exchange¹⁵. The manufacturing sector, albeit in its teething period, provides revenue for the economy. For instance, revenue from manufacturing amounted to 1.2 million US\$ in 1992. In addition, Sierra Leone has one of the richest fishery resources in Africa but poor management prevented it from reaping the benefits of these resources.

Having identified the specific features of the Sierra Leone economy, we now turn to a discussion of its macroeconomic performance since independence in 1961. Such a discussion will help to identify the various problems of the economy and offer some policy prescriptions that may help in the ongoing stabilisation process.

In the immediate post-independence period of 1961-1965, the Sierra Leonean economy was among the fastest growing economies in Africa. Average growth rate in the economy was 7 % between 1950 and 1967¹⁶. In 1963, for instance, real GDP growth rate stood at 4 % while domestic prices rose by only 2 % per annum. Even though domestic money supply did increase, domestic prices and the balance of payment were not badly affected since the substantial growth made the economy to be resilient from the impact of negative internal shocks. The balance of payment was in equilibrium with a

¹⁵ In 1990 alone, revenue from Tourism amounted to \$ 14.4 million.

¹⁶ See *The Courier* Number 18 November-December 1989.

surplus on the current account almost equal the size on the capital account.

This good macroeconomic performance was mainly the product of the existence of a healthy investment climate which made foreign money to flow in leading to an improvement in the external payments balance; and the growing fiscal discipline which prevented huge budget deficits from occurring.

Towards the end of the 1960s, the economic and financial conditions deteriorated dramatically. Both internal and external factors were responsible for this economic decline. Among the internal factors was the relaxation of fiscal discipline which resulted in an uncovered budget deficit of Le 17.6 million in December 1966. Consequently, the huge budget deficit registered in 1966 expanded government borrowing from the banking system leading to a crowding-out of credit to the private sector. Despite the gloomy fiscal situation of the country, a budget surplus of Le 8 million was recorded for the first time in 1969 after independence (See appendix). Perhaps this healthy economic condition was because of prudent management of the nation's resources.

The main external factors that contributed to the economic decline were the deteriorating terms of trade and the consequent foreign exchange crisis which reflect a drop in revenue from diamond exports, the high foreign interest rates, the rising debt problem and the fall in capital inflow. With a crippling economy and a growing foreign exchange problem, the government had no choice but to resort to external borrowing to finance imports and capital projects.

In the early 70s (1971-1975), Sierra Leone began to feel the pinch of global

economic disturbances such as the unprecedented increase in crude oil prices in 1974. This coincided with an increase in the price of manufactured goods, the decline in the world market prices of the country's main exports (cocoa, coffee and diamond) and the aggressive public sector policies of Keynesian expenditure-led growth under the Stevens administration. The excess spending by the government during this period resulted in an inflated budget deficit which the central bank financed via money creation. For instance, base money increased from 8.5 percent in 1970 to 15.6 percent in 1974. The increase in base money moved the inflation rates from single to double digits in 1974. This high inflation level effectively reduced the real value of wages and salaries leading to a brain-drain¹⁷ in the economy. In effect, the country entered the throes of an economic recession supported by IMF credits under stand-by arrangements and compensatory financing facilities to make-up trade gaps and budget shortfalls¹⁸.

In the late 80s, a period of illegal practices ensued as corruption and the smuggling of "the country's life blood" gold and diamond out of the country became the *modus operandum*. The very high degree of smuggling of these minerals resulted in a complete distortion of all trade figures. This is evident in Table 3.1 as diamonds assume the fifth place in the list of exports in 1988.

Compounded with smuggling and corruption was the intense activities in the parallel market for foreign exchange. In an attempt to arrest this situation, the government introduced a two-tier exchange rate system in December 1982 under the "Modified Exchange Arrangements" comprising an official and a commercial market. Whereas the

¹⁷ In the late 70s, most of the highly qualified personnel migrated to foreign countries to seek well-paid employment.

¹⁸ See Pick's World Currency Yearbook 1991.

exchange rate was pegged at Le 1.25 per US \$ in the official market, no definite rate was fixed in the commercial market. Nonetheless, the dual exchange rate system failed to achieve its desired goal of channelling increased flow of foreign exchange resources towards the banking system. The failure of this system resulted in its replacement with a unified exchange rate of Le 2.50 to the dollar in July 1983. This too was ineffective in curtailing the smuggling and parallel market activities of foreign exchange.

Table 3.1: Main Commodities Traded (in Million Leones) From 1986 To 1988.

Exports	1986	1987	1988	Imports	1986	1987	1988
Rutile	658	143	1443	Machinery and Transport Equipments	567	1290	1256
Bauxite	363	717	722	Food, Drink and Tobacco	599	856	1249
Coffee	176	541	445	Fuel and Lubricants	194	535	967
Cocoa	194	628	382				
Diamonds	447	1070	107				

Source: Bank of Sierra Leone, Economic Trends September 1987.

In 1988, there was a sharp decline in exports and a sharp increase in imports. This made the balance of payments deficits to rise from 15 % of GDP in 1985 to 29.8 % of GDP in 1988. However, there has been a slight improvement since then and it has averaged 20.5 % of GDP up to 1991.

Earlier, the total official foreign exchange reserves less gold had plummeted from 16.2 million US \$ in 1978 to 0.2 million US \$ in 1984. Faced with this unhealthy economic situation, the government embarked upon a programme of economic reform designed to reverse the macroeconomic trend. Some of the objectives of this programme, which was aimed at providing a firm base for sustained economic growth, were the reduction of inflation rates to a level that is conducive for economic growth, improvement in both fiscal and external payment position of the country and lay the foundation for

rapid growth and development. In order to achieve these objectives, policies based on fiscal restraints and restrictive money supply were adopted. Nevertheless, these policies were less effective in fine-tuning the economy because the inability of the banking system to effect control over credit to the government, the government persistent resort to contractual financed schemes and the frequent resort to extrabudgetary activities seemed to undermine the stabilisation efforts.

Sierra Leone had a rather long-standing relation with the IMF. The first financial programme was signed in August 1966 and was aimed at reducing overall credit as a means of restricting the demand for imports. By the end of 1966, Sierra Leone's quota with the IMF was 15 million US \$ and its initial gold tranche position 2.3 million US \$ (Bhatia *et al*, 1969). The stabilisation programmes have been regular features since 1979, but relations with the Fund in the past tended to suffer from disagreements over public spending, the devaluation of the currency and the reluctance of the Stevens administration to cut subsidies on rice and petrol. The refusal of President Stevens to yield to IMF demands resulted in a suspension of financial assistance to Sierra Leone in March 1984. Since then, the economy continue to dwindle at a faster rate to the extent that fuel and other essential commodities were in short supply. This dismal trend continued unabated. Because of ill-health and probably the growing appalling economic conditions, Stevens decided to hand over power unconstitutionally to the then head of the armed forces, Major-General Joseph Saidu Momoh.

President Joseph Saidu Momoh inherited an ailing economy in 1986. Because of the appalling economic conditions at the time, Momoh asked for financial assistance from the IMF. Since he was more willing to accept IMF's prescriptions than his predecessor,

rapid growth and development. In order to achieve these objectives, policies based on fiscal restraints and restrictive money supply were adopted. Nevertheless, these policies were less effective in fine-tuning the economy because the inability of the banking system to effect control over credit to the government, the government persistent resort to contractual financed schemes and the frequent resort to extrabudgetary activities seemed to undermine the stabilisation efforts.

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financial assistance was granted in November 1986.

The first IMF package during Momoh's tenure of office amounted to SDR 50.36 million, with SDR 23.16 million in the form of a twelve month stand-by arrangement and SDR 27.2 million in concessional funding over three years under a structural adjustment facility. The IMF loan had "strings" attached to it known as conditionalities. Among the conditionalities of the 1986 loan was the devaluation of the domestic currency and the liberalisation of domestic marketing arrangements.

In spite of the adherence to these conditionalities by the Momoh's administration, the desired objective of the loan of revamping the economy was not achieved. Real output growth continue to assume negative values and the economy continue to be stuck in the groove of double digits inflation around 89 %. In addition to the decline in real output growth and hyperinflation, was the increase in fiscal deficits, the mounting debt problem¹⁹ and the deterioration in balance of payments. The failure of the stabilisation program to reduce budget deficits was attributed to both the inability of the tax authorities to increase tax revenue and the weakness of Momoh's economic policy making.

Since independence in April 1961, there has been a growing divergence between nominal government expenditures and revenue. Whereas expenditures seem to be growing at a faster rate, revenues continue to grow at a snail's pace lagging behind the growth in expenditures. This condition is shown in Table 3.2. Average growth rate in nominal government expenditures was in excess of the average growth in revenues throughout the past two decades. However, in the 1988-1995 period when revenue collection was

¹⁹ By December 1987, Sierra Leone's debt to the IMF and other international agencies had grown to approximately 112 million dollars.

modernized via computerization of the Customs and Excise Department, the average growth in revenues rose to a level above the growth in expenditure.

Table 3.2 : Growth in Government Expenditures And Revenues in Sierra Leone (1964-1994)¹.

Measures of Fiscal Indicators*	PERIOD			
	1964-1971	1972-1979	1980-1987	1988-1995
Average growth in Government Expenditures	7.5	24.7	87.2	69.8
Standard Deviation	8.6	19.3	205.8	89.4
Average growth in Revenues	7.0	16.6	36.8	82.9
Standard Deviation	10.2	15.5	57.3	61.9

Source: International Monetary Fund's International Financial Statistics Yearbook 1994.

*Notes: * These measures are expressed in percentage.*

The rapid increase in nominal government expenditures is reflective of the growing political and social demands by the public. These rising demands arose from the fact that real incomes of workers were plummeting rapidly because of inflation.

With regards to development in the external sector, the performance of the economy has been fragile since the mid 70s. Large trade deficits and net outflows of services resulted in current account deficits of more than 110 million US \$ in the period 1976 through 1982. Import restraint helped to arrest the deficit to less than 25 million US \$ in 1983 and a small surplus was registered in 1985. There was a large surplus in 1986, but this was short-lived as deficits occurred again in 1987. Even though net direct investment in the country stood at 39.4 million US \$ in 1987, there were all indications that long-term capital flew out of the country (see Table 3.3).

Table 3.3 : Balance of Payments Position of Sierra Leone From 1982 TO 1987.*

ITEMS	1982	1983	1984	1985	1986	1987
Merchandise Exports (fob)	110.3	107	132	131.9	126	138.9
Merchandise Imports (fob)	-260.3	-133	-149.7	-141.2	-111.4	-114.8
TRADE BALANCE	-150.0	-25.9	-17.1	-9.4	14.6	24.0
Exports of Services	43.0	35.1	41.3	28.2	26.7	44.1
Imports of Services	-103.8	-63.8	-81.1	-37.0	91.9	-107.3
Net Private Transfers	5.2	3.6	7.9	3.4	1.5	-"
Net Official Transfers	45.2	33.2	25.3	16.5	4.6	7.1
BALANCE ON CURRENT ACCOUNT	-160.4	-17.5	-23.7	1.7	139.3	-32.1
Direct Invest-ment	4.7	1.7	5.9	-31.0	-140.3	39.4
Portfolio Investment	-"	-"	-"	-"	-"	-"
Other Long Term Capital	15.3	-54.1	-65.8	-35.3	-174.8	-17.8
Short Term Capital	11.1	-23.4	9.8	19.8	37.0	-20.7
BALANCE ON CAPITAL ACCOUNT	31.1	-75.8	-50.1	-46.5	-278.1	0.9
Errors and Omissions	54.0	2.0	-17.5	-6.8	42.0	-22.2
Counterpart Items	6.7	-1.0	8.0	-7.3	-22.3	-24.0
Exceptional Financing	66.9	85.1	72.5	56.4	121.6	55.8
TOTAL CHANGES IN RESERVES	1.7	7.1	11.0	2.5	-2.6	21.7

Source: International Monetary Fund's International Financial Statistics Yearbook 1989.

* All figures are in millions of US \$.

** Data for these economic indicators were not available.

The huge balance of payments deficits experienced during this period was attributed to overvaluation²⁰ of the domestic currency and the growing fiscal deficits which, as we saw earlier, drastically deteriorated in the late 70s and early 80s. With the central bank's stock of foreign reserves nearly depleted, the Leone was devalued by more than 180 per cent between 1982 and 1990 (see Table 3.4). This worsening economic performance of the country led the UN (United Nation) to reclassify Sierra Leone as a

²⁰ This overvaluation of the currency helped to fuel the flames of illegal activities in the foreign exchange market.

least developed country.

In November 1987, a state of economic emergency was declared. This was aimed at eradicating mineral smuggling and corruption which had been so endemic among the Lebanese and compradores of the country. In spite of these checks on illegal activities, the government achieved little or no success in eradicating the high level of parallel market activities and smuggling. The diversion of much needed foreign exchange via parallel markets means that the legal economy has been short of foreign currency. This currency crisis forced the government to print additional currency notes, an act which resulted in skyrocketing of prices of essential commodities.

In March 1991, a period of economic and political turmoil ensued as Sierra Leonean dissidents (rebels of the Revolutionary United Front (RUF)) in Liberia supported by Charles Taylor invaded Sierra Leone. At first, this invasion was referred to as a rebel incursion but later turned out to be a civil war. According to many Sierra Leoneans, including the rebel leader Corporal Foday Sankoh, the war erupted because of the selfish attitude of many top politicians of the defunct APC (All Peoples Congress) government in managing the affairs of the state. The resources of the state were inequitably distributed to the extent that over 70 % of the country's 4 million people live in absolute poverty. In an attempt to arrest the situation, the Momoh's administration embarked on a SAPA (Social Action For Poverty Alleviation) and economic recovery programmes that sought to reverse almost 24 years of economic mismanagement by restoring stringent financial discipline and introducing structural reforms aimed at removing administrative controls on certain economic activities. The implementation of these programmes came at a time when the government is fighting a war with the rebels.

Despite the attempts made by the then government to alleviate poverty, the rebel war however, mirrored its efforts to an extent that the results of the reform programme were not seen. By the end of 1991, the real incomes of public and private sector workers had fallen to an abysmal level and the economy pushed into subsistence, surviving only by hand-to-mouth on IMF credits. The revenue of the country could only support few sectors of the economy. Moreover, savings of the public sector were low to an extent that the central bank, instead of acting as lender of the last resort became the lender of the first resort.

Table 3.4 : Sierra Leone's Official Exchange Rate and its Rate of change due to Devaluation/Revaluation (1982-1990).

YEAR	OFFICIAL EXCHANGE RATE (Le/US \$)	RATE OF CHANGE (in per cent) ^b
1982	1.23	0
1983	2.51	104.1
1984	2.51	0
1985	5.21	107.6
1986	35.59	583.1
1987	23.04	-35.3 ^a
1988	39.06	69.5
1989	65.36	67.3
1990	188.68	188.7

Source: IMF, *International Financial Statistics Yearbook 1995*.

^a The negative sign indicates that there was a revaluation in 1987.

^b Author's own calculation.

Until 1992, the strains on the economy continue to inflict pain on the budget to an extent that government was unable to provide the necessary logistics for the military to pursue the rebel war. The lax in the provision of proper logistics for the military and the increasing level of corruption in the country, cost President Momoh's government in April 1992.

A five-man military junta led by Captain Valentine Strasser toppled the Momoh's regime and formed a ruling council known as "The National Provisional Ruling Council (NPRC)". The NPRC, which ruled by decrees, promised the people of Sierra Leone of a speedy conclusion of the rebel war and a quick return to democratic civilian rule when they assumed office. Albeit, it succeeded in returning the country to democratic civilian governance, the NPRC failed in the other area as the rebel war intensified towards the end of 1994 and early 1995. Furthermore, the new government decided to set up a commission of enquiry into the dealings of past heads of government department, parastatals and ministries. Those found guilty faced severe penalties such as confiscation of property and assets and heavy fines. Monies derived from heavy fines were used to prosecute the war and develop some sectors of the economy.

In order to revamp the economy, the NPRC government firmly resolved to continue with the economic recovery programme that was started by the deposed government. Considerable gains were observed during the implementation of the programme. Fiscal deficits were reduced from 12 % of GDP in 1990 to 6.7 % of GDP in 1993²¹. The reduction in fiscal deficits led to a big drop in both the growth rate of money supply and the rate of inflation. This, indeed reminds us of the fact that, in the past, Sierra Leone had been creating money to finance her budget deficits.

Despite the success of the recovery programme in reducing budget deficits and containing inflation, the pace of economic activity continue to drag its feet, largely because of intense rebel activities in the mining and agricultural areas. Growth in real output declined by approximately 1 % in 1992. The drop in output growth came as no

²¹ See Bank of Sierra Leone Bulletin, April 1995.

surprise since the areas that formerly help to boost both agricultural and industrial output were completely destroyed by the civil war.

Civil wars are known to create both direct and indirect impact on output. They affect output directly via the diversion of resources from areas of development into military activities, and indirectly through a reduction in the country's capital stock. Collier (1995) provides evidence for Nigeria, showing that the 3 years of civil war resulted in a substantial decrease in output by 24 %. As a means of illustrating the impact of civil wars on output growth, the growth rates of real GDP for certain African countries are compared for two periods viz pre-civil war and civil war with the help of Table 3.5.

Table 3.5 : Growth in Real GDP before and during a civil war for selected African countries.

Country	Pre-civil war		Civil war		Percentage Change
	GDP growth	Period	GDP growth	Period	
Sierra Leone*	3.3	1968-1990	-1.2	1991-1996	-4.5
Zimbabwe*	9.4	1967-1974	0.9	1975-1980	-8.5
Mozambique	5.3	1970-1974	-1.6	1976-1991	-6.9
Uganda	4.8	1967-1971	-0.5	1971-1981	-5.3
Ethiopia	3.6	1963-1981	1.0	1981-1991	-2.6

Source: Collier (1995).

* Author's own calculation from Data obtained from *International Financial Statistics Yearbook 1994*).

From Table 3.5 it is clear that the war years brought a drastic reduction in output growth for all the African countries sampled. In Zimbabwe, for instance, output growth declined by 8.5 % after the 5 year civil war. Also, in Sierra Leone, output growth declined by approximately 4.5 % after the cessation of hostilities. The same trend in output growth was observed for the other African countries.

In summary, the performance of the Sierra Leone economy had not been

encouraging, despite the civil war. Fiscal deficits, balance of payment deficits, inflation, malnutrition and poverty are among the many problems the government had to grapple with.

3.2 ECONOMIC REFORM PROGRAMME

In recent years, the pace of economic reforms in Sub-Saharan African countries has been very rapid with most countries seeking financial assistance from the IMF and World Bank. In 1994, for instance, the IMF approved new loans amounting to 163 million US \$ to Sierra Leone. This approval was made because Sierra Leone had earlier (on 25th January, 1994) settled its outstanding debts with the IMF. Of the 163 million dollars, 125 million was provided under a 3-year Enhanced Structural Adjustment Facility (ESAF) and the remaining 38 million under a 1-year Structural Adjustment Facility (SAF) arrangements in support of the economic reform programme. The SAF and ESAF are concessional IMF facilities for helping member countries pursuing economic reform programmes aimed at solving their balance of payments problem and improving their growth potentials. They carry an interest rate of 0.5 percent and are repayable within 10 years with a 66 month grace period²².

The authorities aimed at realizing a balance of payments surplus in subsequent years to restore some of the earlier losses in foreign reserves and to meet their payments obligations. They also wish to restore economic growth so as to allow an increase in real per capita income and normalise relations with creditors. Inflation was to be reduced to

²² See *Bank of Sierra Leone Bulletin*, January 1995.

around 4 % by the end of 1996 under a Right Accumulation Programme (RAP) via tight monetary and fiscal policies. Exchange and interest rates reforms were also regarded as priorities. Interest rates and trade were to be liberalized in order to mobilise domestic savings and avoid capital flight, and to make Sierra Leone highly competitive in the international market.

The RAP ended with success in February 1994 amidst difficult economic and social conditions including the rebel war. The balance of payments improved after reforming the public sector by retrenching unqualified personnel in the civil service. Fiscal deficits were also reduced by a substantial amount followed by a sharp drop in prices of goods and services.

The success of the RAP motivated the government to push ahead with the recovery programme. The government's medium-term strategy was to build upon and consolidate the gains made in stabilising and restructuring the economy. Its main aim was to establish a sound and stable economic environment which is structural impediments-free and which can lay the foundation for sustained economic growth and poverty alleviation.

Given the structural bottlenecks in the economy, strict measures were also taken to improve natural resource management, particularly in the mining and fisheries sector. Moreover, greater depth in the foreign exchange market was encouraged to contain the rate of smuggling of diamonds and parallel market activities.

To strengthen the adjustment programme, the World Bank in collaboration with the IMF extended aid to Sierra Leone under the Structural Adjustment Credit (SAC) to

the tune of 50 million US \$ in three tranches²³. The aim of this credit programme was to provide support for the Reconstruction Import Credit (RIC) programme via trade and exchange rate liberalization, fiscal management, civil service and public enterprise reforms.

3.2.1 ECONOMIC POLICIES IMPLEMENTED DURING THE ECONOMIC RECOVERY PROGRAMME

As explained in the preceding section, Sierra Leone has encountered tremendous problems since independence. To tackle these problems government has pursued several policies²⁴ between 1989 and 1994. The economic reform programme, as it was implemented, comprised three major macroeconomic policies viz monetary and exchange rate policies of the central bank and fiscal policy of the government. Other miscellaneous policies such as agricultural and industrial policies were also pursued.

3.2.2 MONETARY AND FINANCIAL SECTOR POLICIES

The primary objective of the authorities in the economic recovery period was to reduce monetary growth to a level consistent, not only with the government's inflation and balance of payments objectives, but also with the objective of providing enough bank

²³ According to the Bank of Sierra Leone report of January 1995 on the state of the economy, the three tranches included a 20 million dollar equivalent upon effectiveness and a 15 million dollar equivalent after each of the two satisfactory performance reviews.

²⁴ Timbergen's rule, which says that "For every n targets there must be n policy instruments to meet these targets", is in full application in this case.

credit to revamp the private sector. Adherence to strict fiscal discipline was the basis to the limit in monetary expansion. The weapon of monetary control used to achieve these objectives was open market operations. The open market operations was carried out in the form of weekly auctions of treasury bills. In order to fuel the open market operations, the central bank introduced a wider range of debt instruments and adopted a new marketing arrangement. The principal objective of this regulatory role was to reduce broad money growth in the economy. As the data in Table 3.6 indicate, broad money growth fell from 37.4 percent in June 1992 to 2.5 percent in March 1995. However, reserve money showed a downward trend from December 1994 to March 1995. Apart from reducing the growth rate of broad money, government also launched a one-year Treasury bearer bond with a fixed coupon rate in order to permit the term structure of interest rate to be market determined. In addition, a clearing facility for official debt was set up to promote the development of secondary interbank money market and to enable the central bank to pursue its major functions effectively.

Table 3.6 : Trends in Monetary Variables during the recovery period (in Million Leones).

Monetary Variables	June 1992	June 1993	June 1994	December 1994	March 1995
MONETARY INDICATORS					
Narrow Money M1 ^a	25,630	32,990	34,360	37,920	39,957
Quasi Money	8,805	14,319	16,004	16,955	16,332
Broad Money M2 ^a	34,435	47,309	50,364	54,875	56,289
Growth in M1 (in per cent)	45.4	28.7	4.2	10.4	5.4
Growth in M2 (in per cent)	34.4	37.4	6.5	9.0	2.6
Bank credit to Private Sector	9,568	12,838	13,339	16,576	-
QUANTITATIVE PERFORMANCE					
Reserve Money	20,498	23,066	29,141	31,346	29,105
Net Foreign Assets of BSL ^b	118,008	143,226	140,344	144,595	68,708
Revaluation Adjustment ^c	-	27,890	37,176	37,176	51,852
Net Domestic Assets of BSL	138,506	166,292	169,485	175,941	97,813
Net Claims on Govt. (Commercial Banks)					
Net Claims on Govt. (Banking System)	1,152	5,878	6,795	6,918	9,688
Net Claims on Govt. by Non-bank Sector					
Total Claims on Government	11,909	9,308	4,152	7,308	10,946
Adjustment during 1994/95 on account of Debits of previous Year	-	2,662	6,137	7,116	8,038
Adjusted Net Domestic Financing	11,909	11,970	10,289	14,424	18,984
				1,246	1,306
				13,178	17,678

Source: *Bank of Sierra Leone Bulletin*, April 1995.

^a Inclusive of International Bank for Trade and Industry (IBTI) deposits/credit in Million Leones at the time of its liquidation.

^b Bank of Sierra Leone.

^c Revaluation adjustment on Net Foreign Assets at end December 1993 exchange rate (Le 571.91/US \$).

In August 1993, the authorities removed the last administered commercial bank interest rate. In an attempt to achieve positive real interest rates²⁵ and to enhance the mobilization of domestic savings, discourage the flight of capital to foreign countries and prevent unproductive investment activities, a policy of credit contraction was pursued in the stabilisation period.

In the past two decades after independence, the financial sector suffered greatly from a lot of inefficiencies leading to the high cost of financial intermediation. Small scale industries were starved of working capital to carry out viable investment projects. As a

²⁵ According to McKinnon (1973), the macroeconomic signalling may be too adverse when real interest rates are positive. This is to say that if individual X sees very high nominal interest rates above recorded inflation, X could interpret this as a signal that most people in the economy expected inflation to proceed and the stabilisation programme to collapse.

means of arresting the problems of the financial sector, government was able to beefed up the supervisory role of the Bank of Sierra Leone over the day-to-day activities of the commercial banks. In November 1993, for instance, the central bank issued directives requiring corrective measures with a view to containing the deterioration of the loan quality and exposure of commercial banks²⁶. In addition to the support given to the central bank by the government, a test study concerning the operation of all the commercial banks was conducted in order to improve the operating efficiency of the banking system and identify the factors leading to the high cost of financial intermediation.

3.2.3 FISCAL POLICY

One of the primary motives of the reform programme was to reduce budget deficits in order to reduce the growth rate in money supply. If Friedman's view is correct, then a reduction in money supply will be able to arrest the inflationary episode in the economy. An immediate result of this policy implementation was a drastic reduction in budget deficits from 6.7 % of GDP in 1993 to 5.6 % of GDP in 1994. This success was due to a broadening of the tax system which resulted in increased revenue, a rise in the elasticity of the tax system and greater reliance on sales tax. Since 1990, the government has expanded the coverage of the sales tax as the tax itself has risen from 10 percent to 20 percent in March 1995²⁷. Moreover, the authorities aimed at developing a value added Tax (VAT) which is yet to be implemented because of the lack of the needed

²⁶ See *Bank of Sierra Leone Bulletin*, April 1995.

²⁷ See *Bank of Sierra Leone Bulletin*, April 1995.

administrative machinery for its implementation.

In June 1994, the authorities embarked on a tax modernization programme by computerizing operations and upgrading the training of inspectors and procedures for the smooth collection of customs and excise duties. The excise tax was unified at 30 % and is levied on alcoholic drinks, manufactured tobacco and passenger cars²⁸. In order to beef up compliance with tax regulations, a taxpayer identification and registration was introduced in August 1995. With the help of technical experts and the modernization of the tax system, revenue collection has improved tremendously in recent years.

Since 1961, government's main efforts in revamping the economy rested entirely on loans from foreign donors. These loans will not only result in monetary expansion, but also lead to the accumulation of huge debts which the government has to service in the future. In a bid to track down this anomalous condition, the Sierra Leone government has decided, in the spirit of restoring budgetary equilibrium, to reduce credit arrangements with foreign donors. This, if brought to bear, will help in sustaining economic growth and development.

Apart from the above measures taken to improve the fiscal situation of the country, government also revised its expenditure policy. This led to a drop in total expenditures to approximately 20 % of GDP in 1994. Despite the cut in expenditures, budgetary allocations for basic social and economic services were not affected.

²⁸ *Ibid.*

3.2.4 EXCHANGE RATE POLICY

In most developing countries, exchange rate reform often take the form of floating the exchange rate in order to marginalize and legalize the parallel market for foreign exchange. In Sierra Leone, prior to 1982, a system of exchange control or fixed exchange rate²⁹ was in force. Since then, the government has been embarking on a policy of exchange rate liberalization. In 1990, for instance, the government employed a liberal exchange rate system in which the exchange rate was allowed to float freely³⁰ against other currencies in the foreign exchange market. The exchange rate system was that of a clean float in which currency restrictions were relaxed and market forces of demand and supply became the only determinant of the exchange rate. The immediate result of this policy was seen as a big drop in the general price level. Inflation rates plummeted to the comparatively low rates of 6 % to 27 % experienced between 1967 and 1982 from the high rates of 30 % to 200 % experienced in the 1983 through 1992 period.

The move from an exchange control system to a liberal system of exchange was good for a country like Sierra Leone because of two main reasons. First, the relative ease with which gold and diamond could be siphoned out of the country serves as an impediment to the administration of an exchange control system in Sierra Leone. This system has been tried several times with little or no success. Second, a system of exchange control could have perverted the reward structure of the economic recovery programme by undermining the confidence in the currency and encouraging massive capital flight.

²⁹ The Leone was pegged at a rate of Le2.00 per 1 British Pound until 1978 when it was delinked from the Pound and pegged to the SDR at rate of Le2.25.

³⁰ Freely floating exchange rate system is advantageous in the sense that it allows the central bank to concentrate on monetary policy issues.

Following the liberalization of the exchange rate was the formation of foreign exchange bureaux in November 1991. This measure was taken to solve the foreign exchange crisis and absorb the parallel market which had been very operative in the past. Notwithstanding this measure, parallel market activities were still practised, albeit in a small scale relative to the period before the establishment of the foreign exchange bureaux. The ineffectiveness of the parallel market was quite evident as the black market premium fell sharply from 31.64 % in June 1991 to 5.12 % the following year. This is shown in Table 3.7.

Table 3.7: Trends in Official and Parallel Exchange rates before and after the establishment of Exchange Bureaux in Sierra Leone.

Period	Official Rate*	Parallel*	Black Market Premium** (in percent)
1984	2.51	7.00	64.14
1985	5.70	15.00	62.00
1986	5.08	24.00	78.83
1987	38.16	45.00	15.20
1988	31.59	48.00	34.19
1989	65.17	85.00	23.13
1990	156.19	168.00	7.03
1991	251.32	315.00	31.64
1992	507.56	535.00	5.13
1993	566.93	580.00	2.25
1994	583.09	590.00	1.17
1995	681.12	767.75	11.28***

Source: Bank of Sierra Leone Economic Bulletin, July 1995.

Notes: * Data on these indicators refer to Year ending June figures.

** The Premium was calculated by the Author by taking the product of 100 and the ratio of the difference between the parallel exchange rate and the official rate to the parallel rate.

*** This high premium, compared to June 1987, was due to the scarcity of foreign exchange emanating from the fears of anticipated financial instability because of intensified rebel insurgence in November 1994. The fear of an anticipated financial instability led to a surge in speculative demand for foreign currency as a precautionary hedge against a possible financial crisis and economic instability³¹. Considering the rudimentary nature of the bureaux, the high speculative demand could not be met and so the excess demand spills into the parallel market leading to its effective operation.

³¹ See R Gilpin (1995).

In January 1995, the Leone depreciated against the dollar by 6.3 %. The depreciation of the currency did not only prevent the flight of capital to foreign countries, but also provided an occasion to increase producer prices for agricultural exports which are almost not forthcoming because of frequent rebel attacks in the agricultural areas. Cocoa and Coffee farmers who take risk to get produce from the rebel occupied areas received greater incentives for their products.

3.3 TRENDS IN OUTPUT GROWTH, MONEY GROWTH AND INFLATION IN SIERRA LEONE

According to Friedman, inflation has always been a monetary phenomenon. Put in another way, inflation cannot occur unless it is validated by a substantial increase in money. In order to examine this argument critically, we will consider the trends in Sierra Leonean inflation after independence, which might be very interesting to examine considering the inflationary episodes which the country had experienced in the past. In the immediate post-independence period Sierra Leonean inflation was that of the creeping type, hovering around single digits. As the figures in Table 3.8 indicate, annual inflation as measured by the Freetown consumer price index averaged 3.9 percent between 1966 and 1973. The low rate of inflation was probably due to stringent monetary control. Growth in narrow money (M1) as well as broad money (M2) averaged 10.9 and 11.9 between 1966 and 1973 respectively.

*Table 3.8 : Growth Rates in Money, Real Output and Prices(in %)**

Year	Narrow Money (M1)	Broad Money (M2)	Real GDP	Inflation
1966	0	3.3	1.5	4.7
1967	0	3.2	-5.0	5.3
1968	22.7	21.9	4.4	0
1969	18.5	17.9	9.0	5.0
1970	-9.4	-6.5	7.7	4.8
1971	10.3	11.6	-2.0	0
1972	21.9	18.8	-2.4	4.5
1973	23.1	24.6	3.9	6.5
1974	14.6	19.7	6.2	14.3
1975	9.1	8.2	0.2	19.6
1976	20.0	21.7	-8.0	16.4
1977	16.7	21.4	11.3	9.0
1978	27.4	31.6	3.2	10.6
1979	19.6	20.1	-0.1	21.3
1980	19.5	21.4	-0.7	13.2
1981	-0.7	2.7	-9.3	23.3
1982	66.4	56.7	-2.3	27.0
1983	41.9	31.4	-30.5	68.3
1984	35.4	28.4	-12.7	66.5
1985	85.2	71.1	-0.6	76.7
1986	105.8	88.4	-13.6	80.9
1987	56.0	64.0	-6.5	181.5
1988	60.5	56.9	24.8	31.3
1989	87.1	74.2	6.2	62.8
1990	64.3	74.0	-18.3	111.0
1991	76.0	76.2	-1.4	102.7
1992	25.1	33.2	2.9	65.5
1993	11.7	21.9	17.9	20.9
1994	10.0	1.1	-6.2	24.2

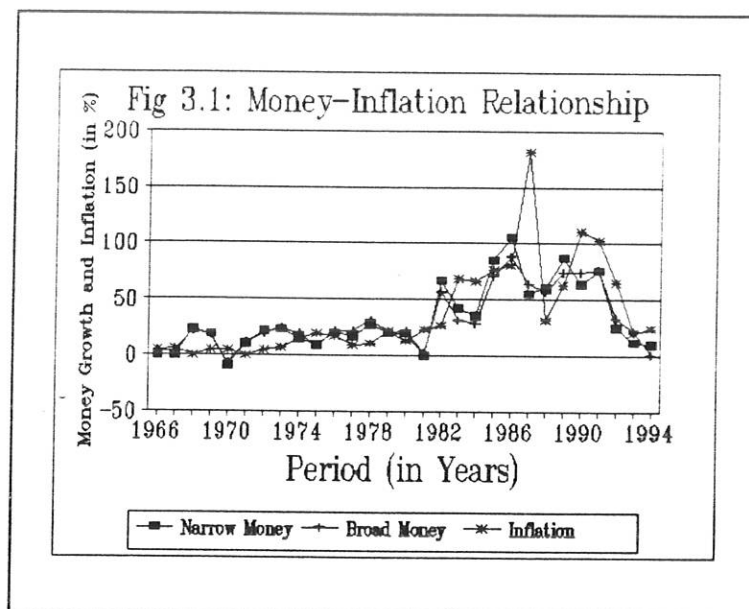
Source: International Monetary Fund's International Financial Statistics Yearbook 1994.

*Notes: * Author's own calculation.*

Between 1974 and 1994, inflation rates reached unprecedented levels as the reported average inflation rate stood at 49.9 percent. The surge in prices during this period was attributed to the rise in both broad money and narrow money growth, and decline in output growth in the economy. GDP growth declined from an annual average

of 2.6 percent in the 1966-1974 period to an average of -2.2 percent between 1975 and 1994. Two points are probably worth noting from this sketchy presentation. First, there exists a negative relation between output growth and inflation (periods of output cuts are associated with periods of increasing prices). Second, increasing monetary growth is always associated with hyperinflation, in the Sierra Leonean case. In other words, periods of high monetary growth coincide with periods of high inflationary trend.

It is quite apparent, from the values in Table 3.8, that the rate of real broad money as well as narrow money growth was negative between 1966 and 1967 meaning that growth in the two monetary indicators fell short of the growth rate in prices. However, the situation changed drastically between 1968 and 1969 with growth in real money supply exceeding the rate of inflation. The positive real growth in money supply was attributed to an increase in money demand in the economy and the lagged effects of excessive domestic financing of budget deficit. Net domestic financing stood at Le 3.6 million against its target of Le 2.3 million in 1968. Between 1979 and 1994, the trends in narrow money growth were mixed, with the highest percentage increase settling at 105.8 %. Broad money growth also exhibit similar trends. On average, high monetary growth in the economy is reflective of hyperinflation. This is true, especially in the last decade when inflationary episodes were experienced with an expansion in domestic credit. Figure 3.1 provides a summary of the forgoing discussion.

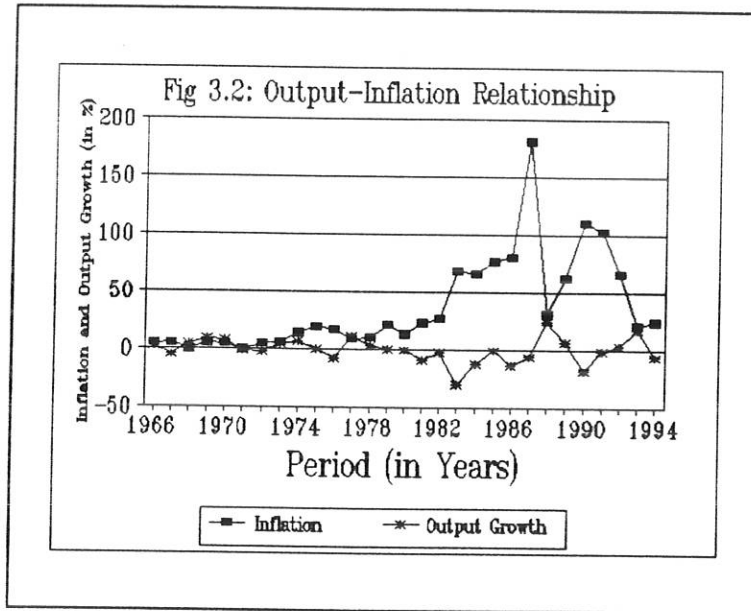


Source: IMF, *International Financial*

Statistics Yearbook (1995).

Output growth in 1968 stood at 4.4 % compared to -5 % in the previous year. This was attributed to an expansion, not only in agricultural and manufacturing output, but also in mineral production. The decline in output growth made inflation to drop from 5.3 % to 0 % during this period. Clearly, this indicates the presence of a negative relationship between inflation and output growth. From 1973 to 1983, the trends in output growth and inflation showed no contracyclical relationship meaning that the trends were mixed. Despite the remarkable expansion in output growth in 1973, inflation hovered around double digits. A possible explanation for this is the unprecedented increase in crude oil prices in 1973 which made most non-oil producing countries, especially in Sub-Saharan Africa, to experience severe macroeconomic imbalances. Between 1983 and 1994, the relationship between output growth and inflation seems to conform to economic *a priori* expectations, albeit very weak. Cuts in output are associated with increase in prices. In 1994, for

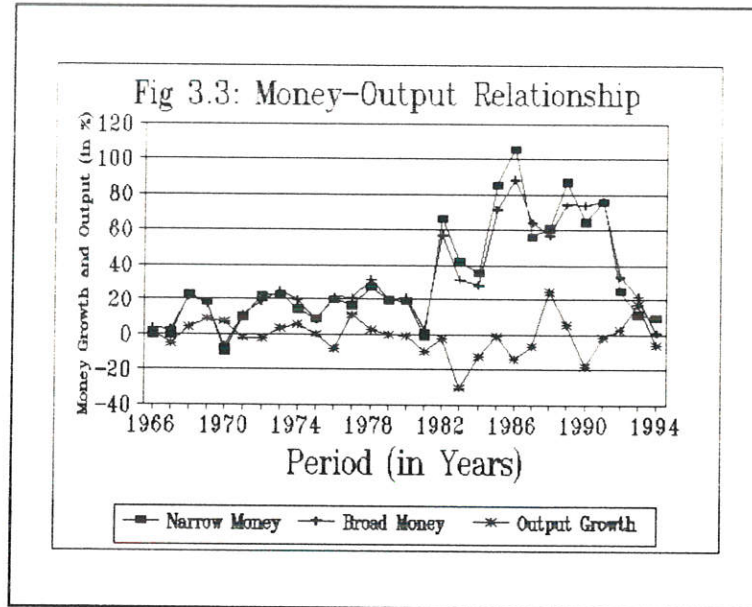
instance, there was a substantial drop in real output growth and a corresponding surge in prices. Perhaps, this was due to the frequent disruptions of the manufacturing and agricultural activities by the civil war. Figure 3.2 summarizes this argument.



Source: IMF, International Financial

Statistics Yearbook (1995).

With regards to the relationship between monetary growth and output, the trend does not seem to support the Lucas-Sargent-Wallace hypothesis that monetary growth results in output expansion, especially between 1982 and 1992. Though mixed trends were observed for some periods, on average, periods of monetary expansion coincide with periods of output slumps. Figure 3.3 explains this relationship.



Source: IMF, *International Financial Statistics Yearbook 1995*.



CHAPTER IV

MODEL SPECIFICATION, EMPIRICAL RESULTS AND ANALYSIS

In chapter III, attempts were made to explore the linkages between money and output, on the one hand, and between each of these macroeconomic variables and prices, on the other, with particular reference to the Sierra Leonean economy. It was observed that money and prices move in the same direction, whilst the reverse was the case for the relationship between prices and output. The relationship between money and output showed mixed trends. Whereas the period 1966-1982 showed a positive relationship between money and output, the period 1983-1992 indicates a negative relationship. However, between 1992 and 1994, the money-output relationship was positive. This rather ambiguous relationship might be due to policy changes.

This chapter considers an analytical framework for econometric analysis of the causal link among output, money and prices. Included in this chapter is the empirical model and a description of the time series properties of the variables in the model. These econometric analyses are presented in sections 4.2 through 4.4.

4.1 ANALYTICAL FRAMEWORK

The inter-relationship that exist among output, money and prices continue to be clearly illustrated in many macroeconomic models formulated for developing countries. It is evident that many of the high inflation developing countries have wholly or partially embarked on adjustment programmes of disinflation. These efforts, it is believed, depend on the macroeconomic structure that underlies the interrelationship among output, money

and prices. A monetary contraction to disinflate the economy is costless to the extent that there are no effects on output, real interest rates and the real exchange rate (Reinhart *et al* (1991)).

On the other hand, a monetary expansion to finance government budget deficits and service the national debt will provoke an increase in aggregate demand by exactly the same amount as the increase in the growth rate of money. In the short run, assuming sticky wages and prices, output will expand beyond the full employment level and the economy will move to a high point of growth. At this point, any slight drop in output below the full employment level will result in rising money wages and, through mark-up pricing, increasing prices. In a nutshell, short run monetary policy is effective in expanding output but would be reflected in rising inflation.

4.2 METHODOLOGY

In this study, the recent developments on co-integration and error correction methodology will be used in order to capture the short run dynamics in the model. According to Granger and Newbold (1974) econometric theory requires that variables be stationary³² or integrated of order zero if results are to be non-spurious. This means that regressing a non-stationary series³³ on another non-stationary series will lead to econometric results with highly significant t-ratios, extremely high R^2 value but very low Durbin-Watson statistic. These results, in actual fact, do not carry any economic meaning

³² A series is stationary if, it has a finite variance, innovations from the mean are transitory and there exists a tendency for the series to revert to its mean value.

³³ A non-stationary series is one with an infinite variance and permanent innovations from the mean.



as far as econometric theory is concerned. However, a major shortcoming of the error correction methodology is that estimation is done on unit roots (non-stationary) variables in the first step which means that the use of OLS is inappropriate because the resulting estimates are inconsistent.

To overcome the problem of spurious results in our regressions, the variables of the model were tested for unit roots using the Dickey-Fuller and Augmented Dickey-Fuller (DF and ADF) tests. These are tests against the null hypothesis that the variables are non-stationary. The DF tests employ the t-statistic on the coefficient of the lagged explanatory variable. The null hypothesis of non-stationarity is rejected if the computed t-statistic is greater than the critical value, say, at the 5 % level for a given sample. The equations for diagnosing the variables for unit roots are of the form

$$Y_t = \alpha + \beta Y_{t-1} + \delta t + \epsilon_t$$

$$Y_t = \alpha + \beta Y_{t-1} + \delta t + \sum_{k=1}^T \lambda_k \Delta Y_{t-k} + \epsilon_t$$

where Y_t denotes the value of the variable Y in the current period, Y_{t-1} is the past value of Y , Y_{t-k} is the past value of Y in the k th period, t is a time trend, α is a drift and ΔY_{t-k} captures the ARMA error process or the additional dynamics that was not considered in the DF test.

After diagnosing the variables of the model for unit roots, the test for cointegration was then employed to examine whether the regressand and the explanatory variables *come over or there* comove or their exist a long run relationship between them. The DF and ADF tests for unit roots residuals were also applied. The equations for these tests are given by

$$\Delta e_t = \beta_0 + \beta_1 e_{t-1} + \epsilon_t$$

$$\Delta e_t = \beta_0 + \beta_1 e_{t-1} + \sum_{i=0}^n \delta_i \Delta e_{t-1} + \epsilon_t$$

where Δ is a difference operator, e_t and e_{t-1} are the current and lagged white-noise residuals respectively. The null hypothesis of no cointegration among the variables, that is the residuals have unit roots, is rejected if the computed t-ratio is greater than the critical value at the 5 % level of significance.

To examine the relationship among output growth monetary growth and inflation, the direct Granger-causality method was used. This method involves regressing the first difference of the present values of a particular variable on the first difference of its past values and the first difference of the past values of another variable. The equations to be estimated in the Granger procedure are of the form

$$\Delta P_t = a_0 + \sum_{k=1}^T a_{1k} \Delta P_{t-k} + \sum_{k=1}^T a_{2k} \Delta M_{t-k} + a_3 T + \epsilon_{1t} \quad \text{b1, msp}$$

$$\Delta M_t = b_0 + \sum_{k=1}^T b_{1k} \Delta M_{t-k} + \sum_{k=1}^T b_{2k} \Delta P_{t-k} + b_3 T + \epsilon_{2t}$$

$$\Delta P_t = c_0 + \sum_{k=1}^T c_{1k} \Delta P_{t-1} + \sum_{k=1}^T c_{2k} \Delta Y_{t-1} + c_3 T + \epsilon_{3t} \quad \text{b1, ysp}$$

$$\Delta Y_t = d_0 + \sum_{k=1}^T d_{1k} \Delta Y_{t-1} + \sum_{k=1}^T d_{2k} \Delta P_{t-1} + d_3 T + \epsilon_{4t}$$

$$\Delta M_t = e_0 + \sum_{k=1}^T e_{1k} \Delta M_{t-1} + \sum_{k=1}^T e_{2k} \Delta Y_{t-1} + e_3 T + \epsilon_{5t} \quad \text{b1, msp}$$

$$\Delta Y_t = f_0 + \sum_{k=1}^T f_{1k} \Delta Y_{t-1} + \sum_{k=1}^T f_{2k} \Delta M_{t-1} + f_3 T + \epsilon_{6t}$$

where ΔP_t , ΔM_t , ΔY_t and T are first differences in prices, money supply, real output and time trend respectively. ϵ_{1t} , ϵ_{2t} , ϵ_{3t} , ϵ_{4t} , ϵ_{5t} and ϵ_{6t} are mutually uncorrelated white-noise residuals.

In the direct Granger-causality method, the null hypothesis that monetary growth does not granger-cause inflation is rejected if the calculated F-statistic for the joint

significance of a_{2k} 's is greater than the critical F-statistic at a given level of significance. Similarly, the proposition that inflation does not granger-cause monetary growth is rejected if the computed F-ratio for the joint significance of b_{2k} 's exceeds the critical F-ratio at any given level of significance. A feedback relationship exists if both F-ratios are significant. They are independent if both F-ratios are insignificant.

A time series multiple regression analysis was employed as the methodology for the analysis of output and monetary behaviour. Ordinary least squares (OLS) and Instrumental variable (IV) estimation techniques were used throughout the analysis.

4.2.1 DATA SOURCES AND DESCRIPTION

The data analyzed in this paper come from various sources. In particular, the study uses annual time series data for the analysis. Data on prices, base money, central bank's claims on the commercial banks and the private sector (CCB), foreign reserves (FR), exchange rates, Gross Domestic Product (GDP) and money supply (M1) were drawn from various issues of the Bank of Sierra Leone Economic Reviews and International Monetary Fund's *International Financial Statistics Yearbook*. Data on government revenue (R) and nominal government expenditures (G) were also extracted from various issues of the IMF's *International Financial Statistics Yearbook*.

Parallel exchange rate figures were extracted from various issues of the Bank of

Sierra Leone Economic Bulletin and Pick's World Currency Yearbook³⁴. A weighted average method is used to compute the proxy variable for world inflation³⁵. In the computation method, the consumer price indices and the gross domestic product of nine major OECD countries (Belgium, France, Netherlands, Germany, USA, UK, Japan, Canada and Italy) were considered.

Since unanticipated money growth is not observable, the residuals of the fitted regression in equation 10 are used as a proxy for money surprise or unanticipated money growth.

The Freetown consumer price index was used as a proxy for prices. The main advantage of using consumer price index in inflation studies in both developed and developing countries is its close theoretical link to the demand for money. Its main weakness, especially in developing countries, is that it does not act as a good measure of prices since it only considers prices faced in major metropolitan areas by urban dwellers. In the data collection exercise an attempt was made to obtain an index of prices which

³⁴ It must be noted that the data reported on these publications for parallel exchange rate was incomplete. In order to solve this problem, I used the Average Black Market Premia to extrapolate the data. The formula used can be represented as:

$$ABMP = \frac{\sum_{t=1}^T \frac{BMR - OE}{OE}}{T}$$

where ABMP is Average Black Market Premia, OE is official exchange rate, BMR is black market exchange rate and T is the sample size.

³⁵ The weighted average formula is given as:

$$WCPI = \frac{\sum_{i=1}^n \frac{GDP_i}{\sum_{i=1}^n GDP_i} \times CPI_i}{n}$$

where GDP_i denotes GDP of the ith country, CPI_i is the consumer price index of the ith country WCPI is world CPI and n is the sample size.

covers a broad spectrum of consumer items in the whole country. However, this was very difficult to get since the only index available at the time of the data collection exercise was the Freetown consumer price index.

In order to deflate nominal values, the consumer price index was used. The CPI is a better deflator than the GDP deflator because the latter is constructed as a value-added deflator which excludes imports (items purchased by residents) and includes exports (items which are not purchased by residents) while the CPI deflator is constructed as an index of prices which includes imports and excludes exports. Since developing countries are highly import dependent we expect a greater part of total consumer expenditures to be devoted to imports which means that the CPI provides a reasonable first-order approximation to the true price deflator (Adam, 1990).

Attempts were made to gather information through informal interviews with government officials conversant with the subject matter. This was done to ensure that vital information is collected regarding the practical realities of the subject.

4.2.2 MODEL SPECIFICATION

The present study attempts to develop a time series model for a small open economy ravaged by war. The model can be seen as a modification of Barro (1981) and Sowa and Kwakye (1993) models. In the modified model, the endogenous response of output and inflation to domestic shock such as war will be considered via the use of a dummy. Specifically, the complete model will describe the behaviour of prices, money

and output in a system of equations. The econometric model is specified as follows:

INFLATION PROCESS

This paper aims in part to examine the behaviour of prices in Sierra Leone. To achieve this a log linear model developed by Sowa and Kwakye will be used. In this model, inflation is assumed to depend on growth in money supply (narrowly defined), real output, exchange rate³⁶ and expected rate of inflation. Using this information the simple inflation model can be specified as

$$\log P_t = \alpha_0 + \alpha_1 \log M_t + \alpha_2 \pi_t^e + \alpha_3 \log XRATE_t + \alpha_4 \log Y_t + U_{1t} \dots (1)$$

where

P_t = General price level in period t

M_t = Money supply (M1) in period t

$XRATE_t$ = Price of foreign exchange (Le/US \$) in period t

Y_t = Real output in period t .

π_t^e = Logarithm of Expected Rate of Inflation in period t

U_{1t} = White-noised residuals

The log linear specification is the most appropriate in this study since it expresses the coefficients as elasticities and also, by compressing the scales in which the variables are measured, the log linear specification helps to reduce the incidence of heteroscedasticity in the model.

From macroeconomic data it is observed that a feedback relationship exist between

³⁶ Because of the increasing dollarization of the Sierra Leonean economy, exchange rate was measured as the amount of local currency exchange per unit of US \$ (Le/US \$) throughout the study.

inflation and output. Hence, the real output variable in equation 1 proxied as real GDP helps to capture this feedback relationship. To account for the effect of monetary growth in the economy on prices the money supply variable is considered in the specification. The variable XRATE accounts for the effects of exchange rate policy on prices.

The expected inflation rate in equation 1 is determined according to the assumption that a 1-year percentage increase in the price level will be the same as in the previous years. The equation for the generation of this variable is given as

$$\pi_t^e = \left(\frac{\pi_{t-1} - \pi_{t-2}}{\pi_{t-2}} + 1 \right) \pi_{t-1} \dots \dots \dots (2)$$

Rearranging equation 2 gives

$$\pi_t^e = \frac{\pi_{t-1}^2}{\pi_{t-2}} \dots \dots \dots (3)$$

where

π_{t-1}^e = Expected annual rate of inflation in period t-1

π_{t-1} = Actual rate of inflation in period t-1

and π_{t-2} is actual rate of inflation in period t-2.

In Sierra Leone, financial institutions are relatively underdeveloped and economic activities insufficiently monetized. This implies that an adjustment mechanism is required to capture most of the delayed effects of an increase in money supply so that the price equation (equation 1) is augmented by including the 1 year lagged money supply as

$$\log P_t = \alpha_0 + \alpha_1 \log M_t + \alpha_2 \pi_t^e + \alpha_3 \log XRATE_t + \alpha_4 \log Y_t + \alpha_5 \log M_{t-1} + U_{1t} \dots \dots (4)$$

where M_{t-1} denotes Money Supply in period t-1 and all the other variables carry the usual meaning.

Equation 4 which is the model representing the long run relationship between the regressand and the regressors assumes that adjustment to changes in the later is instantaneous (London, 1989). This assumption may not be valid in the short run since a sudden increase in the money supply provokes a rise in real cash balances.

Prior to the establishment of the Exchange Bureaux in Sierra Leone in December 1992, foreign exchange transactions in the parallel market was widespread to the extent that a foreign exchange crisis occurred in 1982. Acquiring foreign exchange via unofficial channels involves some cost. The parallel exchange rate is therefore added to the specification in (4) to capture the cost of acquiring foreign exchange.

Before 1982, the fixed exchange rate did not allow rapid fluctuations in the exchange rate to affect prices. However, the intermittent adoption of a flexible exchange rate after 1982 generated wide fluctuations of the Leone to the extent that these fluctuations affected prices. A slope dummy is therefore attached to the exchange rate to capture the effects of the wideswings in the currency. The dummy variable assumes a value zero prior to 1982 and a value 1 after 1982 so that the equation for calculating the slope dummy be given as

$$SLD1 = DUMMY \times \log XRATE_t \dots \dots \dots (5)$$

Similarly, a slope dummy is attached to the parallel rate to get

$$SLD2 = DUMMY \times \log BMR_t \dots \dots \dots (6)$$

where BMR_t = Parallel exchange rate in period t .

The ongoing rebel war has contributed a lot in stifling economic activities in the

country. In a time of war the limited financial and human resources are devoted to military activities. This means that the production of civilian goods and services will fall which in turn creates excess demand for goods. This excess demand for goods leads to an increase in prices. A war dummy is therefore added to the specification in (4) to account for the effect of the war on prices. This dummy will assume a value zero prior to 1991 (the year that marks the beginning of the war) and a value 1 after 1991. Finally, a 1-year lagged exchange rate will be incorporated into the model to account for the possibility of adjustment of inflation to changes in exchange rate policy. To account for the discernible effect of world prices on domestic inflation, the variable WP_t , is included into the model.

Incorporating all the above arguments into the specification in (4) the relevant inflation equation for estimation will be

$$\begin{aligned} \log P_t = & \alpha_0 + \alpha_1 \log M_t + \alpha_2 \pi_t^e + \alpha_3 \log XRATE_t + \alpha_4 \log Y_t + \alpha_5 \log M_{t-1} + \alpha_6 \log BMR_t \\ & + \alpha_7 \log XRATE_{t-1} + \alpha_8 \log WP_t + \alpha_9 SLD1 + \alpha_{10} SLD2 + \alpha_{11} WAR + U_{1t} \dots \dots \dots (7) \end{aligned}$$

where $\alpha_1, \alpha_5, \alpha_6, \alpha_7, \alpha_8, \alpha_9, \alpha_{10}, \alpha_{11} > 0$ and U_{1t} is an error term distributed normally with 0 mean and constant variance.

The coefficient α_4 is expected to be negative since a drop in output is known to generate inflationary pressures. α_2 is expected to be positive since expectations of a future rise in prices normally induce individuals to change their spending patterns by purchasing more goods in the current period. The ultimate result of this is an excess demand in the goods market leading to high inflation in the current period.

One of the secondary objectives of this paper, as outlined in the introductory part, is to examine the nature of inflation series in Sierra Leone. To achieve this, we specify the inflation rate as a random walk and noise model. The econometric model is therefore,

$$\Delta^2 \log P_t = \lambda_0 + \lambda_1 \Delta \log P_{t-1} + \lambda_2 \Delta^2 \log P_{t-1} + \lambda_3 \text{TIME} + U_{2t} \dots \dots \dots (8)$$

where U_{2t} is a white-noise series³⁷, $\Delta^2 \log P_t$ is the first difference rate of inflation in period t , $\Delta \log P_{t-1}$ denotes the 1-year lagged inflation rate, $\Delta^2 \log P_{t-1}$ is the first difference lagged inflation and TIME denotes time trend. The DF and ADF tests were used to examine the nature of the inflation series in Sierra Leone.

REAL OUTPUT EQUATION

In order to test the hypothesis that an unexpected increase in money results in wide fluctuations in output a Barro (1981) type model of output growth-money surprise is constructed. In this model, real output is assumed to depend on unexpected changes in the stock of money (money surprise)³⁸, nominal government expenditures and trend in growth rate of real output.

The adopted model is expressed as

$$\begin{aligned} \log Y_t = & \beta_0 + \beta_1 (\Delta \log M_t - \Delta \log \hat{M}_t) + \beta_2 (\Delta \log M_{t-1} - \Delta \log \hat{M}_{t-1}) \\ & + \beta_3 \log G_t + \beta_4 \text{TIME} + U_{2t} \dots \dots \dots (9) \end{aligned}$$

where Δ is a difference operator, G denotes nominal government expenditures, $(\Delta \log M_t - \Delta \log \hat{M}_t)$ is the money surprise or unexpected monetary growth term and $\Delta \log \hat{M}_t$ is

³⁷ A series is white-noised if consecutive values of that series are uncorrelated.

³⁸ To economize on the number of degrees of freedom, the money surprise variable was set at two lags.

the anticipated monetary growth variable. The *TIME* variable helps to capture the trend in growth of real output. $\Delta \log \hat{M}_t$ is determined by the following money growth equation:

$$\Delta \log M_t = \gamma_0 + \gamma_1 \Delta \log M_{t-1} + \gamma_2 (\log RG_t - \log NG_t) + \gamma_3 \Delta \log M_{t-2} + \epsilon_t \dots \dots (10)$$

where RG is real government expenditures, NG is normal government expenditures and ϵ_t is a white-noise series. The lagged dependent variables incorporated into the anticipated money growth equation help to capture the elements of serial dependence not explained by the other regressor in the equation. Quantitatively, normal government expenditure was obtained adaptively according to the following equation:

$\log NG_t = \beta \log RG_t + (1-\beta) \log NG_{t-1}$, with the adaptive coefficient, β , obtained according to the fit of the money growth equation.

Two main reasons can be advanced for the inclusion of $(\log RG_t - \log NG_t)$ into equation 10. First, Sierra Leone is going through a period of civil war, in which the long run response of money to an increase in the government budget is different from that in the pre-civil war period because of different spending patterns by the government in these two periods. Second, because permanent expansions in the share of GDP absorbed by the government creates an expansion of the taxing capacity, there is every likelihood that changes in nominal government expenditures alone would not create monetary expansion. To this end, it is only changes in real government expenditures relative to normal that would result in monetary expansion.

The rationale behind incorporating the money surprise term into equation 9 is to capture the spillover effects of monetary disequilibrium on output. Unanticipated increase

in money supply is known to generate an increase in real activity (assuming rational expectations) in the short run as producers in their attempt to adjust money balances to equilibrium level change their spending and holdings of financial assets (Agenor, 1990). The coefficient β_1 is therefore expected to be positive. This is the most important coefficient in the study since the study aims at testing the hypothesis that unexpected monetary growth in the economy is responsible for fluctuations in output.

The Barro model is modified by replacing budget deficits for government expenditure. Budget deficit is used to reflect the effects of fiscal policy on output growth. The modified equation is thus:

$$\log Y_t = \beta_0 + \beta_1 (\Delta \log M_t - \Delta \log \hat{M}_t) + \beta_2 (\Delta \log M_{t-1} - \Delta \log \hat{M}_{t-1}) \\ + \beta_3 \log (G/R)_t + \beta_4 TIME + U_{2t} \dots \dots \dots (11)$$

where G/R denotes budget deficits and R is nominal fiscal revenues.

A second modification of the model is the addition of the real price for foreign exchange ($XRATE/P$) to the specification in (11). This variable is worth adding because Sierra Leone, like any other least developed country, depends heavily on foreign trade. This implies that supply decisions are influenced by the profitability of exports and import substitution. An increase in the relative price of foreign exchange, via nominal devaluation, raises the domestic demand for imports which in turn reduces the foreign currency price of exports. The apparent increase in the income terms of trade will encourage domestic production of import substitutes and exportables. Because of the delay in realizing the positive trade effect of a nominal devaluation on real output growth, the one-year lagged relative price of foreign exchange is included to the real output equation

in order to capture this delayed effect. During a civil war the real GDP of an economy is negatively affected via the diversion of resources into the procurement of military equipments. To account for the effect of the war on real activity a war dummy is added to the output equation. The augmented output model becomes

$$\log Y_t = \beta_0 + \beta_1 (\Delta \log M_t - \Delta \log \hat{M}_t) + \beta_2 (\Delta \log M_{t-1} - \Delta \log \hat{M}_{t-1}) + \beta_3 \log (G/R)_t \\ + \beta_4 TIME + \beta_5 \log (XRATE/P)_t + \beta_6 \log (XRATE/P)_{t-1} + \beta_7 WAR + U_{2t} \dots \dots (12)$$

In estimating equation (12) it is expected that budget deficits are assumed to have a positive effect on output growth so that $\beta_3 > 0$. The sign on β_5 depends on whether a change in real price for foreign currency exerts an expansionary or contractionary effect on output. If the effect is contractionary β_5 will be negative, otherwise, it will be positive.

MONEY SUPPLY EQUATION

Following the accounting identity, a country's money supply will be equivalent to the sum of the amount of currency in circulation with the non-banking public and commercial bank deposits. This relationship can be modelled as

$$M^s = C + BD \dots \dots \dots (13)$$

where C denotes currency in circulation with the non-banking public and BD denotes bank deposits.

Banks normally hold a portion of their assets in the form of reserves to ensure that they remain solvent at all times. Assuming banks maintain a fixed amount of reserve ratio,

$$r = \frac{R}{BD}; 0 < r < 1 \dots \dots \dots (14)$$

where R = Reserves held by banks and

r = constant reserve ratio.

In any economy, the currency portion of money supply can either be held as reserve assets or as money in circulation with the public. Assuming that the desired currency deposit ratio is constant, then

$$k = \frac{C}{BD} \dots \dots \dots (15)$$

where k is currency deposit ratio.

From equation 15,

$$kBD = C \dots \dots \dots (16)$$

Replacing 16 for C in equation 13 gives

$$M^s = BD + kBD = (1 + k) BD \dots \dots \dots (17)$$

Combining reserve ratio and currency deposit ratio gives

$$r + k = \frac{R + C}{BD} \dots \dots \dots (18)$$

hence

$$BD = \frac{R + C}{r + k} \dots \dots \dots (19)$$

Replacing equation 19 for BD into equation 17 gives

$$M^s = \left(\frac{1+k}{r+k} \right) R + C \dots \dots \dots (20)$$

where $1+k/r+k$ is the money multiplier denoted as m . The expression in (20) could be written as

$$M^s = m(R+C) \dots \dots \dots (21)$$

In any particular country, the monetary base is regarded as the sum of the currency held with the public for transaction purposes and the cash reserves of the commercial banks. Algebraically, this relationship can be modelled as

$$MB = R + C \dots \dots \dots (22)$$

where MB is base money.

Replacing 22 for $(R + C)$ in 21 gives

$$M_t^s = m_t MB_t \dots \dots \dots (23)$$

From 23 it could be observed that a unit increase in base money will result in a multiple increase in overall supply of money in the economy via m_t .

Following Aghevli *et al* (1978), any increase in base money must be matched by an increase in foreign reserves, increase in the central bank's claims on commercial banks and the private sector and increase in the central bank's claims on the government. Therefore,

$$\Delta MB = \Delta CG + \Delta CCB + \Delta FR \dots \dots \dots (24)$$

where

ΔFR = Increase in foreign reserves

ΔCCB = Increase in central bank's claims on the commercial banks and the private sector

ΔCG = Increase in central bank's claims on the government.

Aggregating ΔFR and ΔCCB into a single variable, say ΔQ , equation 24 becomes

$$\Delta MB_t = \Delta CG_t + \Delta Q_t \dots \dots \dots (25)$$

From 25,

$$MB_t - MB_{t-1} = \Delta CG_t + \Delta Q_t \dots \dots \dots (26)$$

hence

$$MB_t = \Delta CG_t + \Delta Q_t + MB_{t-1} \dots \dots \dots (27)$$

In Sierra Leone the bulk of the Central Bank's claims on the government comprise money created for financing fiscal deficits. Therefore, assuming ΔCG_t reflects fiscal deficits in the economy, equation 27 can be remodelled as

$$MB_t = G_t - R_t + W_t \dots \dots \dots (28)$$

where $W_t = \Delta Q_t + MB_{t-1}$.

Substituting 28 into 23 we get

$$M_t^s = m_t (G_t - R_t + W_t) \dots \dots \dots (29)$$

In order to facilitate the estimation of equation 29, we linearize it by introducing logarithms³⁹. The transformed money supply equation can be written as

³⁹ Aghevli et al (1978) used the same approach in their analysis of the inflationary process in developing countries.

$$\log M_t^s = \delta_0 + \delta_1 \log G_t - \delta_2 \log R_t + \delta_3 \log W_t + \log m_t \dots \dots \dots (30)$$

where δ_0 , δ_1 , δ_2 and δ_3 are expressed as functions of the sample means⁴⁰ of $\log G$, $\log R$ and $\log W$. It is hoped that this model will help to analyse monetary behaviour in the Sierra Leonean economy.

⁴⁰ For details on these functions see appendix.

The complete model is summarized below as

$$\begin{aligned} \log P_t = & \alpha_0 + \alpha_1 \log M_t + \alpha_2 \pi_t^e + \alpha_3 \log XRATE_t + \alpha_4 \log Y_t + \alpha_5 \log M_{t-1} + \alpha_6 \log BMR_t \\ & + \alpha_7 \log XRATE_{t-1} + \alpha_8 \log WP_t + \alpha_9 SLD1 + \alpha_{10} SLD2 + \alpha_{11} WAR + U_{1t} \dots \dots \dots (31) \end{aligned}$$

$$\begin{aligned} \log Y_t = & \beta_0 + \beta_1 (\Delta \log M_t - \Delta \log \hat{M}_t) + \beta_2 (\Delta \log M_{t-1} - \Delta \log \hat{M}_{t-1}) + \beta_3 \log (G/R)_t \\ & + \beta_4 TIME + \beta_5 \log (XRATE/P)_t + \beta_6 \log (XRATE/P)_{t-1} + \beta_7 WAR + U_{2t} \dots \dots \dots (32) \end{aligned}$$

$$\log M_t^s = \delta_0 + \delta_1 \log G_t - \delta_2 \log R_t + \delta_3 \log W_t + \log m_t \dots \dots \dots (33)$$

The endogenous variables in this model include P, Y and M; the remaining variables in the model are treated as exogenous.

4.3 TIME SERIES PROPERTIES OF THE VARIABLES, DIAGNOSTIC TESTS AND EMPIRICAL RESULTS

In section 4.2, we established an analytical framework for econometric analysis of the model in hand. This section concentrates on the time series properties of the variables, diagnostic tests of the model and the analysis of results. These results will be obtained after a thorough screening of the variables to remove a time-dependent mean from them. The rational behind this move is to avoid the spurious regression results normally encountered when a non-stationary variable is run on another non-stationary variable. As a starting point of the screening process, the time series properties of the variables are considered.

4.3.1 TIME SERIES PROPERTIES OF THE VARIABLES

Diagnosing time series data for the presence of unit roots has been a common practice for most economic researchers in recent years. Basically, this entails exploring the univariate time series behaviour of the data. A knowledge on the time series behaviour of the data is of particular importance to making a decision on whether the subsequent estimation should be done on the variables in their levels or differences. As was mentioned earlier, the DF and CRADF (Augmented Dickey-Fuller statistic for the cointegrating residuals) tests provide details on the determination of the time series properties of the variables. The broad objective of these tests is to check whether the steady-state of the series is indeterminate or whether the series gravitates to some steady-state level (Reinhart *et al*, 1991). If the steady-state of the series is indeterminate, then

the effect of any shock to the series will be permanent. However, if the series gravitates to some steady-state level, then the effect of any innovation in the form of shocks to the series will fade away over time.

Following the unit root tests of the variables is the test for unit roots on the residuals (cointegration of the variables) of the long run static regressions. The cointegration test was carried out in order to find out whether there exists a long run relationship between the regressand and the regressors. Engle *et al* (1987) suggested that a feasible estimation method for cointegrating variables is the so called error correction method (ECM) which encompasses variables both in their levels and differences⁴¹. Variables in differences provide information on the short run dynamic adjustment of the model, whereas those in levels indicate the long run equilibrium properties.

4.3.1.1 UNIT ROOT TESTS ON THE VARIABLES

In the present study, unit root tests were applied to both variables in their levels and differences for the sample period 1966 through 1994. This was done in order to know the order of integration⁴² of the variables. The results of the tests are reported in Table 4.1. As is evidenced in Table 4.1, the results show that all the variables in levels, save ~~the~~ $(\Delta \log M_t - \Delta \log \hat{M}_t)$ and π_t^e , are non-stationary over the complete sample period. There

⁴¹ The process of differencing variables normally leads to a loss of vital long-run information. However, this problem is taken care of by using the concept of cointegrating relationship of the variables in which the adjustment error term is incorporated into the model.

⁴² A Variable is integrated of order 1, that is $I(1)$, if it becomes stationary after differencing once. On the other hand, a variable is integrated of order 0, that is $I(0)$, if it is stationary without differencing.

is, however, a slight ambiguity regarding the order of integration of the price and the world price variables in their levels. Whereas the ADF results support the non-stationarity of the variables, the without trend DF result supports their stationarity. Moreover, it is quite obvious from the results in Table 4.1 that, all the variables considered in the study do not seem to have a deterministic trend component.

The variables in their first difference, save world inflation, are stationary according to the DF and ADF results. However, the second difference of the world inflation variable, $\log WP_t$, appear to be stationary. This means that measures of world inflation will appear in second difference, whereas others will appear in first difference and in levels in the short-run dynamic models.



Table 4.1: Time Series Properties of the variables (1966-1994)^a

Variable ^b	DF		ADF(1)		Order of integration ^c
	With Trend	W/out Trend	With Trend	W/out Trend [*]	
$\log P_t$	-1.2309 (-3.5796)	3.6668 (-2.9706)	-1.6381 (-3.5867)	0.6865 (-2.9750)	At least I(1)
$\log WP_t$	-0.0205 (-3.5796)	-3.6460 (-2.9706)	-1.0108 (-3.5867)	-2.1267 (-2.9750)	At least I(1)
$\log Xrate_t$	-1.1238 (-3.5796)	1.2657 (-2.9706)	-1.2019 (-3.5867)	1.0653 (-2.9750)	At least I(1)
$\log Y_t$	-1.8617 (-3.5796)	-0.4726 (-2.9750)	-2.2872 (-3.5876)	-0.6036 (-2.9750)	At least I(1)
$\log M_t$	-2.5490 (-3.5796)	-2.5490 (-2.9750)	-1.8366 (-3.5876)	-1.7886 (-2.9750)	At least I(1)
$(\Delta \log M_t - \Delta \log \hat{M}_t)$	-5.1783 (-3.6027)	-5.2323 (-2.9850)	-3.8840 (-3.96119)	-4.1220 (-2.9907)	I(0)
$\log(G/R)_t$	-3.2550 (-3.5796)	-2.5363 (-2.9706)	-1.6347 (-3.5876)	-1.6729 (-2.9750)	At least I(1)
π^*_t	-4.8323 (-3.6027)	-4.6426 (-2.9850)	-3.3622 (-3.6119)	-4.1220 (-2.9907)	I(0)
$\log BMR_t$	-1.5159 (-3.5796)	-1.1889 (-2.9706)	-1.5292 (-3.5867)	1.0231 (2.9750)	At least I(1)
$\log G_t$	-0.9472 (-3.5796)	1.7421 (-2.9706)	-0.5378 (-3.5867)	1.9750 (-2.9750)	At least I(1)
$\log R_t$	0.4671 (-3.5796)	3.6841 (-2.9706)	-0.3380 (-3.5867)	1.5650 (-2.9750)	At least I(1)
$\log m_t$	-1.2173 (-3.5796)	-1.2527 (-2.9706)	-2.1169 (-3.5867)	-2.1980 (-2.9750)	At least I(1)
$\log W_t$	-1.7100 (-3.5867)	1.0874 (-2.9750)	-1.7530 (-3.5943)	1.8298 (-2.9798)	At least I(1)
$\log(Xrate_t/P_t)$	-3.4934 (-3.5796)	-2.1545 (-2.9706)	-3.0242 (-3.5867)	-1.4132 (-2.9750)	At least I(1)
$\Delta \log P_t$	-6.9368 (-3.5943)	-6.9330 (-2.9750)	-4.8825 (-3.5943)	-4.8240 (-32.9798)	I(0)
$\Delta \log WP_t$	-2.7298 (-3.5867)	-1.9435 (-2.9750)	-3.0666 (-3.5943)	-1.9058 (-2.9798)	At least I(1)
$\Delta^2 \log WP_t$	-5.0903 (-3.5867)	-5.1713 (-2.9798)	-4.9977 (-3.6027)	-5.0548 (-2.9850)	I(0)
$\Delta \log W_t$	-7.1626 (-3.5943)	-6.0134 (-2.9798)	-4.4788 (-3.6027)	-3.3197 (-2.9850)	I(0)
$\Delta \log Xrate_t$	-5.2364 (-3.5867)	-4.4713 (-2.9750)	-3.6725 (-3.5943)	-2.9821 (-2.9798)	I(0)
$\Delta \log Y_t$	-4.5636 (-3.5867)	-4.4755 (-2.9750)	-3.5630 (-3.5943)	-3.4563 (-2.9798)	I(0)
$\Delta \log M_t$	-6.6032 (-3.5867)	-6.6365 (-2.9750)	-5.4958 (-3.5943)	-5.3831 (-2.9798)	I(0)
$\Delta \log G_t$	-6.1946 (-3.5867)	-5.2447 (-2.9750)	-3.9032 (-3.5943)	-3.0811 (-2.9798)	I(0)
$\Delta \log BMR_t$	-5.2998 (-3.5867)	-4.6824 (-2.9750)	-4.2846 (-3.5943)	-3.4485 (-2.9798)	I(0)

Table 4.1: continued

Variable	DF		ADF(1)		Order of Integration
	With Trend	W/out Trend	With Trend	W/out Trend	
$\Delta \log R_t$	-6.3473 (-3.5867)	-6.4804 (-2.9750)	-5.7635 (-3.5943)	-5.8902 (-2.9798)	I(0)
$\Delta \log m_t$	-5.6551 (-3.5867)	-5.8325 (-2.9750)	-4.9479 (-3.5943)	-5.1224 (-2.9798)	I(0)
$\Delta \log(X_{rate}/P_t)$	-8.2191 (-3.5867)	-8.3870 (-2.9750)	-6.3352 (-3.5943)	-6.4581 (-2.9798)	I(0)
$\Delta \log(G/R)_t$	-11.9160 (-3.5867)	-12.1704 (-2.9750)	-5.8468 (-3.5943)	-5.9539 (-2.9798)	I(0)

Notes: * W/out Trend = Without Trend

^a Values in parenthesis represent critical t-ratios at the 5 % level of significance.

^b A variable is stationary if the computed t-ratio is greater than the critical t-ratio (the value in parenthesis). A variable is non-stationary if the computed t-ratio is less than the critical t-ratio.

4.3.1.2 TESTS FOR COINTEGRATION

Having conclusively accepted the non-stationarity of the variables considered in this study, we now proceed to check whether the dependent variable drift too far apart from the explanatory variables or not. At times it is reasonable to expect significant divergence in the behaviour of economic variables, albeit this may not occur in the long run if there is a causal relation among the variables. Infact, if there is a causal relation, it would mean that the variables are cointegrated⁴³ or they move together.

To test for cointegration, we ran each dependent variable preferably on significant non-stationary explanatory variables in each long run static regression. This was done in order to strengthen the CRADF test results. The residuals obtained therein were tested for unit roots. If the residuals have unit roots, then the null hypothesis cannot be rejected, which means that the variables are not cointegrated. On the other hand, if the alternative

⁴³ Two variables, say, X_{1t} and X_{2t} are said to be cointegrated if individually they are integrated of order d but their linear combination $Q_t = X_{1t} -$

λ X_{2t} is integrated of order $d-b$, where $b > 0$.

hypothesis cannot be rejected, then we can safely conclude that the residuals are stationary implying that the variables are cointegrated or there exists a long run relationship between them.

The results of the cointegration tests are reported in Table 4.2. The results of these tests are rather ambiguous with the exception of those reported for the price equation. Whereas the CRDF (Dickey-Fuller statistic for the cointegrating residuals) results support the stationarity of the residuals, the CRADF results indicate that the variables are not cointegrated. Given these ambiguous results, we proceed to estimating the dynamic model by assuming that the variables are cointegrated. If there is no long run relationship between the dependent variable and the regressors, the adjustment coefficient (coefficient of the lagged residuals of the long run regression) in the dynamic regression will carry the wrong sign (in this case positive) and be insignificant.

Table 4.2: Results of unit root test on the OLS and IVS residuals

Equation	Test Statistic*	
	DF	ADF(1)
Price	-5.0082** (-2.093)	-4.9811** (-2.093)
Real Output	-4.6589 (-4.0012)	-3.7473 (-3.9851)
Money Supply	-6.2677 (-5.3542)	-4.8541 (-5.3298)

Notes: * Critical values are in parenthesis.

** The critical values are not available for more than 5 regressors in the DF and ADF Tables. The t-ratios obtained from the regression of the first difference residuals on there lags are therefore reported with their corresponding critical values in parenthesis.

4.3.2 GRANGER CAUSALITY TESTS

In this study the causal relation among output growth, monetary growth and inflation is examined via the use of the direct Granger-causality method. This method

involves assigning a finite parameterization in the causality test equations (see Section 4.2 above) and testing the joint significance of the regression coefficients. A major failing⁴⁴ of this method, however, concerns getting the appropriate lag length for the variables. Using the wrong lag length of the variables may result in serial correlation in the residuals and hence biased the test results. A possible remedy to this problem is for the data series be passed through a causality pre-filter before the causality tests are carried out. This will help to pre-whiten the data series.

Prior to the causality tests, therefore, the Durbin's test⁴⁵ was conducted to check for first-order serial correlation in the OLS residuals of the Granger (1969) test equations. As the results in Table 4.3 indicate, the hypothesis of no serial correlation in the residuals cannot be rejected. The implication of these results is that the output, money and price series should not be passed through a causality pre-filter to pre-whiten them before conducting the causality tests.

The Granger's framework is developed in a multivariate context, but for the purpose of the empirical analysis in this paper attention is directed only to the trivariate case. Table 4.3 provides a summary of the trivariate Granger-causality test results. The evidence from the causality results suggests that growth in money supply (M1) had a significant positive impact on inflation at least for the period covered. Likewise, increase

⁴⁴ A detail investigation into the failings and merits of the Granger-causality method will not be pursued since this is beyond the scope of the study.

⁴⁵ The equation used for the test is given by

$$\epsilon_{it} = \beta_0 + \beta_1 \epsilon_{t-1} + \sum_{j=1}^3 \beta_2 \Delta Q_{t-j} + U_t;$$

($i=1,2,\dots,6$) and ΔQ is the growth in the lagged dependent variable in the Granger test equations. If the coefficient of the lagged residual

ϵ_{t-1} is insignificantly different from 0, the hypothesis of no serial correlation in the residuals cannot be rejected.

in prices granger-causes monetary expansion, albeit marginally.

Apparently, the aforementioned results are inconsistent with one of the hypotheses of the study that a one-way causation exists between money and prices. Perhaps, this feedback relationship may be due to the government's frequent resort to domestic money creation to finance its huge expenditure. One of the policies pursued by the Sierra Leone government since 1968 was the financing of budget deficits and the servicing of the national debt via money creation. This policy would not have been attractive had the government been able to enact and administer sufficient tax programs to acquire the needed revenue for its undertakings. The inflation which arises because of deficit financing induces the government to prompt the monetary authorities to create more money. The monetary expansion which may result because of money creation provokes an increase in aggregate demand which in turn lead to an inflationary spiral in the economy. This self-perpetuating mechanism of the inflation process could lead to disastrous economic consequences (Aghevli *et al*, 1977). In summary, the significant feedback observed between money and prices appear to support the findings of Aghevli and Khan (1978) that monetary expansion causes inflation and inflation causes monetary expansion.

Table 4.3: Results of the Trivariate Direct Granger Causality Tests on Output, Money and Prices for Sierra Leone (1966-1994)

Direction of Causality	F-Statistic	Durbin's Test (t-ratio)	SIGN	CHOW TEST ^d
Money To Prices Prices To Money	F(7,17) 10.80 ^a F(7,17) 2.39 ^c	0.13 -0.15	Positive Positive	0.03 0.33
Output To Prices Prices To Output	F(7,17) 3.43 ^b F(7,17) 0.73	-0.80 -0.16	Negative Negative	1.09 0.28
Output To Money Money To Output	F(7,17) 2.64 ^b F(7,17) 3.24 ^a	-0.15 -0.11	Negative Indeterminate	0.37 2.38

Notes: ^a Significant at 1 %, 5 % and 10 % levels; ^b Significant at the 5 % level.

^c Significant at the 10 % level.

^d The critical F-statistic is F(9,17) 2.69

Another quite interesting feature of the results reported in Table 4.3 concerns the pattern of interaction between output and prices. Whereas movements in output seem to Granger-cause movements in prices, we find that the converse does not hold. This rather interesting result does not seem to support Barro's (1979) findings that price changes result in significant changes in real output in the economy.

With regards to money and output, the Granger tests result indicate that money growth Granger-causes output growth but with no definite pattern. Moreover, as can be seen in table 4.3 output growth exert a significantly negative impact on monetary growth. These findings appear to be inconsistent with Barro's results that monetary growth exert a significant positive impact on output growth.

In order to strengthen our analysis, the stability of the relationship among output, money and prices was examined both quantitatively and qualitatively by means of the Chow (1960), CUSUM (cumulative sum of recursive residuals) and CUSUM SQ (cumulative sum of squares of recursive residuals) tests respectively. The Chow test was performed by breaking the sample into two sub-periods with 1979 serving as the break-point, that is, the year during which the Sierra Leonean economy was caught in a web of severe economic difficulties such as the liquidity crisis, the sharp increase in prices as a result of the second OPEC revolution, weakening terms of trade and many others.

With regards to the CUSUM and CUSUM SQ tests a graph plot was used to check for parameter stability. According to the graphs of both the CUSUM and CUSUM SQ, the null hypothesis of parameter stability cannot be rejected since the plots are within the 5 % critical boundaries. Likewise, the calculated F-statistic for the joint test of parameter

stability for the Chow test shows that the Granger-causality test equations are all stable at the 5 % level of significance.

4.4 REGRESSION RESULTS AND EMPIRICAL ANALYSIS

In this section we analyse the empirical results of the model presented in subsection 4.2.1. For the purpose of estimation, ordinary least squares (OLS) and instrumental variable (IVS) estimation techniques were used. As was mentioned earlier, the Engle-Granger two-step estimation procedure or error correction representation was used. The use of this method in the current study does matter since, according to the cointegration test results, all the three endogenous variables of the model are cointegrated with the regressors. The analysis of the results is carried out as follows.

PRICE EQUATION

A major problem encountered while estimating the price equation was the endogeneity of the real output variable, $\log Y_t$. The real output variable while serving as an explanatory variable in the price equation is itself a dependent variable in the output equation of the model. Neglecting the endogeneity problem in our estimation may lead to simultaneous equation bias and hence cloud inference. To avoid this, the instrumental variable estimation method was used. The exogenous variables in the output and money supply equations are used as instruments. These instruments are highly correlated with real output but uncorrelated with the disturbance term in the price equation. The Instrumental Variable procedure yielded almost the same results when compared with

those obtained by the OLS method.

A general-to-specific approach of modelling was adopted by first including all the explanatory variables in the original price equation in a regression and then purging the resulting regression of insignificant variables. The empirical results for the price equation based on annual observations are reported in Table 4.4.

Table 4.4: Long-Run Static and Dynamic regression results for the Price equation (Instrumental Variable Estimation)^{1/}

Regressor	Dependent Variable is $\log P_t$		Regressor	Dependent Variable is $\Delta \log P_t$
	Long-Run Static Regression ^{2/}	Long-Run Cointegrating Regression ^{2/}		Short-Run (Dynamic) Regression ^{2/}
Constant	2.6910 (2.74)	1.6035 (3.30)	Constant	0.0617 (2.23)
$\log Y_t$	-0.5993* (-3.97)	-0.5214* (-4.42)	$\Delta \log Y_t$	-0.4437* (-4.65)
$\log M_t$	0.6587** (2.50)	0.3605** (2.52)	$\Delta \log M_t$	0.4226* (6.35)
$\log M_{t-1}$	0.5507* (4.48)	0.6139* (5.19)	$\Delta \log M_{t-1}$	0.3669* (4.83)
$\log \text{XRATE}_t$	0.7190** (1.74)	0.4557*** (1.45)	$\Delta \log \text{XRATE}_t$	0.1086*** (1.88)
$\log \text{XRATE}_{t-1}$	0.1764** (2.50)	0.1853** (3.64)	$\Delta \log \text{XRATE}_{t-1}$	0.2056* (7.57)
π_t^*	0.0011 (0.027)		$\Delta^2 \log \text{WP}_t$	0.8256** (3.25)
$\log \text{WP}_t$	0.8782** (2.32)	0.4481*** (2.02)	$\Delta \log \text{BMR}_t$	0.3336** (2.18)
$\log \text{BMR}_t$	0.4664*** (1.94)	0.2448*** (1.49)	ECM_{t-1}	-1.3117 (-5.03)
SLD1	0.6529 (0.68)			
SLD2	-0.3273 (1.001)			
WAR	0.1014 (0.99)			
R^2	0.9997	0.9995	R^2	0.9869
$\bar{R}^2$	0.9992	0.9994	$\bar{R}^2$	0.9758
D.W Statistic	2.0009	2.0975	D.W Statistic	2.1814
F-Statistic(11,12)	3223.8	4861.3	F-Statistic (10,14)	121.4
CHOW Test			CHOW Test	
F-Statistic (13,25)	0.0063	0.14	F-Statistic (10,22)	0.91
Serial Correlation Test			Serial Correlation Test	
$\chi^2(1)$	0.1120	1.0703	$\chi^2(1)$	3.4352
Functional Form Test			Functional Form	
$\chi^2(1)$	0.7342	1.6243	$\chi^2(1)$	4.4351
Normality Test			Normality Test	
$\chi^2(2)$	0.4442	0.7260	$\chi^2(2)$	0.8873
Heteroscedasticity Test			Heteroscedasticity Test	
$\chi^2(1)$	3.5666	0.4911	$\chi^2(1)$	1.3825

Notes:^{1/} The interactive Econometric Package MICROFIT Version 3.0 was used to carry out the estimation.

^{2/} Values in parenthesis represent *t*-ratios.

* Significant at the 1 % level.

** Significant at the 5 % level.

*** Significant at the 10 % level.

DW is Durbin-Watson Statistic.

As the results in Table 4.4 attest, all the variable coefficients, except the slope dummy for parallel market exchange rate, have the hypothesized signs. The autonomous

terms for both the long-run static and dynamic regressions are significantly different from zero at the 5 % level. This implies that, on average, the natural rate of inflation in Sierra Leone is non-zero both in the long-run and short-run. The long-run elasticities of inflation with respect to output growth are approximately -0.59 and -0.52 respectively. The implication of this result is that a 10 % increase in output growth in the economy will, *ceteris paribus*, result in a 5.9 % and 5.2 % decrease in the rate of inflation in the long-run. However, the short-run impact of output growth on inflation is slightly smaller relative to the long-run elasticities. In the short-run, if output grows at 10 %, inflation rate will decline by about 4.4 %. With regards to the significance of the real output variable, the results indicate that output growth is significant in all the long-run static regressions and the dynamic regression at the 1 % level of significance. One quite interesting feature of the real output coefficient is its robustness despite the method of estimation. The coefficient of real output ($\log Y_t$) in the OLS method, though not reported here for the sake of brevity, was more or less the same as the coefficient of $\log Y_t$ in the Instrumental Variable estimation method.

The estimated elasticities of price with respect to changes in money supply ($M1$) are positive and significant in all the regressions (long-run as well as dynamic) at the 5 % level of significance. An increase in money growth by 10 % will provoke a 6.6 % or 3.6 % increase in prices in the long-run, and 4.2 % in the short-run. The lagged money supply coefficient is positive and significant in the long-run static as well as the dynamic regressions. The significance of the lagged money supply variable probably reflects the unlimited delayed effect with which the process of money stock-price level adjustment occur. As is evidenced in Table 4.4, our findings do not lend support to the monetarists view that a 1 % increase in money growth result in an equi-proportionate increase in

prices. These results appear to be in firm agreement with those of London(1987), Sowa *et al* (1993) and Kallon (1993).

The coefficient of expected rate of inflation is very low (0.0011) reflecting the slow revision of inflation expectations in the economy. Additionally, expected inflation does not seem to explain price formation in Sierra Leone. This somewhat surprising result may be due to the inability of the trade union and other pressure groups to provide a propagating mechanism through which expectations can be translated to future inflation.

The degree of responsiveness of domestic prices to nominal devaluations is positive in both the long-run and short-run. A 10 % devaluation of the domestic currency is likely to raise the rate of inflation by approximately 7.2 % or 4.6 % in the long-run. In the short-run, however, the impact of a nominal devaluation is smaller since a 10 % devaluation of the currency only results in a 1.1 % increase in the rate of inflation. These results are expected since frequent and large foreign exchange devaluations in Sierra Leone have led to increased prices of goods and services. Lagged values of official exchange rate, though significant, seems to exert little pressure on prices. According to the reported results, a 10 % devaluation this year will lead to a slight increase (approximately 2 %) in prices next year.



Although the official exchange rate and its 1-year lag were significant, the slope dummy included to capture the effect of the massive devaluation on prices since 1982 was not significant but with the expected positive sign. Perhaps, this is due to the fact that the massive devaluations which began in 1982 did not influence price formation in the country at least for the period under consideration. Clearly our findings lend support to those of

Sowa *et al* (1993) for the Ghanaian economy.

The regression result for the coefficient of black market exchange rate indicate a significant positive relationship between inflation rate and parallel market exchange rate. This result is expected since the volume of transactions that occur in the parallel market relative to the official market is high. However, the slope dummy for parallel market exchange rate is not only insignificant but carries the wrong sign. This is probably attributed to the fact that the decline in black market premia arising from exchange rate liberalization lowered the motivation of individuals to actively participate in black market activities. The more individuals participate in black market activities the higher the cost of acquiring foreign exchange via official channels because of scarcity. The high cost of acquiring foreign exchange will obviously raise the price of imports and hence general prices of goods and services.

Sierra Leone, like any other small and highly open economy, cannot dissociate itself from developments in the world economy. In particular, the Sierra Leonean economy is not insulated from external shocks such as a sudden increase in foreign price or an increase in crude oil prices. As can be seen from the results presented in Table 4.4, world inflation appear to exert more pressure on domestic prices than the official exchange rate. An increase in world price by 10 %, assuming all things remain the same, will push domestic prices up by 8.9 % or 4.5 % in the long-run and by 8.3 % in the short-run respectively. These findings appear to be consistent with the small country assumption that a small and highly open economy is well integrated with the world economy. A slight disturbance to the big economies will, all else equal, result in a slight disturbance in small open economies.

A war dummy representing the impact of the rebel war on aggregate demand and prices was found to be insignificant and positively related to the rate of inflation. The insignificance of this dummy variable is not surprising since the domestic shock to the economy due to rebel activities occurred between 1991 and 1996, a period short enough to have any significant impact on domestic prices. Based on the general-to-specific approach to estimation, this variable was dropped from the long-run cointegrating regression.

The coefficient of the ECM term, ECM_{t-1} , in the dynamic regression is negative and significant. This shows that the error correction specification is appropriate. The reported results for the ECM coefficient(-0.737) suggest that the speed of adjustment is approximately 74 % from actual inflation in the previous year to equilibrium inflation. This reflects an almost complete adjustment.

According to the reported results of the coefficient of multiple determination adjusted for degrees of freedom($\bar{R}^2$) and the diagnostic tests, the specification of the long-run and short-run models was proper. The R^2 and $\bar{R}^2$ values are very reasonable indicating the proper fit of the models. The F-Statistic shows that all the explanatory variables are jointly significant at the 5 % level in both the long-run and short-run models. The DW-Statistic and LM (Lagrange Multiplier) test for serial correlation do not provide any indication for the presence of serious autocorrelation in the residuals of the price equation. This absence of a serious autocorrelation problem suggests that no important variable has been omitted from the price equation. RAMSEY'S RESET test results

provide no indication that the functional form of the price equation is inadequate. This implies that the log-linear specification of the price equation is appropriate. Tests on skewness and kurtosis of residuals reveal that the residuals of the price equation are normally distributed reflecting the absence of outliers.

Finally, the results of the heteroscedasticity tests on the residuals do not show any strong case for heteroscedastic disturbances. This, indeed, is not surprising given the log-linear form of the price equation.

REAL OUTPUT EQUATION

Prior to the estimation of the real output equation, the money surprise values were obtained. We have already presented the specification of the anticipated money growth model in sub-section 4.2.2. The results of the specified model based on annual observations can be represented as

$$\Delta \log \hat{M}_t = 0.0825 + 0.54^* \Delta \log M_{t-1} + 0.28^* (\log RG_t - \log NG_t) + 0.15 \Delta \log M_{t-2}$$

(1.3965) (2.7140) (2.6845) (0.7709)

$$R^2 = 0.52 \quad \bar{R}^2 = 0.43 \quad \text{DW-Statistic} = 2.18$$

where t-ratios are in parenthesis, DW-Statistic denotes Durbin-Watson statistic and an asterisk against a coefficient denotes significance at the 5 % level.

The above results were obtained after correcting for serial correlation using the Cochrane-Orcutt iterative estimation procedure. The interactive econometric package, **MICROFIT286** Version 3.0, provides facilities for this estimation procedure. The reported results for anticipated money growth equation suggest that the lagged money growth values exert a positive impact on expected money growth. The sum of the

coefficients of $\Delta \log M_{t-1}$ and $\Delta \log M_{t-2}$ (0.69) is less than unity implying that money growth in Sierra Leone follows a stationary process. Intuitively, the effect of any innovation (in the form of shocks) to the money growth process will only be temporary and not permanent.

The fitted values of the above equation were subtracted from the actual money growth values to obtain the money surprise values (see appendix). Using these values in the estimation of the real output equation yields the results reported in Table 4.5.

Table 4.5: Long-run Static and Dynamic Regression Results for the Real Output Equation (OLS)^a

Regressor	Dependent Variable is $\log Y_t$		Regressor	Dependent Variable is $\Delta \log Y_t$	
	Long-Run Static Regression	Long-Run Cointegrating Regression		Short-Run (Dynamic) Model	Adjusted White's Heteroscedastic Consistent S.E.'s Estimation
Constant	1.1468 (1.9611)	4.9135 (9.37)	Constant	-0.0284 (-1.47)	-0.0284 (-1.62)
$(\Delta \log M_t - \Delta \log \hat{M}_t)$	-0.0521 (-0.2907)		$(\Delta \log M_{t-1} - \Delta \log \hat{M}_t)$	-0.3248** (-2.64)	-0.3248*** (-1.94)
$(\Delta \log M_{t-1} - \Delta \log \hat{M}_{t-1})$	-0.3522** (-2.69)	-0.4980* (-4.24)	$\Delta (\log \text{XRATE}/P)_t$	-0.0698*** (-1.61)	-0.0698 (-1.29)
$\log(\text{XRATE}/P)_t$	0.0230 (0.4611)		$\Delta \log(G/R)_t$	0.0155* (2.76)	0.0155*** (1.77)
$\log(\text{XRATE}/P)_{t-1}$	0.3213*** (1.81)	0.0365*** (1.68)	ECM^{t-1}	-0.1713** (-2.28)	-0.1713** (-2.48)
$\log(G/R)_t$	0.0533*** (1.56)	1.6105** (2.61)			
TIME	0.0212 (1.04)				
WAR	-0.2352 (-0.4090)				
R^2	0.9381	0.9484	R^2	0.7465	
$\bar{R}^2$	0.9126	0.9349	$\bar{R}^2$	0.6354	
DW Statistic	1.42	2.0416	DW Statistic	1.2177	
F-Statistic (7,22)	36.8	69.88	F-Statistic	14.63	
CHOW Test			CHOW Test		
F-Statistic (9,24)	0.35	0.28	F-Statistic (6,20)	2.09	
Serial Correlation Test			Serial Correlation Test		
$\chi^2(1)$	2.3989	0.0518	$\chi^2(1)$	3.4011	
F-Form (1,15)	1.5921	0.0373	F-Form (1,18)	2.9720	
Functional Form Test			Functional Form Test		
$\chi^2(1)$	1.9314	0.7169	$\chi^2(1)$	0.7048	
F-Form (1,15)	1.2558	0.5314	F-Form (1,18)	0.5446	
Normality Test			Normality Test		
$\chi^2(1)$	0.2746	1.0205	$\chi^2(2)$	0.6377	
Heteroscedasticity Test			Heteroscedasticity Test		
$\chi^2(1)$	0.0796	1.5550	$\chi^2(1)$	6.7050	
F-Form (1,23)	0.0735	1.5255	F-Form (1,22)	8.5291	

Notes: ^a Values in parenthesis denote t-ratios.

* Significant at the 1 % level.

** Significant at the 5 % level.

*** Significant at the 10 % level.

The results in table 4.5 suggest that the effect of unanticipated money growth on

output is contractionary and not expansionary as Barro (1978) suggested. The unanticipated money growth elasticity of real output is -0.05 implying that an increase in unanticipated money growth by 10 % will, in the long-run, reduce output growth by 0.5 % in the current period. Additionally, the money surprise variable is insignificant at even the 20 % level. Consequently, this variable is dropped from the long-run cointegrating regression. However, the coefficient of the lagged value of unanticipated money growth is significant but with the unexpected sign. The lagged money surprise elasticity of output (-0.35) indicates that a rise in an unexpected money growth by 10 % this year will reduce output growth by 3.5 % the following year. In the short-run, the impact is weaker in the sense that unanticipated money growth results in a smaller change in output relative to the long-run period. The sum of the two money surprise coefficients (-0.4043) reveals that a persistent sudden monetary shock in the economy by 10 % per year over a 2-year period would reduce output growth by 4 %. These results are indeed not encouraging considering our earlier discussions about the relationship between unexpected money growth and growth in output. In short, our results failed to provide support to the neoclassical synthesis that a sudden increase in money results in wide fluctuations (a rise) in output growth. The contractionary effect of unexpected money growth on output in Sierra Leone may be due to the financial constraint the country is facing, especially after the hosting of the OAU conference in 1980.

The long-run elasticities of output with respect to changes in the price for foreign exchange and its 1-year lag are 0.0230 and 0.3213 implying that devaluation of the exchange rate has an expansionary effect on output growth in the economy. However, the current value of the price for foreign exchange is not significant at even the 10 % level. In effect, this variable was omitted from the long-run cointegrating regression. In the

cointegrating regression, lagged values of the price for foreign exchange again turned out to exert a positive impact on output growth in the economy. In the short-run, however, devaluation of the currency does not lead to output expansion but a contraction in output growth. This result seems to be consistent with the structuralist contention that devaluation is contractionary in the short-run. The main thrust of their argument was that the production structure of the economy might be inflexible in the short-run implying that an increase in the relative price of tradables due to devaluation would not bring about a rapid increase in the production of tradables. This is so because there may be some important lags in an economy's ability to increase exports which means that the production capacity in the tradable sector may approximate its upper limit, making it difficult to expand output in the short-run.

According to the results in Table 4.5, the coefficient of the ratio of government expenditure to fiscal revenue is significantly positive in both the long-run and short-run. The trend rate of growth in real output in the economy is approximately 2.1 %, while Barro (1978) obtains a similar value for the United States using annual data from 1946 to 1976.

The war dummy which captures the impact of rebel activities on real output was found to be insignificant and negatively related to real output. The negative coefficient of the war dummy implies that rebel activities have contributed, though insignificantly in stifling real economic activities in Sierra Leone.

The coefficient of the lagged error term in the short-run (dynamic) regression is significantly negative at the conventional level of significance (5 %). The coefficient of

-0.1713 indicates that the speed of adjustment is about 17 % from actual output last year to equilibrium output reflecting the slow adjustment of output growth in the economy.

Finally, the diagnostic and coefficients of determination results reveal that the specification and fit of the output model are appropriate. The test of joint significance of the parameters suggest that all the coefficients of the output model are jointly significant. The DW-Statistic and LM tests do not show any serious case of serial correlation in the residuals of all the regressions implying that no important variable is omitted from the output equation. However, results of the heteroscedasticity tests provide a case for the presence of heteroscedastic disturbances in the short-run model. This problem was solved by applying WHITE'S Heteroscedastic Consistent Estimation Technique. Though the significance of the variables changed slightly, the coefficients did not change after the application of WHITE'S estimation procedure. The normality tests posit that the residuals of the regressions are normally distributed implying the absence of outliers

MONEY SUPPLY EQUATION

In this equation all the variables, save government expenditure, have the *a priori* signs and significant at different levels of significance (see Table 4.6). The coefficient of the money multiplier is approximately unity and significant at the 5 % level. This result corroborates the findings of Aghevli *et al* (1978) for some southern cone countries. Government expenditure elasticities of money supply are 0.0828 and 0.0742 in the long-run and short-run respectively, implying that money creation in the economy increases with increase in government expenditures. A 10 % increase in government expenditures will lead to an increase in money supply by 0.8 % in the long-run and 0.7 % in the short-run. The long-run elasticity of money with respect to changes in $\log W_t$ is positive and

significant. In the short-run, however, $\log W_t$ turned out to be more significant. The long-run revenue elasticity of money supply is -0.4050 implying that money supply increases with cuts in government revenue. This result is expected since in Sierra Leone money creation has been the common practice of the government to finance its expenditures whenever there are lags in revenue collection. The short-run revenue elasticity of money supply is smaller relative to the long-run elasticity. An increase in government revenue by 10 % will lead to a drop in money supply by 3.3 % in the short-run. The short-run adjustment coefficient to disequilibrium (the ECM term) is -1.1406 indicating a speed of adjustment of approximately 114 %.

The diagnostic tests results as well as the coefficient of determination are quite reasonable suggesting that the model is appropriate. According to the $\bar{R}^2$ value adjusted for degrees of freedom, 99.2 % of the variations in money supply are attributable to variations in the regressors in the long-run. In the short-run this statistic is smaller since only 72.9 % of the variations in money supply are explained by the regressors. The model results do not show any serious problem of serial correlation, heteroscedastic disturbances, model misspecification and normality of the residuals.

Table 4.6 : Long-run Static and Dynamic Regression Results for the Money Supply Equation(OLS)^{1/}

Regressor	Dependent Variable $\log M_t$	Regressor	Dependent Variable is $\Delta \log M_t$
	Long-Run Static Regression		Dynamic Regression
Constant	0.2491 (2.97)	Constant	0.0658 (0.13)
$\log W_t$	0.2156** (2.79)	$\Delta \log W_t$	0.2468* (3.21)
$\log M_t$	0.98** (2.92)	$\Delta \log M_t$	0.6886*** (1.74)
$\log G_t$	0.0828** (2.55)	$\Delta \log G_t$	0.0742 (0.8089)
$\log R_t$	-0.4050* (-3.83)	$\Delta \log R_t$	-0.3272*** (-1.96)
		ECM_{t-1}	-1.1406* (-3.43)
R^2	0.9929	R^2	0.7288
$\overline{R}^2$	0.9917	$\overline{R}^2$	0.6474
DW Statistic F-Statistic (4,23)	2.1451 802.87	DW Statistic F-Statistic (5,20)	2.1182 8.95
CHOW TEST F-Statistic (6,23)	0.13	CHOW TEST F-Statistic (6,26)	1.26
Serial Correlation Test χ^2 (1) F-Form (1,22)	1.0270 0.7996	Serial Correlation χ^2 (1) F-Form (1,19)	1.6508 1.2373
Normality Test χ^2 (1)	0.0652	Normality Test χ^2 (2)	0.2237
Functional Form Test χ^2 (1) F-Form (1,22)	3.7621 3.2595	Functional Form Test χ^2 (1) F-Form (1,19)	2.6629 2.0789
Heteroscedasticity Test χ^2 (1) F-Form (1,27)	0.0023 0.0021	Heteroscedasticity Test χ^2 (1) F-Form (1,25)	0.1426 0.1327

Notes:^{1/} Values in parenthesis denote t-ratios

* Significant at the 1 % level.

** Significant at the 5 % level.

*** Significant at the 10 % level.

4.4.1 THE NATURE OF THE INFLATION SERIES IN SIERRA LEONE

As was mentioned earlier, the DF and ADF tests were applied in order to examine the nature of the inflation series in Sierra Leone. These tests were carried out by estimating sequentially the first difference of the inflation series ($\Delta^2 \log P_t$) over three sub-

periods beginning with 1966 and ending in 1987 when inflation settled in triple digits. From 1966, the sample was extended to 1991 when the first major domestic shock (civil war) hit the economy and resulted in a skyrocketing of prices of essential goods and services. Finally, the sample was extended to 1994 (the end of the sample period considered in this study). Table 4.6 presents the results of the sequential estimation process.

Table 4.7: Dickey-Fuller and Augmented Dickey-Fuller Tests Results for the Nature of the Inflation Series in Sierra Leone (1966-1994)*

Regressor	Dependent Variable is $\Delta^2 \log P_t$		
	SAMPLE PERIOD		
	1966-1987	1966-1991	1966-1994
Constant	-7.3087 (-0.5514)	-1.9865 (-2.6086)	-0.3572 (-0.5410)
$\Delta \log P_{t-1}$	0.5184 (1.4612)	-0.9921 (-3.2219)	-0.7466 (-2.4391)
$\Delta^2 \log P_{t-1}$ **	-0.8926 (-3.4870)	-0.0065 (-0.0293)	0.0120 (0.0534)
TIME	0.5804 (0.3920)	4.9391 (3.0429)	2.4408 (4.6287)

Notes: * The calculated t-ratios are in parenthesis.

** The t-ratios of the 1-year lagged inflation rate is compared against the Dickey-Fuller t-ratios and that of the 1-year lagged difference against the values in the student t-distribution.

As can be seen from the tabulated results, the DF and ADF tests suggest that between 1966 and 1987, the inflation series seems to follow a non-stationary process rather than a stationary process. Thereafter, the inflation series turned out to be stationary. The graphs of the recursive estimates of the values of lagged inflation provide a summary to the foregoing argument (see appendix). The coefficient of the 1-year lagged difference inflation rate is significant between 1966 and 1987. This indicates that the inflation series follow a random walk during this period. However, when the sample is extended beyond 1987, the different-stationarity of the inflation series was not supported.

From the plot of the recursive estimates of lagged inflation coefficient, it was quite evident that this coefficient kept increasing at first and later, especially between 1990 and 1994, assumed a declining trend. The declining trend of the lagged inflation coefficient between 1990 and 1994 may be attributed to the contractionary monetary policy the government was pursuing during this period. The trend coefficient is not significant in the first sub-sample (1966-1987) suggesting that inflation series is not trend-stationary during this period. This result does not seem to support Rocha's (1991) findings for the former Yugoslavia economy that inflation series follows a trend-stationary process. However, in the second and third sub-periods the DF and ADF results support the trend-stationarity of the inflation series.

4.4.2 TESTS FOR MODEL STABILITY

In order to strengthen the analysis of the model results, tests of parameter constancy⁴⁶ were carried out. This was done by applying quantitatively Chow (1960) and some qualitative (CUSUM and CUSUM SQ) tests⁴⁷. The Chow test was carried out by dividing the pooled sample into two sub-samples using 1979 (a rather difficult year for the economy of Sierra Leone) as the break point. The F-test was then undertaken using the residual sums of squares of the two separate regressions and those of the pooled regression. The CUSUM and CUSUM SQ tests were conducted after dropping the dummy variables from the price and output equations. This was done in order to maintain the singularity of the explanatory variables coefficient-matrix.

⁴⁶ *Checking for parameter constancy, especially in long time series data is a very important aspect of proper model specification.*

⁴⁷ *See appendix for details on these tests.*

From the results presented in Tables 4.4 through 4.6, the null hypothesis of parameter constancy (stability) cannot be rejected at the 5 % level according to Chow. Likewise, the CUSUM and CUSUM SQ tests results show that there is no systematic or sudden changes in the coefficients of the regressors suggesting that the model of the current study is stable. The graph plots of the CUSUM and CUSUM SQ were within the critical boundaries at the 5 % level significance.

CHAPTER V

CONCLUSION, POLICY PRESCRIPTIONS AND EXTENSIONS

In this study we have been able, via a battery of econometric tests, to examine the causal relationship among output growth, money growth and inflation. In addition to this, We have been able to explore the behaviour of each of these macroeconomic variables with particular reference to the Sierra Leonean economy. By modifying the models developed by Sowa *et al* (1993) and Barro (1981), a time series model was developed for Sierra Leone to explore the behaviour of these variables and to investigate their relationship. The impact of the rebel war on economic activities was also examined analytically. From the findings of this study, one can argue that civil wars lead to deceleration in output or economic growth. By comparing the growth in output before and during a civil war for selected war-torn economies in Sub-Saharan Africa we were able to arrive at results which support this argument. Output growth declined rapidly in countries like Uganda, Ethiopia, Mozambique, Sierra Leone, Zimbabwe, to name but a few, during their civil wars.

Furthermore, the study attempts to identify the features of the Sierra Leonean economy with reference to the overall economic performance and policies adopted in the post-independence era. From the findings of the study, it is quite apparent that Sierra Leone is a country endowed with rich natural resources but mismanagement prevents it from realizing much from these resources. Inflation, balance of payment deficits, fiscal deficits, poverty, to name but a few, continue to threaten the living standards of the people.

Based on the diagnostic tests, it was evident that all the variables, except unanticipated money growth and expected inflation, have unit roots. The results of the cointegration tests show that price, output and money supply are cointegrated with their respective explanatory variables. Over the period of study, Granger tests results confirmed that there exist a positive feedback between money growth and inflation, a one-way relationship between output growth and inflation and a negative feedback between growth in money supply and output growth. Tests of parameter constancy show that all the equations of the model are stable at the 5 % level of significance.

With regards to the econometric results, the R^2 and $\bar{R}^2$ values reveal that the model fit the data properly. Most of the explanatory variables appear to be significant with the *a priori* signs. The results of the output equation failed to support Barro's (1978) argument that expansion in unanticipated money growth results in output expansion. As was mentioned earlier, this may be due to the financial constraint the economy is facing. The coefficient of the price for foreign exchange suggest that devaluation has an expansionary effect on output growth in the long-run. In the short-run, however, output contracts as the domestic currency is devalued. The domestic arising from the rebel war, though insignificant, contributed to the stifling of output expansion. The impact of the rebel war was, infact, more pronounced in the export sector since the volume of exports fell substantially during intense rebel activities.

The empirical results for the price equation suggest that output growth exerts a dampening effect on inflation, while monetary expansion and exchange rate devaluation lead to inflation in the economy. The influence of external factors on domestic inflation

is also quite evident from the significance of the world inflation variable. However, the impact of the rebel war on prices was not significant, albeit it led to increase in prices of goods and services. In addition, the effectiveness of the parallel market is apparent since increased black market activities significantly increase the rate of inflation.

In the money equation, all the explanatory variables have the correct signs and are significant. However, government expenditure is not significant in the short-run. The short-run adjustment coefficient (coefficient of the lagged error term) has the right sign and significant in all the equations of the model indicating that the error correction specification is valid.

The current study is different from other studies already undertaken in Sierra Leone because of three main reasons. First, the short-run dynamics of inflation, output and nominal money was investigated, via the Engle-Granger two-step estimation procedure. Second, tests for the structural stability of the causality tests equations and the three equations of the model were presented. Third, Dickey-Fuller and Augmented Dickey-Fuller tests were carried out to determine whether Sierra Leonean inflation series follows a trend-stationary process or difference-stationary (random walk) process. The results posit that, on average, inflation follows a trend-stationary process implying that an increase in inflation rates due to shocks will be temporary.

From the findings of this study, the following policies are recommended. First, the results show that the financing of government's huge budget deficits, via money creation, by the monetary authorities is one of the main causes of inflation in Sierra Leone. Money creation arises from the inability of the government to get the required revenue to meet

its expenditures. Anti-inflation policies should therefore include measures aimed at restructuring the revenue system so as to remove the lags in revenue collection. A feasible approach to this restructuring exercise is the strengthening of the revenue authority by providing increased incentives for those officials in key areas of revenue collection. This will help to minimize corruption, improve efficiency in tax collection and hence increase government revenue.

A second policy consideration in the present study is the control of money supply via more stringent fiscal and monetary discipline. Stringent monetary and fiscal policies, especially during a period of devaluation, lower the rate of inflation by reducing excess demand for imports and foreign exchange in the economy.

Since external shocks, such as increase in world price of goods have an unfavourable effect on domestic prices and balance of payments, policies should be directed towards increased export volumes and government expenditure cuts. This policy stance may help to sustain domestic demand.

The rebel war in Sierra Leone, according to the findings of the study, has had a negative impact on output growth via the reduction in the country's capital stock. The reduction in capital stock arises from the fear of insecurity which resulted in a massive outflow of capital. Policies should therefore be directed towards enhancing output growth as well as the repatriation of capital. This can be achieved by taking measures that will help to reduce insecurity in the country. Such policy measures should include the demobilisation and encampment of rebel combatants and the formation of a broad-based government to incorporate the interests of the rebels. This will help to create an

atmosphere of security. An atmosphere of peace, it is believed, encourages investment activities and the inflow of capital leading to an expansion in the country's capital stock and output.

Finally, although the empirical analysis of the current study help to shed considerable light to a clear understanding of the causal patterns among output growth, money growth and inflation in the Sierra Leonean economy, there remain some areas that deserve some further attention. First, an empirical analysis regarding the joint movement of the nominal stock of money, the price level and real output was not considered in this study. Such an empirical analysis will help to provide some insights into the relative advantages of competing macroeconomic theories. The empirical analysis will require a specification search on a list of many variables from which a compact system showing the relationship among the variables is obtained.

Second, the analysis of the relative strength of the explanatory variables in creating impact on the dependent variables may also be an important area to explore in future research. This can be done by computing and ranking the β -coefficients of the explanatory variables according to strength.

Third, although the sample size and the explanatory variables considered in this study can be regarded as representative, inclusion of variables like import price indices in the price equation and using a larger sample size than the one considered here may provide more reliable results regarding the behaviour of output, money and prices in the economy.

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APPENDICES

Appendix 1

Parameters of The Money Supply Equation

In the money supply equation of the model formulated for Sierra Leone in this study, the coefficients of the explanatory variables expressed as functions¹ of the sample means of the explanatory variables themselves can be represented as

$$\delta_0 = \log \left(\exp^{\log \bar{G}} - \exp^{\log \bar{R}} + \exp^{\log \bar{W}} \right) -$$

$$\frac{1}{(\exp^{\log \bar{G}} - \exp^{\log \bar{R}} + \exp^{\log \bar{W}}) (\exp^{\log \bar{G}} \times \log \bar{G} - \log \bar{R} \exp^{\log \bar{R}} + \log \bar{W} \exp^{\log \bar{W}})}$$

$$\delta_1 = \frac{\exp^{\log \bar{G}}}{(\exp^{\log \bar{G}} - \exp^{\log \bar{R}} + \exp^{\log \bar{W}})}$$

$$\delta_2 = \frac{\exp^{\log \bar{R}}}{(\exp^{\log \bar{G}} - \exp^{\log \bar{R}} + \exp^{\log \bar{W}})}$$

$$\delta_3 = \frac{\exp^{\log \bar{W}}}{(\exp^{\log \bar{G}} - \exp^{\log \bar{R}} + \exp^{\log \bar{W}})}$$

where a bar over a variable denotes the sample mean of that variable and all the variables carry the usual meaning.

¹ For details on these see Aghevli et al (1978).

Appendix 2

Actual Money Growth, Anticipated Money Growth and Unanticipated Money Growth in Sierra Leone (1966-1994).

Year	Actual Money Growth ($\Delta \log M_t$)	Anticipated Money Growth ($\Delta \log \hat{M}_t$)	Unanticipated Money Growth ($\Delta \log M_t - \Delta \log \hat{M}_t$)
1966	-	-	-
1967	0	-	-
1968	0.20479	-	-
1969	0.16990	0.19280	-0.022905
1970	-0.098440	0.16663	-0.26507
1971	0.098440	0.051566	0.046875
1972	0.19783	0.10210	0.095725
1973	0.20764	0.19472	0.012924
1974	0.13613	0.17807	-0.041939
1975	0.087011	0.16063	-0.073623
1976	0.18232	0.19547	-0.013147
1977	0.15415	0.17927	-0.025124
1978	0.24201	0.14480	0.097210
1979	0.17920	0.22939	-0.050191
1980	0.17841	0.22395	-0.045547
1981	-0.0065574	0.23073	-0.23728
1982	0.50951	0.15537	0.35414
1983	0.34993	0.42064	-0.070707
1984	0.30289	0.42697	-0.12408
1985	0.61619	0.35673	0.25945
1986	0.72163	0.50958	0.21205
1987	0.44464	0.42170	0.022943
1988	0.47613	0.50647	-0.033313
1989	0.62638	0.41084	0.21554
1990	0.49652	0.60432	-0.10780
1991	0.56558	0.33978	0.22580
1992	0.22384	0.43576	-0.21191
1993	0.11047	0.26190	-0.15143
1994	0.094887	0.16348	-0.068592

Source: IMF's International Financial Statistics Yearbook November, 1995.

Appendix 3

Tests of Parameter Constancy

The tests of parameter stability employed in this paper include Chow (1960), CUSUM and CUSUM SQ tests. The Chow test begins by dividing the pooled sample into sub-samples and computing the restricted and unrestricted residual sums of squares. The F-test is applied on the computed residual sums of squares. The unrestricted residual sums of squares combines the residuals sums of squares of the regressions for the different sub-samples, while the restricted residual sums of squares represents the sums of squares of the regression for the pooled sample. The F-Statistic used in this study to conduct the Chow test can be written as

$$F = \frac{(RRSS - URSS) / K + 1}{URSS / T_1 + T_2 - 2K - 2}$$

where K = number of parameters in the pooled regression

T_1 = number of observations for the first sub-sample

T_2 = number of observations for the second sub-sample

RRSS = Residual sums of squares of the pooled regression

URSS = Sum of residual sums of squares of the first and second regressions of the sub-samples.

The critical F-Statistic with degrees of freedom is given as F (K+1, $T_1 + T_2 - 2K - 2$). The null hypothesis of parameter constancy is rejected if the computed F-Statistic is greater than the critical value of F with (K+1, $T_1 + T_2 - 2K - 2$) degrees of freedom.

The CUSUM statistic for the CUSUM test is represented as

$$S_r = \frac{\sum_{j=k+1}^r Q_j}{\hat{\sigma}_{OLS}}$$

where $r = k+1, k+2, k+3, \dots, T$ and Q_j 's are normalized one-period-ahead forecast

residuals and $\hat{\sigma}_{OLS}$ is the standard error of the regression. The CUSUM test uses a graphical method and involves plotting S_r and a pair of straight lines for values of $r = k+1, k+2, k+3, \dots, T$. The lines are drawn by assuming a cut-off point of 5 %. The statistic S_r has a β -distribution under the null hypothesis of parameter constancy. This hypothesis is rejected if S_r 's breaches the 5 % line parallel to the mean value of S_r .

The formula for the CUSUM SQ test is akin to that of CUSUM test, except that the normalized one-period-ahead forecast residuals Q_j is squared. The formula is given as

$$S_r^2 = \frac{\sum_{j=k+1}^r Q_j^2}{\sum_{j=k+1}^T Q_j^2}$$

where r , T and Q_j carry the usual meaning.

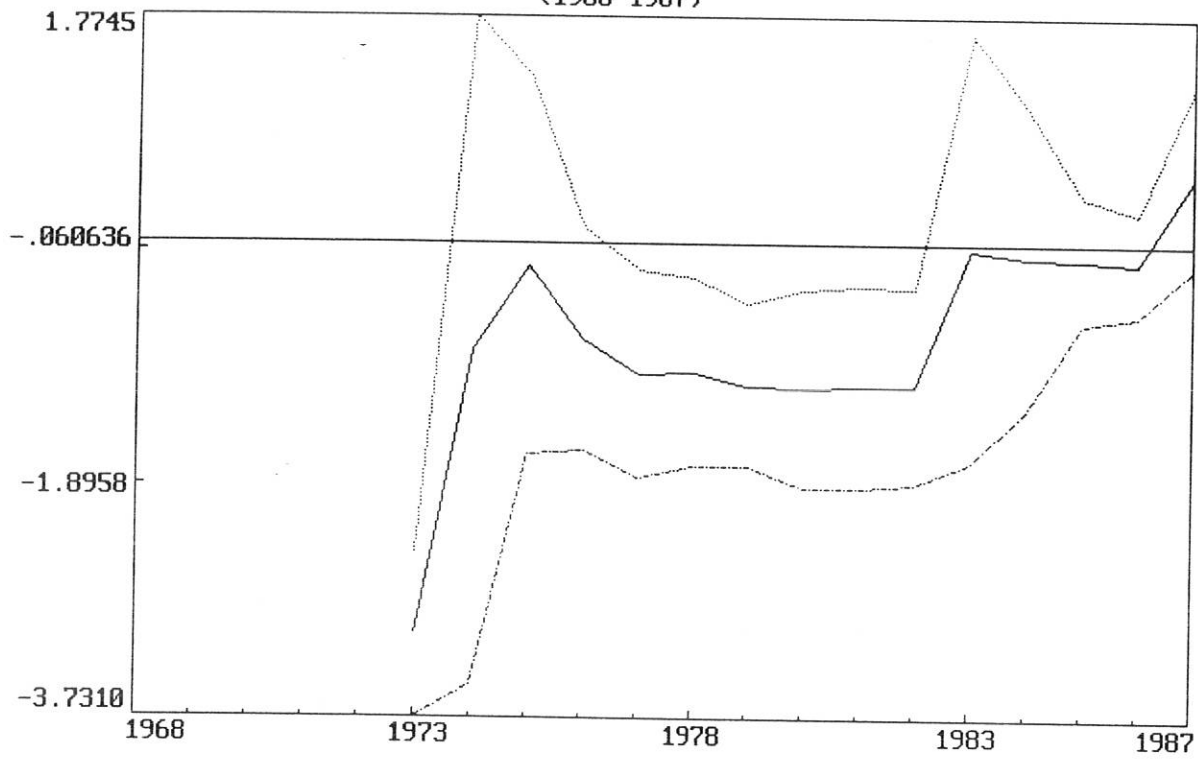
APPENDIX 4

Government's Fiscal Indicators(in Million Leones) From 1966 To 1994

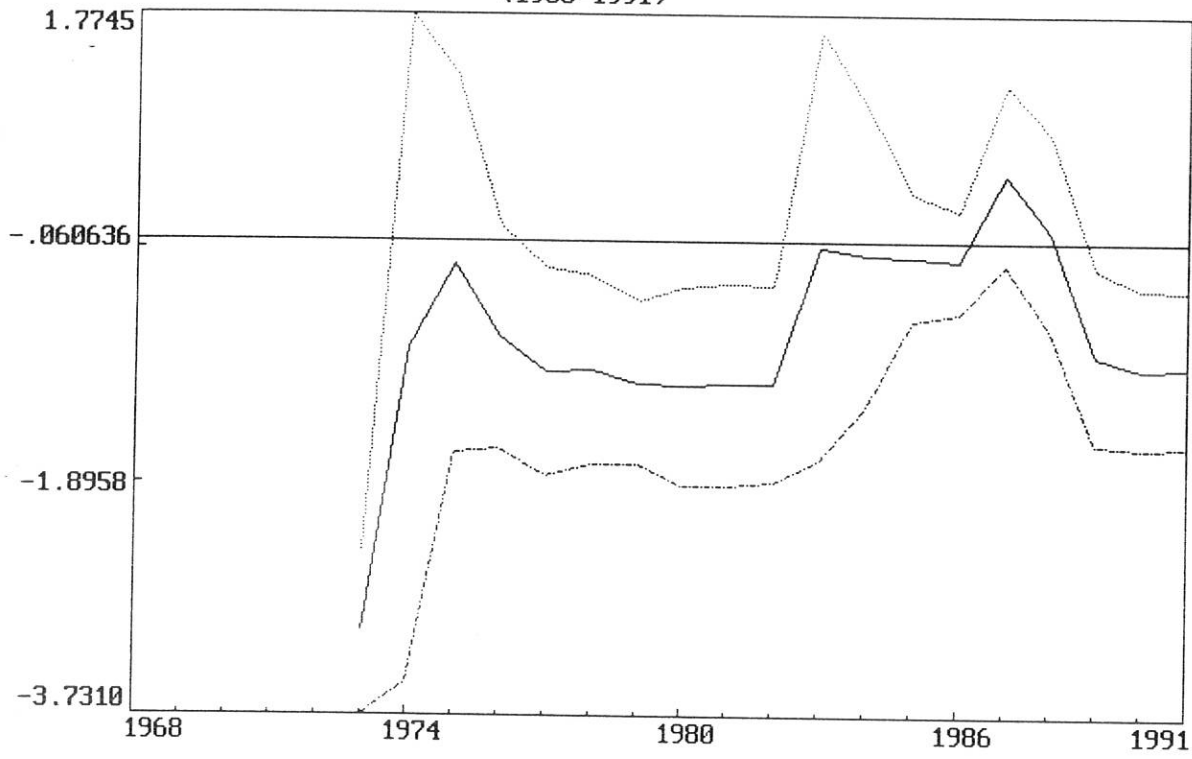
Year	Government Expenditures	Government Revenue	Budget Deficits
1966	40	34	-6
1967	39	37	-2
1968	41	39	-2
1969	43	51	8
1970	48	52	4
1971	58	54	-4
1972	68	60	-8
1973	76	64	-12
1974	113	92	-21
1975	157	97	-60
1976	144	95	-49
1977	170	119	-51
1978	249	157	-92
1979	311	174	-137
1980	334	190	-144
1981	358	221	-137
1982	353	182	-171
1983	416	156	-260
1984	451	229	-222
1985	578	286	-292
1986	778	486	-292
1987	5412	1264	-4148
1988	4656	2333	-2323
1989	7090	3693	-3397
1990	8191	5499	-2692
1991	30901	17902	-12999
1992	56993	35384	-21609
1993	78695	54294	-24401
1994	104654	67414	-37240

Source: IMF's, *International Financial Statistics Yearbook November, 1995*.

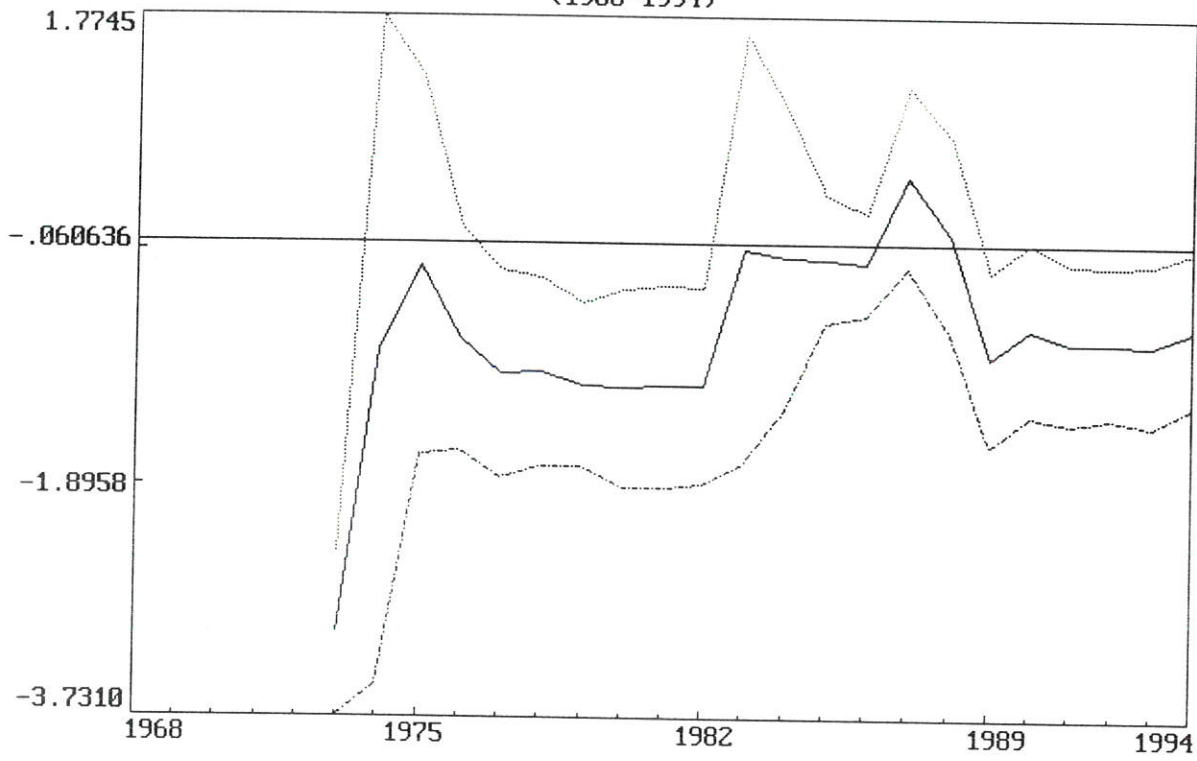
Appendix 5A: Recursive estimates of the Lagged Inflation Coefficient
(1966-1987)



Appendix 5B: Recursive estimates of the Lagged Inflation Coefficient
(1966-1991)



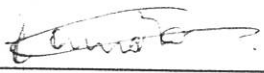
Appendix 5C: Recursive Estimates of the Lagged Inflation Coefficient
(1966-1994)



DECLARATION

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university. I also declare that all sources of material utilized for this thesis have been fully acknowledged.

Name: ALIMAMY KAMARA

Signature: 

Date: 3rd June, 1996

Place: ADDIS ABABA UNIVERSITY, ADDIS ABABA, ETHIOPIA