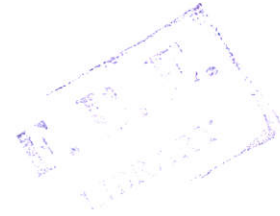


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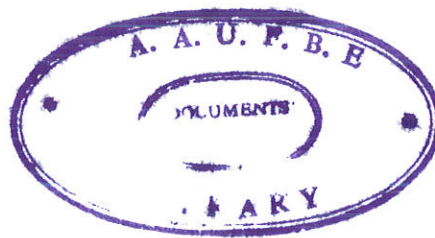
ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES



GOVERNMENT BUDGET DEFICIT AND INFLATIONARY PROCESS
IN ETHIOPIA



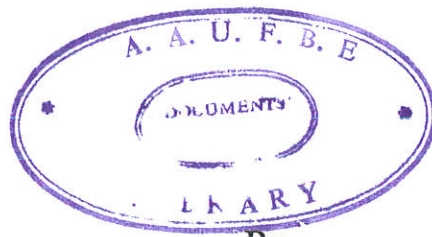
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ADDIS ABABA UNIVERSITY
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Government Budget Deficit and Inflationary Process in Ethiopia



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In memory of my heavenly and unforgettable sister, Metasebia Lake.



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ABSTRACT

The main objective of the study is to examine the causal relationship between the budget deficit, money supply and inflation in Ethiopia using the Aghevli and Khan (1978) model using Ethiopian data obtained from Ministry of Finance, Ministry of Economic Development and Co-operation and National Bank of Ethiopia.

The main findings of the study are:

- The existence of lag structure in the government budgetary mechanism caused a two way causation between money supply and inflation.
- The monetarist paradigm of sustained inflation resulting from budgetary deficit financing by money creation has been empirically confirmed. In the long-run supply factors have been found to have a significant influence in the determination of inflation.
- Due to the effect of government borrowing and external influence, the Central Bank is unable to conduct an independent monetary policy

The policy implication of the result of the study is that without implementing effective fiscal policy, it is difficult to realize macroeconomic stability and economic development. This includes, among others, eliminating budget deficit, reducing time lags in tax collection, strengthening fiscal discipline and accountability in the use of public fund. Fiscal prudence and effectiveness are also indicated in improved tax performance and efficiency in tax administration. It is also necessary to reform the National Bank of Ethiopia and its operations so that it is empowered to exercise independent monetary policy.

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1. INTRODUCTION

1.1 BACKGROUND AND STATEMENT OF THE PROBLEM

A small budget deficit is among the more common indicators of economic stability or good fiscal policy performance. It is believed that public finance shapes the course of economic development. It affects resource use and financing pattern and together with monetary and exchange rate policies, influences the rate of inflation. Public spending also affects the behavior of producers and consumers and influences the distribution of wealth and income in the economy. Balance of payment crises and foreign debt problem could be aggravated in the face of imprudent fiscal policy (WB, 1988).

There are four ways in which the fiscal deficit can be financed: printing money, running down foreign reserves, borrowing from abroad, and borrowing from domestic sectors. Excessive use of each type of financing causes specific macro-economic problem. Printing money may lead to inflation; foreign reserve use can lead to exchange rate crises and foreign borrowing may lead to an external debt problem.

With regard to the relationship between budget deficit and inflation, some studies have shown that there is a positive correlation between budget deficits and inflation in developing countries (Aghevli and Khan (1978)). These studies, in line with

the monetarists explanation of inflation, assume the link between budget deficit and inflation is through deficit financing by means of borrowing from the banking system. Contrary to this there are also other studies that indicate a reverse relationship between the budget deficit and inflation (Aghevli and Khan, 1978). The explanation of this argument is simple: inflation affects the government budget by lowering the real value of revenue due to long lags that exist in the collection of taxes. But the expenditure side tends to be fixed in real terms so that when prices rise, the money value of expenditure is raised proportionately. The net effect of these two features of government budget is widening the budget deficit. The simultaneous operation of these two causations tends to a self - perpetuating inflationary pressure.

The fiscal and monetary policies which have been undertaken by different political regimes in Ethiopia have affected the course of economic development in the country. Real GDP growth, which averaged 4 percent per annum during 1965-75, dropped substantially to about 1.5 percent over the period 1974-91 (Government of Ethiopia, 1993). Government budget deficit, which was moderate before 1975 has risen dramatically after 1975, due to accelerated government expenditure. Government expenditure to

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GDP ratio increased from 14.3 in 1970 to 45.2 in 1990 (Teshome, 1992). Monetary expansion also manifested some acceleration. Broad money expanded during 1987-1990 at an average annual rate of 18 percent compared to a historical rate of 12.5 percent (Government of Ethiopia, 1993). Generally, monetary expansion was due to the monetization of increasing budget deficits. This, among other things, has resulted in an inflationary pressure in the economy. Thus, the goals of this study are to investigate the link between government budget deficit, money supply and inflation and to determine how strong or weak this relationship is and to examine the factors behind such a link.

1.2 OBJECTIVE OF THE STUDY

The main objective of the study is to examine the casual relationship between budget deficit, money supply and inflation. Answering the following question is the crux of the study. Does increase in money supply, resulting from the monetization of budget deficits, trigger inflation? Does an increase in the general price level forces the government to increase money supply to finance inflated deficit? Do both the monetization of budget deficit and the rise in the general price level force the government to increase money supply in the economy?.

1.3 HYPOTHESES OF THE STUDY

The basic hypothesis is that while government expenditure rises with inflation, Government revenues would tend to fall behind in real terms owing to collection lags. This is testing the hypothesis that nominal government expenditures adjusted upwardly faster than revenues with increase in prices. The financing of this inflation induced deficits would then increase the money supply and generate further inflation. That is, there is a two way relationship between money supply and inflation.

1.4 SIGNIFICANCE OF THE STUDY

The study is useful for the following reasons:

- The knowledge of causal patterns might help policy makers in formulating fiscal and monetary policies in order to bring about macro-economic stability and economic growth in the country.
- The results may become useful for further research on related issues.

1.5 SCOPE AND LIMITATIONS OF THE STUDY

A. Scope of the Study

The scope of the study is limited to the analysis of the causal link among budget deficit, money supply and inflation. And limited to the period 1966 - 1996.

B. Limitation of the study

The main limitation of the study is lack of data. Consumer price index that incorporate items consumed by both urban and rural dwellers is not available and consequently the Addis Ababa consumer price index will be used as a measure of inflation.

1.6 METHODOLOGY AND DATA SOURCE

The methodology is quantitative in nature. First a simple descriptive analysis of the nature and behavior of government budgetary revenue and expenditure, monetary and inflationary development will be undertaken. In order to strengthen the quantitative analysis, some econometric techniques will be introduced. These include, Two Stage Least squares (2SLS) method.

The source of data for this study are ministry of Economic Development and Co-operation, Ministry of Finance, National Bank of Ethiopia.

2. LITERATURE REVIEW



The major objective of the study is to examine the causal relationship between budget deficit, money supply and inflation. Thus, in this part we will try to examine first the basic feature of inflation and public finance in developing countries. Then attempt will be made to survey the monetarist and structuralist thinking and their empirical evidence regarding the causal link between budget deficit, money supply and inflation.

2.1 The Relationship Between Inflation and Budget Deficit

Public sector deficit occupy a central role in causing inflation in many developing countries. This is especially important in those countries where the government has to rely on the central bank to finance its fiscal imbalance, due to undeveloped security markets and Open Market Operation. Monetization of budget deficit thus becomes the major force for money creation and inflation. (Miguel and Neumeyer, 1989)

The link between budget deficit and inflation is manifested through inflation tax revenue, sometimes known as seigniorage. seigniorage is defined as the amount of resources the government can obtain from printing money.

When the government finances its deficit by issuing money, which the public adds to its holdings of nominal money balances to maintain the real value of money balances constant, we say the government is financing itself through the inflation tax. Inflation tax is the tax imposed on the money holder as a result of inflation. Higher rate of inflation, however, do not always provide more resources to the government. There is a limit to it. As Friedman (1971) put it, there is a revenue maximizing rate of inflation which correspond to the point where the demand for money is unitary elastic. Beyond that point, further increases in inflation will actually reduce the inflation tax revenue in the steady state. That is, the amount of revenue the government can raise by printing money depends on how fast the government increases the monetary base and how much people want to hold money balance. As money growth increases, seigniorage revenue increases, as does inflation. And as inflation rises, people economize on real cash balances because the opportunity cost of holding money rises. Because of this velocity adjustments, seigniorage will increase less than proportionately with the increase in money growth and inflation. If, however, the financing requirement is too large, inflation will become so high that no increase in money growth can produce an increase in real seigniorage (Cardoso, 1988).



In the explanation of the causation between budget deficit and inflation, there are two lines of thinking. The first, started with the classical hyper inflation model of Cagan (1952), emphasizes a one directional relationship between budget deficit and inflation in a way that the former causes the latter. In fact, the relationship is expressed through monetization of budget deficit.

The second is the Aghevli and Khan (1978) model of two way interaction between budget deficit and inflation. The explanation is that large budget deficit can lead to rapid inflation by causing the government to print money to finance deficit. Higher inflation also increases the measured deficit. Tanzi (1977) shows the mechanism through which inflation increases budget deficits. As he pointed out, due to lags in the collection of government revenue, in the presence of inflation, real value of government revenue declined so much so that deficit increases.

Tanzi (1977) presented the analysis mathematically as follows:

Let, R = Real value of tax revenue accruing in period zero
but paid n period latter,
 T = Nominal value of accruals in period zero,
 P_0 = Price level at time zero and

E = Elasticity of tax accrual with respect to changes in the price level.

$\pi = \frac{dP_o}{P_o dt}$ = inflation at time zero.

$$R = \frac{T}{P_o(1+\pi)^n} \dots\dots\dots(1)$$

$$E = \frac{dT}{dP_o} * \frac{P_o}{T} \dots\dots\dots(2)$$

Rearranging equation (2),

$$E \frac{dP_o}{P_o} = \frac{dT}{T} \dots\dots\dots(3)$$

$$\frac{dT}{T} - E \frac{dP_o}{P_o} = 0 \dots\dots\dots(4)$$

Integrating equation (4), one can arrive at

$$\ln T - E \ln P_o = C \dots\dots\dots(5)$$

Or

$$\begin{aligned} \text{Or } TP_o^{-E} &= e^C \\ \text{Or } T &= kP_o^E \dots\dots\dots(6) \end{aligned}$$

where C is the constant of integration and $k=e^C$.

Substituting equation (6) into (1), will give

$$R = \frac{kP_o^{E-1}}{(1+\pi)^n} \dots\dots\dots(7)$$

Differentiating equation (7) partially with respect to π , P , E and n yields

$$\frac{\partial R}{\partial \pi} = \frac{-nkP_o^{E-1}}{(1+\pi)^{n+1}} \dots\dots\dots(8)$$

$$\frac{\partial R}{\partial P_o} = \frac{(E-1)kP_o^{E-2}}{(1+\pi)^n} \dots\dots\dots(9)$$

$$\frac{\partial R}{\partial E} = \frac{kP_o^{E-1} LnP_o}{(1+\pi)^n} \dots\dots\dots(10)$$

$$\frac{\partial R}{\partial n} = \frac{-kP_o^{E-1} Ln(1+\pi)}{(1+\pi)^n} \dots\dots\dots(11)$$

Equation (8) implies that R will fall with an increase in π as long as n is greater than zero. If n=0, R will not change with π regardless of E.

Equation (9) indicates that if E equals to unity or two, R will not depend on P, but only on π and n.

Equation (10) implies that given p and π , the higher E is, the higher R will be. Furthermore, equation (11) implies that given a positive rate of inflation(π), the longer lags (n), the smaller (R) will be.

In general, since government in developing countries could not finance their deficit through Open Market Operation due to undeveloped capital market, they are forced to print new money. This causes an expansion of money supply which intern causes inflation in the economy. That is why inflation in developing countries a fiscal phenomenon.

2.2 Monetarist Thinking

The monetarist paradigm assert that sustained inflation resulted from budget deficit financed by money creation. It is the result of overspending (Cardoso, 1988).

To understand the basic foundation of the monetarist model which is referred to as a new version of quantity theory of money, one should survey the basic feature of the old version of the quantity theory of inflation.

The old version of the quantity theory of inflation consists of the single proposition that increases in money supply uniquely determine the rate of inflation. There are two alternative equations used to express this theory (see Ghatak, 1995):

The first, the Cambridge Equation, called cash balance theory, is written as:

$$M^s = kPy \quad \dots\dots\dots (1)$$

Whereas the second , the Fisher Equation, is written as:

$$M^sV = PT \quad \dots\dots\dots (2)$$

Where; M^s = actual quantity of money (Money supply),
 y = total real value of income,
 P = the general price level,

k = income velocity of money,
 T = total value of transaction and
 V = transaction velocity of money

In both equations, in the long-run k, y, T and V are independent of the change in money supply and therefore are assumed constant. So, the Cambridge equation shows an equilibrium condition comprising the exogenous money supply on the left side and the demand for money on the right hand side. The only variable that varies so as to equilibrate the money market is the price level, and has an unambiguous direct effect on the demand for money (kPy). The direct effect can be easily provided by differentiating equation 1 with respect to time.

$$d \ln M^s / dt = d \ln P / dt \quad \text{or}$$

$$m = p \quad \dots \dots \dots (3)$$

Where m and p denote growth rate.

Equation 3 implies that the rate of change of the price level (p) is equal to the rate of change of money supply (m) which indicates the unique relationship between the money supply and the price level. The Fisher equation also gives identical result.

By refining the old version of quantity theory of money, the monetarists convey the idea that the long and large price

movements are traceable to monetary factors. In Friedman's view, "inflation is always and everywhere a monetary phenomenon". Furthermore, according to the monetarists, money supply is mainly controlled by the monetary authorities and thus it is exogenous (Kotwal, 1987).

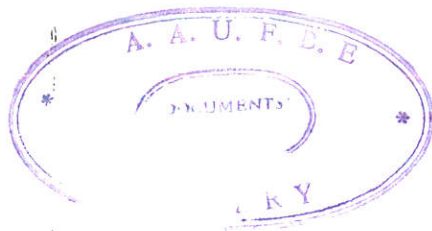
In general, according to both the quantity and monetarist theory of inflation there is a one way causation between money supply and inflation and that the direction of causation is from money supply to inflation. In contrast to this, recently, a number of studies have argued that the expansion of money supply is itself a result of ongoing inflation and at the same time a cause of inflation (Aghevli, 1977). The explanation for this argument goes as follows: an expansion of money supply increases aggregate demand for goods and services in the economy, which will require either the expansion of output or prices. In the case of output rigidity, the increase in price results in an inflated government budget deficit which the government will have to finance by printing money. Clearly, this argument reveals the existence of a feedback (two-way causation) between money supply and inflation. That is, according to this argument there is a vicious circle whereby the budget deficit causes money supply to rise, this in turn increases inflation which again leads to an inflated budget deficit, and the process repeats itself.

2.3 Structuralists' Thinking

Economists have formulated various models of inflation for different economies. In particular, inflation in developing countries has generated a great deal of theoretical and empirical research. One major concern, particularly in Latin American countries, was the debate on the relative importance of monetarist versus structuralist explanation of inflation.

As explained in the previous section, the monetarists argue that the rate of growth of money supply per unit of output is responsible for inflation. This view implies that it is always by applying breaks on the growth of money supply that inflation can and has been controlled. In contrast to this the structuralists convey the impression that inflation is caused by structural bottle-necks which existed in the agricultural, Foreign and government sectors (Canace, 1982).

In the government sector the tax base of most developing countries is very narrow but the demand for investable fund on the part of the government is very high owing to the massive programs of industrialization and infrastructural development. The narrow tax base is due to a low level of per capita income. The major source of revenue in these economies is the tax on foreign trade which is highly variable. Given such a fiscal



structure, governments in these countries are forced to deficit financing which in the presence of rigid output response, results in inflation.

According to this view, unless the above structural features are eliminated, the program of economic growth in these countries are bound to cause inflation. The orthodox proposition of controlling inflation by reducing budget deficits, supply of credit and wage is considered counterproductive as it will push the economy into a severe recession. The monetarist policies of controlling inflation would accelerate it by reducing government investment in the bottle-necked sectors. The remedies for inflation proposed by the structuralists include a long term development program to achieve the necessary structural change.

In general the structuralists believed that government budget deficit is a structural problem which cause inflation due to creation of money. According to them inflation is unavoidable unless the necessary structural changes has been taken place.

Taking into account the low productivity of the agricultural sector and the problems of government budget deficit and balance of Payments, it is tempting to say that the structuralist theory could explain the inflationary process in Ethiopia.

2.4 Empirical Evidences

One of the study in line with the monetarist explanation of inflation is Abebayehu's work (1989). He used a single equation model to investigate the determinants of inflation in six African countries using a quarterly data over the period of 1960 - 1983. The model takes into account lag structure and exogenism of money supply growth with respect to inflation which is tested statistically rather than assumed. The derived model is fitted to data from countries of Egypt, Ghana, Morocco, Nigeria, Sudan and Tunisia. For each country, the model fits the data well and the results are generally consistent with the monetarist explanation of inflation.

Earlier, London (1989) had examined the role of money supply and exchange rate in the inflationary process in 23 African countries. The application of the pure monetarist model of the Harberger type (which adds expected inflation to the pure monetarist model) reveals that the growth of money supply, expected inflation and real income were significant determinants of inflation for the period between 1974 and 1985. Exchange rate was later introduced as one of the explanatory variables in the pure monetarist model. The result showed that exchange rate movements had a remarkable influence on the inflationary process

in the 1980s. London's study, in general, indicates that both the monetarist and structuralist elements influenced the inflation process in Africa in the 1980s.

Chhibber and others (1989) employed a highly dis-aggregated econometric model that considered both monetary and structural factors in Zimbabwe over the period of 1969-86. Findings from this study indicate that monetary growth, foreign prices, exchange and interest rates, unit labor cost and real output are the determinants of inflation in this country.

Saini (1982), applied the Harberger type monetarist model to identify the causes of inflation in six Asian countries. The empirical results showed that the growth of money stock was not the primary source of inflation in these countries.

Sowa (1994), using an error correction model (ECM), estimated an inflation equation for Ghana. The finding prove that inflation in Ghana, either in the long or short-run, is influenced more by output volatility than by monetary factors. He recommended that to control inflation more attention should be paid to supply factors. Further, government should pursue consistent fiscal policies.

Aghevli and Khan (1978) also developed a model which take into account the two way causation between money supply and inflation in developing countries. In their research on Brazil, Colombia, the Dominican Republic, and Thailand over the period 1961-74, they arrived at the conclusion that government expenditures respond faster to inflation than revenues thereby generating an inflated budget deficit which intern lead to an inflationary spiral. Aghevli and Khan model is also demonstrated to the Kenyan economy.

With regard to Ethiopia, while there are not many works to be cited, the following two studies are the exception.

Tekle (1990), Studied inflation in Ethiopia for the period 1973/74-1989/90 by a careful look at some of the years. He examined the growth of different important variables such as growth of money supply and real GDP, the level of annual rainfall and velocity of money vas-vis inflation. Examining these variables he concluded that inflation in Ethiopia is mainly caused by the growth of money supply. Moreover, he stressed the importance of drought in aggravating inflation. However, such kind of analysis cannot be taken for granted since the conclusion depends on the periods examined and personal judgment.

Another related work is done by Semu (1994). In his study, he identified inflation as a function of the growth of money supply and real GDP, expected inflation, budget deficits and lagged real money balance. He found, on the basis of the regression's R^2 and F-statistics, that the monetarist model did not explain inflation in Ethiopia. Moreover, money growth rate becomes statistically insignificant and takes the wrong sign. Moreover, even though the title of the study is the interaction of budget deficit, money supply and inflation, in no place, the interaction among these variables has shown and analyzed clearly.

In general, the empirical evidence reviewed above show that the monetary and structural elements had a great influence on the inflationary process in developing countries.

3. SPECIFICATION OF THE MODELS AND METHODS OF ESTIMATION

(The Aghevli and Khan (1978) Model)

From the empirical evidence, we observe that the monetarist model did not explain inflation in Ethiopia. This is perhaps because the earlier research work applies a pure monetarist model which assume that money supply is a policy variable so that inflation is a result of excess growth of money supply. But we might get a good result if we let the growth of money supply also a result of inflation. Moreover, in our model, money supply is not an independent policy variable because the borrowing requirement of the government and the fluctuation of foreign exchange reserve are not fully under the control of the monetary authority. Therefore, the chosen model employed in this paper assumes that money supply and inflation are linked in a two - way relationship and this link is expressed as a reflection of the monetization of the budget deficit to inflation. The basic model involves four stochastic equations explaining, respectively, the price level, government expenditures, government revenues, and the money supply, and one definitional equation dealing with the formation of expectations regarding inflation (Aghevli, 1977). Each of these equations will be discussed in turn bellow:

Price Level Equation: To determine prices, it is necessary first to formulate the real money demand as a function of real income and the opportunity cost of holding money. In most developing countries, where capital market is underdeveloped, substitution between money and real asset is more important so that the opportunity cost of money holding in developing countries is the return on real assets which is reflected by the expected rate of inflation.

Therefore, the real money balance can be specified in log linear form as

$$\log(M/P)_t^d = a_0 + a_1 \log y_t - a_2 \pi_t, \dots \dots (1)$$

Where $a_1, a_2 > 0$
 M = Stock of nominal money balance
 P = price level (CPI)
 y = real income
 π = expected rate of inflation
 d = demand
 t = time



The actual stock of real money balance is assumed to adjust proportionally to the difference between the demand for real money balances and the actual stock in the previous period (Aghevli, 1977). So,

$$\Delta \log(M/P)_t = \lambda [\log(M/P)_t^d - \log(M/P)_{t-1}] + U_{t1}, \dots \dots (2)$$

Where λ denotes the coefficient of adjustment, $0 < \lambda < 1$. The disturbance U_{t1} is brought in to allow for random influences in carrying out the adjustment.

substituting (1) into (2) and solving for real money balance and inverting results.

$$\log(M/P)_t = \lambda a_0 + \lambda a_1 \log Y_t - \lambda a_2 \pi_t + (1 - \lambda) \log(M/P)_{t-1} + U_{t1} \dots (3)$$

$$\log(P/M)_t = -\lambda a_0 - \lambda a_1 \log Y_t + \lambda a_2 \pi_t - (1 - \lambda) \log(M/P)_{t-1} + U_{t1} \dots (4)$$

$$\log P_t = -\lambda a_0 - \lambda a_1 \log Y_t + \lambda a_2 \pi_t - (1 - \lambda) \log(M/P)_{t-1} + \log M_t + U_{t1} \dots (4')$$

Government Expenditure Equation: Assuming that desired real government expenditures are related to the level of real income, the log linear functional form is

$$\log(G/P)_t^d = g_0 + g_1 \log y_t \dots \dots \dots (5)$$

Where, $g_1 > 0$ and G = nominal government expenditures

Assuming that in the long-run the government increases its real expenditure proportionally with real income growth, g_1 is expected to be unity.

The actual real government expenditure is assumed to adjust to the difference between the desired real expenditure and actual real expenditure in the previous period,

$$\Delta \log(G/P)_t = d(\log(G/P)_t^d - \log(G/P)_{t-1}) + U_{t2} \dots \dots (6)$$

Where, $0 < d < 1$, and d = the coefficient of adjustment. The disturbance U_{t2} is brought in to allow for random influences in carrying out the adjustment.

substituting (6) into (5) results¹.

$$\log(G/P)_t = dg_0 + dg_1 \log y_t + (1-d) \log(G/P)_{t-1} + U_{t2} \dots (7), \text{ or}$$

$$\log G_t = dg_0 + dg_1 \log y_t + (1-d) \log(G/P)_{t-1} + \log P_t + U_{t2} \dots (8)$$

From these equations, one can obtain the mean or average time lag in the adjustment of real government expenditure. This lag is defined simply as $(1-d)/d$. Here we expected in the long-run the growth of government expenditure is proportional to the growth of price. that is, price elasticity of nominal government expenditure is expected to be unity.

Government Revenue Equation: Assuming that desired real government revenues are related to the level of real income, the log linear functional form is

$$\log(R/P)_t^d = t_0 + t_1 \log y_t \dots \dots \dots (9)$$

Where, $t_1 > 0$ and R = nominal government revenues

¹ Note: Since (5) represent the long-run government expenditure function, (8) can be called the short-run government expenditure function. Once we estimate the short-run function (8) and obtain the estimate of adjustment coefficient, d, we can easily derive the long-run function by simply dividing dg_0 and dg_1 by d and omitting the lagged term, which will then give (5). (see Gujarati, 1988, p. 520). The same is true for Price and Revenue equation.

Assuming that in the long-run the government increases its real revenue proportionally with real income growth, t_1 is expected to be unity.

The actual real government revenue is assumed to adjust to the difference between the desired real revenue and actual real expenditure in the previous period,

$$\Delta \log(R/P)_t = e[\log(R/P)_t^d - \log(R/P)_{t-1}] + U_{t3}, \dots (10)$$

Where, $0 < e < 1$, and e = the coefficient of adjustment.

substituting (10) into (9) results

$$\begin{aligned} \log(R/P)_t &= et_0 + et_1 \log y_t + (1-e) \log(R/P)_{t-1} + U_{t3}, \dots, \text{or} \\ \log R_t &= et_0 + et_1 \log y_t + (1-e) \log(R/P)_{t-1} + \log P_t + U_{t3}, \dots (11) \end{aligned}$$

From these equations, one can obtain the mean or average time lag in the adjustment of real government revenue. This lag is defined simply as $(1-e)/e$. Here we expected in the long-run the growth of government revenue is proportional to the growth of price. that is, price elasticity of nominal government revenue is expected to be unity.

In this framework, even if one start from a balanced budget, as nominal income rises, one will observe an increasing divergence between expenditure and revenue if the former adjusts faster. That is, the nominal deficit will be a function of the increase in the price level, provided that $e < d$, even though $g_1 = t_1$.

There are plausible reasons for expecting government expenditure in developing countries like Ethiopia to adjust faster than revenue to nominal income increases arising from inflation. Even if the government fully recognizes the need to restrain expenditure during inflation period, it finds difficult to reduce its commitments in real terms. On the other hand, low nominal income elasticity of taxes and long lags in tax collection accompanied with inefficient tax administration causes tax revenue to fall in real terms.

Money Supply Equation: Money supply, M , (in broader term) is related through money multiplier, b , to the stock of high - powered money, H ,

$$M_t = b_t * H_t \dots \dots \dots (12)$$

Change in H can be occurred due to changes in central bank's claim on government (ΔCG) and changes in foreign currency reserves and changes in central bank's claims on commercial banks denoted in one composite term (ΔFC). That is

$$\Delta H_t = \Delta CG_t + \Delta FC_t \dots \dots \dots (13)$$

v

$$H_t = \Delta CG_t + \Delta FC_t + H_{t-1} \dots \dots \dots (13')$$

If changes in central bank's claims on the government are simply a reflection of fiscal deficit, equation (13') can be written as

$$H_t = G_t - R_t + E_t \dots \dots \dots (14)$$

$$\text{Where, } E_t = \Delta FC_t + H_{t-1}$$

A change in the fiscal deficit is thus assumed to result an equal change in the stock of high power money. This would be true to the extent that government deficits are financed from the central bank, borrowing abroad or borrowing from commercial banks with the banks immediately replenishing reserves by recourse to the central bank.

Therefore, the money supply equation (13) can be written as

$$M_t = b_t (G_t - R_t + E_t) \dots \dots \dots (15)$$

The use of identity (15) along with the other equations would make the model nonlinear in variables; and since one can use a system method of estimation, it is more convenient to work with linear models so that we approximated equation (15) by a

relationship linear in logarithms form which was obtained by linearizing about sample means.² The resulting linear equation is:

$$\log(M/b)_t = k_0 + k_1 \log G_t - k_2 \log R_t + \log E_t + U_{t4} \dots (16)$$

$$\log M_t = k_0 + k_1 \log G_t - k_2 \log R_t + \log E_t + \log b_t + U_{t4} \dots (16')$$

Where the parameter k_0 , k_1 , k_2 and k_3 are all the functions of the sample means of $\log G$, $\log R$ and $\log E$.

Equation (16') can be obtained by calculating the sample means of logarithms of the variables G , R and E and deriving them or by estimating them within the model along with the other parameters.

Inflation Equation: The expected rate of inflation is assumed to be generated by the adaptive expectations or by error learning mechanism, so that

$$\Delta \pi_t = \beta(\Delta \log P_t - \pi_{t-1}) \dots (17)$$

β denotes the coefficient of expectations, $0 < \beta < 1$. And we can write this equation as

$$\pi_t = \beta(\Delta \log P_t) + (1 - \beta)\pi_{t-1} + U_{t5} \dots (17')$$

² See Aghevli and Khan (1978)

The complete model can be outlined as follows:

$$\log P_t = -\lambda a_0 - \lambda a_1 \log y_t + \lambda a_2 \pi_t - (1 - \lambda) \log(M/P)_{t-1} + \log M_t + U_{t1} \dots (18)$$

$$\log G_t = dg_0 + dg_1 \log y_t + (1 - d) \log(G/P)_{t-1} + \log P_t + U_{t2} \dots (19)$$

$$\log R_t = et_0 + et_1 \log y_t + (1 - e) \log(R/P)_{t-1} + \log P_t + U_{t3} \dots (20)$$

$$\log M_t = k_0 + k_1 \log G_t - k_2 \log R_t + k_3 \log E_t + \log b_t + U_{t4} \dots (21)$$

$$\pi_t = \beta \Delta \log P_t + (1 - \beta) \pi_{t-1} + U_{t5} \dots (22)$$

The variables defined as endogenous, exogenous and pre-determined are the following.

Endogenous:

P = Domestic price level (CPI),

G = Nominal Government Expenditures,

R = Nominal Government Revenues,

M = Broad Money Supply, which consist Money in Circulation,
Demand deposit, Time and Saving deposit.

π = Expected rate of Inflation.

Exogenous:

y = Real Income,

b = Money Multiplier, and

E = The sum of changes in international reserves and changes in Central Bank claim on the private sector and the stock of high powered money in the previous period.

Pre determined variables:

$(M/P)(-1)$ = Real Money balance in the previous period,

$(G/P)(-1)$ = Real Government expenditures in the previous period,

$(R/P)(-1)$ = Real Government revenues in the previous period, and

$\pi(-1)$ = Inflation in the previous period.

To test whether expenditure increases faster than revenue with increases in prices, it needs to prove that the average time lags in government expenditure $[(1-d)/d]$ is less than to that of revenue $[(1-e)/e]$.

4. ANALYSIS OF BUDGETARY AND MONETARY DEVELOPMENT

4.1 BUDGETARY DEVELOPMENT

Public finance affects economies in many different ways. Revenue, expenditure and public sector deficit determine the inflation rate, the current account deficit, the growth of the national debt and the level of economic activity (WB, 1988).

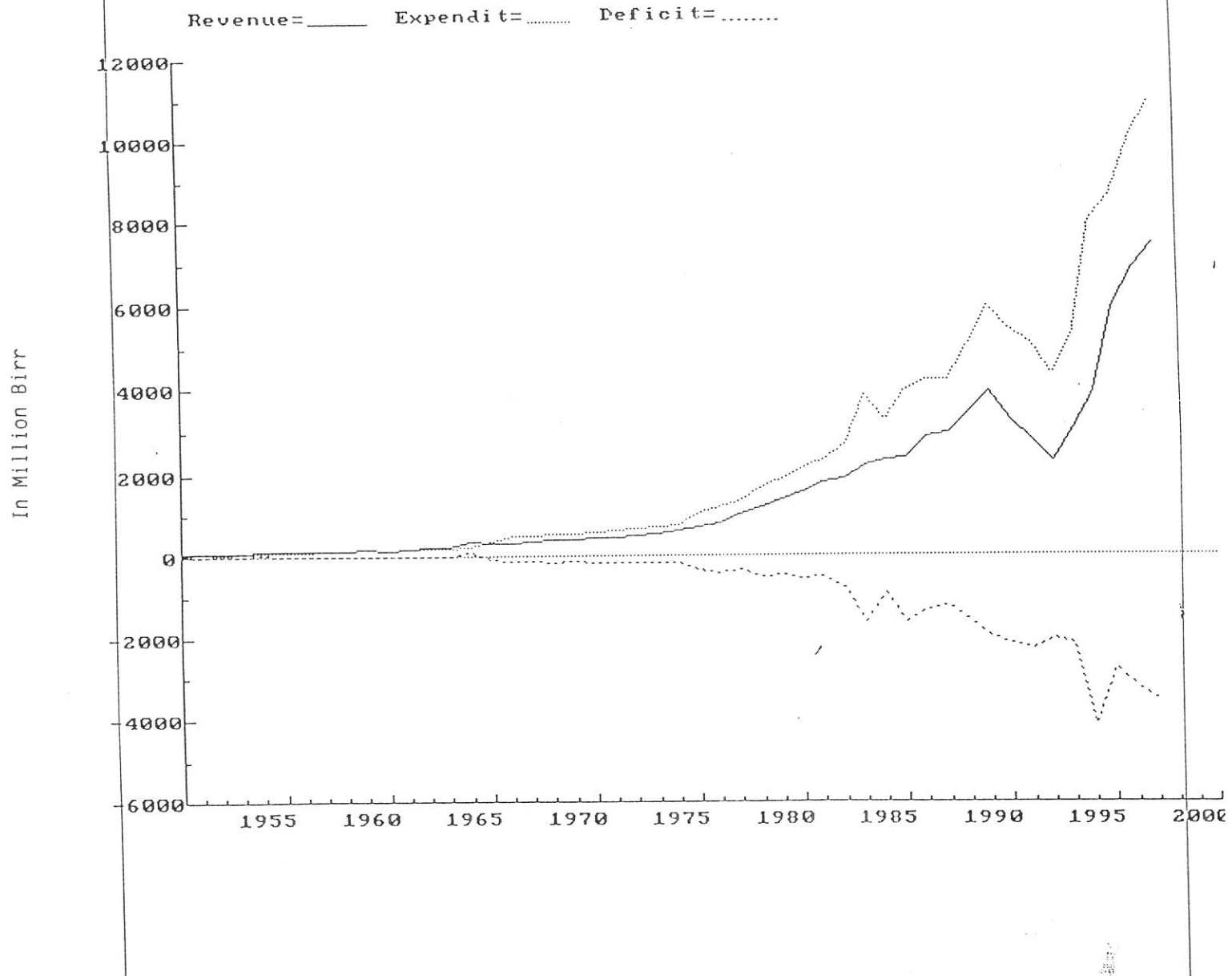
In Ethiopia in the past three decades government budget deficit has been affecting the course of economic development. As shown in figure 1, between 1950 and 1955 budgetary surplus were recorded. During 1956 - 1964 balanced budgets were recorded, more or less, and in the following decade (1965 - 1974), the practice of "fiscal conservatism" kept the budget deficit small. It was after the period 1974 when the monarchy was replaced by military government, that large budget deficit sustained.

The average budget deficit as a share of GDP at current factor cost was 2, 9 and 10 percent during 1961 - 1974, 1975 - 1991 and 1992 - 1997 respectively. The fast growth of the public sector economy was the main reason for the persistent large deficit in the economy particularly during the Derg regime. The development of large public sector in the economy has peculiar feature. It started by socialist government through nationalization of private property during 1975 and 1976.

Already, by the middle of 1976, much of the economic wealth of the country were in government hands and major control and management responsibilities of the economy also lay with the government. This form of management and the establishment of an expanded bureaucracy, state administration and the conduct of endless "campaigns" during 1975 - 1991 had resulted a large public economy and large persistent budget deficit. Socialist motto was the rule during this period. Private sector participation in the economy was limited by law and public investments were not necessarily guided by social rate of return, government expenditure may not be planned always and may reflect the needs to cover "emergency cost", there was a trend towards increased government reliance on ad hoc and unstable revenue sources and the role of fiscal policy in the alleviation of mass poverty and in bringing about economic structural adjustment was not played (Teshome, 1992).

After the down fall of the Derg regime in 1991, the central planned economy was replaced by a market based economy. The general features of the fiscal policy since then are set in the Policy Framework Papers (PFPs) of Ethiopia. The fiscal policy measures that are contained in the PFPs fall under either of the following five sub-themes: decentralization of authority to regions, reforms of government revenue, and expenditure, fiscal imbalances and financing and fiscal administration. However, the time appears too short to achieve a significant reduction in deficit to GDP ratio to date.

For the proper understanding and analysis of fiscal deficit over the longer period that consists of different economic policy oriented regimes, it requires thorough observation of the nature of government expenditure, revenue and ways of deficit financing



4.1.1 GOVERNMENT EXPENDITURE

The scale of public finance has increased dramatically in the country during the past three decades. This results large and growing government budget deficit as shown in Table 1. During 1961 - 1974 average annual public expenditure as a share of GDP at current factor cost was about 12 per cent. It has increased to about 27, 26 per cent for the period 1975 -1991 and 1992 - 1997, respectively. However, the growth rate of public revenue has not kept pace with that of public spending. In the same period average annual share of total domestic revenue in GDP was 10, 18 and 16 per cent respectively. Higher growth of government expenditure relative

Table 1: Average annual ratio of Domestic Revenue to Total Expenditure, Total expenditure to GDP and domestic revenue to GDP at current factor cost (percent)

Period	Domestic Revenue/ Total Expenditure	Total Expenditure /GDP	Domestic Revenue/GDP
1950 - 1960	114.7(15.72)		
1961 - 1974	87.9(22.65)	11.8(2.8)	9.9(1.2)
1975 - 1991	67.6(6.5)	26.9(5.3)	18.1(3.3)
1992 - 1997	60.6(8.83)	25.5(3.76)	15.5(3.43)

Source: Ministry of Finance, Budgetary Revenues and expenditure.

Note: The figure in parentheses are the standard deviations of the yearly ratios.

to revenue can be seen also from the decline in the ratio of total domestic revenue to total government expenditure. The ratio averaged 115 per cent per annum during 1950 - 1960 declined to 88, 68 and to 61 per cent for the period 1961 - 1974, 1975 - 1991 and 1992 - 1997 respectively.

Generally the trend of increasing government deficit has been shown by higher share of expenditure in GDP to that of revenue and by the continuous decline in the ratio of total domestic revenue to total government expenditure.

The relatively highest growth rate of expenditure has been also shown in Table 2. Average annual growth rate of total real expenditure was about 7, 10, 9 and 7 per cent in the years 1950 - 1960, 1961 - 1974, 1975 - 1991 and 1992 - 1997 respectively. In fact, the average annual growth rate for the period 1975 - 1989 and 1993 - 1997 were 12 and 15 per cent respectively. It is due to the relatively steeper drop of growth rate in 1990, 1991 and 1992 the average growth rate lowered for the period 1975 - 1991 and 1992 - 1997.

Table 2: Average Annual Growth rate of Real Government Expenditures (in per cent)

Period	Recurrent expenditures	Capital expenditure	Total expenditure
1950 - 1960	7.1(11.5)		7.1(11.5)
1961 - 1974	7.7(11.27)	9.4(20.3)	10.0(12.48)
1975 - 1989	10.4	15.4	11.5
1975 - 1991	8.3(14.0)	11.2(24.4)	8.8(14.9)
1993 - 1997	4.0	12.8	7.2
1992 - 1997	1.3(19.58)	23.4(52.6)	6.7(23.3)

Source: Ministry of Finance, Budgetary Revenues and expenditure.

Note: The figure in parentheses are the standard deviations of the yearly ratios.

Regarding the structure of expenditures, and the impact these had on the nature and magnitude of government deficits several observations are indicated. Government expenditure allocation between capital and recurrent expenditure are shown in Table 3

Table 3: Government Recurrent/Capital expenditure (Yearly average)

Period	Recurrent/Capital expenditure
1950 - 1960	12.5(9.84) *
1961 - 1974	4.4(0.87)
1975 - 1991	2.9(0.74)
1992 - 1997	2.0(0.79)

Source: Ministry of Finance, Budgetary Revenues and expenditure.

Note: The figure in parentheses are the standard deviations of the yearly ratios.

* the figure taken from Teshome Mulat, 1992.

The average annual ratios of recurrent to capital expenditure have been declining over time. The decline in the ratio for the period 1975 - 1991 need not imply that a significant change had occurred in the overall investment level in the country. Rather it implies the change in investment responsibility from the private sector to government. This could be seen from the fact that government share of total fixed capital formation, which averaged a mere 20 per cent per annum during the period 1961 - 1974, has increased to 71 per cent per year during 1975 - 1992 (Teshome, 1992).

The lowest ratio for the period 1992 - 1997 implies that even though the socialist planned economic system changed to market based economic system, the overall structure of government expenditure has not still changed with in this short period of time.

With regard to the structure of recurrent expenditure and its impact on budget deficit, as shown in Table 4, a number of points can be made: first, while the bulk of expenditure is

made in "General service", "Defence" expenditure forms the single most important category of that group. Defence on the average accounted from the total recurrent expenditure 26, 22, 39 and 15 per cent during 1950 - 1960, 1961 - 1974, 1975 - 1991 and 1992 - 1997. The high share of defence in total recurrent expenditure particularly during the period 1975 - 1991 shows how the government pumped its resources into destructive activities with adverse effect on economic growth.

Second, even though expenditure on social services has not shown relatively a declining trend, the economic service share in the total recurrent expenditure has been continuously declining except for the period 1992 - 1997.

Table 4: Functional Distribution of Recurrent Expenditure (in per cent)

Period	Defence/Recurrent Exp.	General service/Recurrent Expenditure	Economic/Recurrent Exp.	Social/Recurrent Exp.
1950 - 1960	26.5(1.76)	61.9(2.67)	15.6(1.9)	17.7(2.5)
1961 - 1974	22.0(4.43)	51.4(8.17)	11.3(3.08)	21.7(2.52)
1975 - 1991	39.6(6.36)	53.2(5.57)	6.2(1.16)	18.9(1.29)
1992 - 1997	15.3(3.47)	30.9(2.57)	9.8(1.28)	24.9(2.46)

Source: Ministry of Finance, Budgetary Revenues and expenditure.

Note: The figure in parentheses are the standard deviations of the yearly ratios.

Third, during 1992 - 1997 the allocation of recurrent expenditure to defence has drastically decreased but the advantage that could have been reaped from this has virtually been offsetted by a decline in government revenues. For example, total real expenditure in 1992 fiscal year declined by 35 per cent, while domestic revenue fell by 36 per cent.

The overall deficit, therefore, remained at about 10 per cent of GDP which was more or less equals to the 1991 level.

Fourth, the rapid growth of government expenditure has created a situation where domestic revenue fails to cover recurrent expenditure let alone to contribute to capital expenditure. For example, of the period 1975 - 1997, it was only in 1984, 1988 and 1994 - 1997 that domestic revenue has met recurrent expenditure.

4.1.2 GOVERNMENT REVENUE

The level and structure of taxes are other factor that affect government deficit. As it is shown in Table 5, on the average, taxes have risen slightly as a proportion of GDP from the period 1961 - 1974 to 1975 - 1991 but declined during 1992 - 1997 due to higher relative growth rate of GDP.

Real tax revenues had an annual average growth rate of about 9 per cent during 1950 - 1974 but declined to 5.4 per cent during 1975 - 1991. The ratio of tax revenue to total expenditure also has shown a declining trend indicating a widening gap between government expenditure and tax revenue. Likewise the ratio of tax revenue to domestic revenue has

declined, showing a higher growth of non-tax revenue in the domestic revenue.

Table 5: The annual average Growth rate of Tax Revenue and Taxes share in GDP, Total Expenditure and Domestic Revenues (in per cent)

Period	Growth rate of Real Tax Revenue	Tax Revenue /GDP	Tax Revenue/ Total Exp.	Tax Revenue/ Domestic Revenue
1950 - 1960	8.1(12.38)		91.6(14.58)	80.4(10.41)
1961 - 1974	8.7(19.42)	8.4(1.24)	74.9(19.54)	85.2(2.93)
1975 - 1989	7.6			
1975 - 1991	5.4(13.2)	13.4(1.69)	50.8(8.18)	74.9(6.77)
1992 - 1997	11.3(29.9)	11.1(2.19)	43.4(4.68)	72.0(4.08)

Source: Ministry of Finance, Budgetary Revenues and expenditure.

Note: The figure in parentheses are the standard deviations of the yearly ratios and growth rates.

With respect to the structure of tax revenue as shown in Table 6, during 1961 - 1974 the average annual share of Direct and Foreign Trade Taxes have decreased but the share of Indirect Taxes has increased. During the period 1975 - 1991 the average annual share of Direct and Indirect Taxes have increased while the average annual share of Foreign Trade Taxes has declined mainly due to poor performance of Foreign Trade Taxes.

Table 6: Tax Revenue structure (in per cent)

Period	Direct Taxes/Total Taxes	Indirect Taxes/Total Taxes	Foreign trade Taxes/ Total Taxes
1950 - 1960	29.3(7.78)	18.5(7.77)	52.3(4.99)
1961 - 1974	25.9(3.96)	30.7(6.14)	43.4(5.92)
1975 - 1991	36.0(7.14)	29.1(4.47)	34.9(10.83)
1992 - 1997	34.6(3.65)	27.7(4.60)	37.2(6.52)

Source: Ministry of Finance, Budgetary Revenues and expenditure.

Note: The figure in parentheses are the standard deviations of the yearly ratios.

Generally, though real revenue growth rate has lagging behind the expenditure growth rate over the longer period, we have seen the rising trend of tax revenue. This is mainly attributed to tax reforms and some improvements made in tax

administration. To cite some example of reforms made in the past:

- Rural land use Fee and Agricultural Activities Income Tax proclamation 77/1976 and its amendment proclamation 152/1978,
- The Customs Tariffs Regulations, Legal Notice 42/1976,
- Income Tax proclamation 30/1992 and 107/1994,
- Sales and Excise Tax proclamation 68/1993,
- Export Tax proclamation 38/1993 and Import tax proclamation

4.1.3 DEFICIT FINANCING

The large and growing deficit which have been recorded in the past have been financed through domestic and external finance. The former includes borrowing from the domestic bank, non-bank sectors and money printing and the latter refers to borrowing from the rest of the world.

Government borrowing from the central bank directly affects reserve and total money supply. Recourse to Commercial bank finance may have similar effects on the level of money supply and it may also has a crowding out effect on the private sector. In fact, the crowding out effect was carried out through a more direct route during 1975 - 1991. In this period private sector participation was limited by law. Moreover,

credit rationing, cumbersome procedures in licensing and permits, frequent changes in investment law and red - taps were directly discourage investment.

As shown in Table 7, a number of points may be made with regard to the sources of deficit financing. First, even though the level of external assistance have been increasing throughout the period, its share in the total annual deficit financing on the average have shown a declining trend. External assistance were about 73 per cent of the total yearly deficit financing on the average during 1964 - 1974 but declined to 27 and 10 per cent during 1975 - 1991 and 1992 - 1997, respectively. On the other hand, the level and share of external loan has been increasing for the period 1992 - 1997. It accounted about 58 per cent of deficit financing level.

Table 7: Source of Deficit Financing

Period	External Assistance	External loan	External assistance and loan	Domestic Bank Borrowing	Total Deficit
A. Average Annual levels (in million Birr)					
1950 - 1963	0.0	13.8	13.8	-28.6	-14.8
1964 - 1974	86.5	40.3	126.8	-8.0	118.8
1975 - 1991	292.1	332.2	624.3	471.7	1096.0
1992 - 1997	288.5	1710.5	1999.0	957	2956
B. Average Annual share of Deficit financing (in per cent)					
1964 - 1974	72.8	33.9	106.7	-6.7	100
1975 - 1991	26.7	30.3	57.0	43.0	100
1992 - 1997	9.8	57.8	67.6	32.4	100

Source: Ministry of Finance, Budgetary Revenues and expenditure.

Note: The figure in parentheses are the standard deviations of the yearly ratios.

Negative in fifth and sixth column indicate domestic bank saving and budget surplus

During 1950 - 1963 there is no recorded evidence that the Ethiopian government received any external assistance.

Second, with regard to domestic borrowing, prior to 1966 the government have never been borrowed from domestic bank but then after the level and share of domestic borrowing has increased and reached its maximum level during 1975 -1991. In this period the annual average share of domestic borrowing were about 43 per cent of the total yearly deficit financing.

Third, recently a shift in the source of deficit financing have been observed . During 1975 - 1991, the then government heavily adopted inflationary deficit financing source, that is, domestic bank borrowing. But during 1992 - 1997 the new government has adopted non-inflationary deficit financing source that is external loan. In fact, this may postponed inflation into the future unless the loan has been used in the area where the future return be able to repay the loan with its interest.

4.2 MONETARY DEVELOPMENT

In the previous section we have seen the deterioration of government budget deficit which undoubtedly has a repercussion on the development of liquidity in the country.

As shown in Table 8, the country experienced an expansionary monetary policy since 1964. In fact, the source (or cause) of

liquidity growth differ from one regime to another depending on the source of deficit financing each regime adopted.

Table 8: Monetary Variables

Period	A. Growth Rates (in per cent)				
	C	D	QM	M1	M2
1964 - 74	9.7(11.8)	8.3(18.6)	19.1(9.6)	9.1(10.4)	11.5(8.8)
1975 - 91	12.9(12.5)	17.8(15.3)	10.4(12.6)	14(8.3)	12.6(4.2)
1994 - 97	1.8	14.7	23.9	7	12.1
1992 - 97	5.6(9.4)	13.3(7.3)	24.0(10.22)	8.7(7.1)	13.1(5.2)
Period	B. Growth Rates (in per cent)		C. Share in Total DC		Inflation Rate
	NFA	DC	CG	CS	
1964 - 74	19.2(43.2)	11.8(6.4)	20.6	79.4	2.7
1975 - 91	-9.6	17.4(12.1)	50.1	49.9	9.9
1994 - 97	99.7	7.8	59.9	40.1	
1992 - 97	89.8(130)	10.8(5.5)	62.3	37.7	5.5 ^{*1}

Source: National Bank Annual Report.

Note: The figure in parentheses are the standard deviations of the yearly ratios, and * is average for 1965 - 1974 and *1 is average for 1992-1996

Where; C = Money in circulation outside bank

D = Demand deposit

QM = Quasi money

M1 = Narrow money supply

M2 = Broad money supply

NFA = Net Foreign Asset

DC = Domestic credit

CG = Credit to central government

CS = Credit to other sectors

The average annual growth of narrow and broad money supply during 1964 -1974 (Imperial regime) were about 9 and 12 per cent respectively. On the determinant side, net foreign asset during this period increased by 19 per cent while domestic credit increased by 12 per cent indicating that external sources constitute the major factor influencing money supply, whereas domestic credit plays only a secondary role in determining the growth of money supply(M2). During the period under consideration the ratio of claim on central government

to total domestic credit was as low as 21 per cent whereas credit to other sector accounted about 80 percent of total domestic credit.

During the Derg regime (1975 - 1991) when the country experienced large and growing budget deficit, the average annual growth rate of M1 and M2 was 14 and 13 per cent, respectively. During this period the expansion of domestic credit became a dominant factor for higher growth rate of broad money supply. Domestic credit during this period grew on the average by 17 percent per annum whereas net foreign asset have shown a declining trend on the average by 9.6 per cent per annum (excluding 1986 and 1991 for unusual higher values in this period). The share of credit to central government in total domestic credit reached about 50 per cent whereas the remaining share was attributed to other sectors including State owned Enterprises.

During the period 1992 - 1997 there was an upsurge of domestic liquidity with M1 and M2 expansion of 9 and 13 per cent respectively. The expansion of broad money has resulted from significant increase in net foreign assets which were induced by a coffee boom and inflow of external loan. Domestic credit has also increased significantly.

Generally, we have observed that over the longer period of time fiscal deficit has deteriorated to a high level of 13 per cent of GDP in 1990 with higher level of bank borrowing of about 67 per cent. The growth of liquidity (M2) in the economy also has shown a rising trend on the average by 12 per cent per annum and by 19 and 21 per cent in 1990 and 1991 respectively. These have caused an increase in the general price level in the economy.

As shown in Table 8, the annual average inflation rate for the period 1964 - 1974 was about 3 percent and increased to about 10 per cent during 1975 - 1991, and then declined to about 5.5 percent during the period 1992 - 1996.

Thus, we have seen that in the past, government deficit increased continuously mainly due to an accelerated growth of government expenditure. This resulted in an expansion of money supply which on the average over the past three decade grew at 12 per cent per annum, showing a strong link between budget deficit and money supply. The expansion of money supply in turn caused inflation in the country, though it appears low compared to other African countries.

5. EMPIRICAL EVIDENCE

The equations specified in the model we use include Price, Government expenditure and revenue and Money supply. The model is estimated by Two - Stage Least Square method (2SLS). Two Stage Least Square is the method used for replacing the endogenous variables of the right hand side of equations by their predicted values obtained from the reduced form and then estimating the equation by OLS.

Since the variable used in the study are time series, unit root and cointegration tests have been undertaken. The tests have shown that the variables in each equation are unit root and cointegrated. Then a one period predicted lagged residual term is also included in each equation and its coefficient is found to be statistically insignificant so that we can drop lagged residual term and estimate each equation using the variables at level. That is we do not need to go to Error Correction Method.

Serial correlation is detected in the revenue equation and corrected by the Cochrane - Orcutt iterative method. The predicted value of the estimations are denoted by $fitP_t$, $fitG_t$, $fitR_t$ and $fitM_t$.

Before we test the significance of coefficients, the standard errors obtained from the second stage of 2SLS are corrected, and their modified value used to compute t - ratio of the estimated coefficients (see Madalla, 1992 for more information).

The diagnostic test of each equation indicates that the model is consistent with the data. There is no evidence of first or higher order auto-correlation in each equation. The statistics also support the view that the distribution of the error terms are homoscedastic normal.

Before going to the interpretation of each parameter in each equation, we would first test whether the full - sample coefficients have remained stable throughout the entire period under investigation. If the sample coefficients are not stable throughout the period, inferences drawn on the strength of the full sample estimates may be invalid. We, therefore, re - estimate the model using the Recursive Least Squares estimates to test whether there has been any significant changes in the value of the coefficients of the model throughout the period. For simplicity we plot the recursive estimates of each parameter for each equation to see whether the coefficients are statistically stable with certain confidence interval. From the figures we see that in any case the plots are very

steady and any movements in the values have not been significant. That is, at no point in the sample do the values of the coefficients lie outside the narrowest point of the confidence interval. Thus, taken together with the full sample results, this recursive analysis indicates a highly acceptable level of coherence with the data. Though, recursive estimates are calculated for every variable in the model, we plot the recursive estimates for variables in the price equation (see Annex VV - VVIIII)

Furthermore, structural stability test using plots of cumulative sum and sum of squares of recursive residuals for each equation is also undertaken. For simplicity, we have shown plots of cumulative sum and sum squares of recursive residuals for price equation only (see Annex VIII and VIII). The figures show that at no point the cumulative sum and sum of square recursive residuals lie outside the critical bound at 5 per cent significance level, so that we do not have any problem of structural instability in the sample over the period under investigation.

The final estimation results of the model are reported in the next page. The results include the corrected standard errors of coefficients, the adjusted R^2 , the F - statistics and standard errors of the regression result.

1. PRICE EQUATION

$$\log P_t = 1.64 - .205 \log y_t + .237 \pi_t - .784 [\log M - \log P]_{t-1} + .966 \text{fit} M_t$$

(2.31) (.3139) (.46176) (.24699) (.12263)

$$\text{adj. } R^2 = 0.94$$

$$F(4, 25) = 96.605 \text{ [.000]}$$

$$\text{S.E. of the regression, } \sigma = 0.13351$$

2. GOVERNMENT EXPENDITURE EQUATION

$$\log G_t = -7.578 + 1.0955 \log y_t + .33193 [\log G - \log P]_{t-1} + .8079 \text{fit} P_t$$

(2.13488) (.30995) (0.15058) (.10534)

$$\text{adj. } R^2 = 0.97$$

$$F(3, 26) = 357.32 \text{ [.000]}$$

$$\sigma = 0.12796$$

3. GOVERNMENT REVENUE EQUATION

$$\log R_t = -7.3852 + 1.0929 \log y_t + .4151 [\log R - \log P]_{t-1} + .7123 \text{fit} P_t$$

(2.5668) (.37313) (.20308) (.13802)

$$\text{adj. } R^2 = 0.98$$

$$F(4, 24) = 290.04 \text{ [.000]}$$

$$\sigma = 0.13094$$

4. MONEY SUPPLY EQUATION

$$\log M_t = .024 + 2.55 \log \text{fit} G_t - 2.03 \log \text{fit} R_t + .385 \log E_t + .39 \log B_t$$

(.1895) (.69017) (.66555) (.1019) (.3009)

$$\text{adj. } R^2 = 0.99$$

$$F(3, 26) = 530.144 \text{ [.000]}$$

$$\sigma = 0.102754$$

5. Inflation Equation

$$\pi = 0.94605 \Delta \log P_t + 0.055347 \pi_{(t-1)}$$

Note: figures in parentheses are standard errors

Examining the results, we observe the estimated coefficients of all equations have the sign which are in accord with priory expectation. Moreover, the F - statistics of each equation reject the joint hypothesis that the coefficients of each equation are all zero. This shows that the above regression equations are well fitted to the data under investigation.

Coming to the interpretation of individual equation, the estimated short-run Price function shows that real income and the expected inflation rate have no statistically significant influence on the current price level. But they have the correct sign in accordance with a priory expectation and are by no means negligible. The latter result may be attributed to a relatively low level of inflation rate experienced in the country for a long period of time. The country has never experienced high level of persistent inflation. Moreover, a strong trade union and other organized interest groups that could provide a 'propagation mechanism' through which expectations could influence the price level were absent. Lagged real money balance produced a highly significant negative influence on the current price level. That is, if the previous year real money balance increased by one per cent, the current price level will decline by 0.78 per cent assuming other variables remain constant. This results, of course, from

the original money demand function, which implies that the higher the stock of real money balance in the previous year to a given demand for these balance, the smaller will be the real demand for money in current period so that the price level in the current period will decline assuming other variables remain constant.

The coefficient of adjustment of this equation is $\lambda = 0.216$ ($=1-.784$), implying that about 22 per cent of the discrepancy between the expected and the actual price level is eliminated in a year. The mean time lags in the adjustment of real money balance to the difference between desired and actual real money balance in the previous period is about $(1 - \lambda)/\lambda = 3.6$ years showing that changes in the money supply takes quite longer time, on the average, for their effect to be felt on the price changes. This longer required period of adjustment affects the inflationary process in the country. This is because if the government increases the stock of money, the public took longer period of time to realize actually the stock of money has increased in the economy in order to adjust their real demand for money accordingly. This indicates that in the short-run the government can create money with less inflationary impact.

To get back to the long-run price function all that should be done is to divide the short-run coefficients through by the adjustment coefficient ($\lambda=0.216$) and drop the $[\text{LogG-LogP}]_{t-1}$ term. The result is

$$\log P_t = 7.5722 - 0.9465 \log y_t + 1.0986 \pi_t + 0.9663 \text{fit} M_t$$

$$(1.30957) \quad (0.17483) \quad (0.25492)^3 \quad (0.12263)$$

As can be seen, all coefficients are statistically significant at 5 per cent level. The long-run partial elasticity of price with respect to income, estimated at 0.946, is substantially greater than the corresponding short-run elasticity of 0.2045 implying that supply factors have a significant influence in the determination of inflation. That is, in the long-run the growth of real income has a significant dampening effect on the growth of price level. We also observe that the impact of expected inflation on the price level is significant in the long-run, implying that expectation work in the long-run in the determination of price level. Another important result of this equation is that the coefficient of the nominal money stock is highly significant and approximates unity. This is a definite confirmation of monetarist conviction that in the long-run the growth of price is proportional to the growth of nominal money supply assuming other variables do not change.

³ See Kmenta (1971), p.444 for the approximation of the standard errors

That is, in the long-run there is a one to one relationship between the growth of money supply and price level.

Considering the short-run government expenditure function, the partial income elasticity of expenditure is unity and statistically significant at one per cent level. Previous year real government expenditure is also statistically significant at the 5 per cent level and has a positive impact on current nominal government expenditure.

The coefficient of adjustment of this equation is $d = 0.66807$ ($= 1 - 0.33193$) and suggests that about $2/3$ of the disequilibrium between the desired and actual real expenditure will be eliminated in one year. The mean time lags in the adjustment of real government expenditure to the difference between desired and actual real expenditure in the previous year is $(1 - d)/d = 0.5$ year.

The long-run government expenditure function is

$$\log G_t = -11.3928 + 1.6581 \log y_t + 0.80787 \text{fit} P_t$$

(3.04493) (0.44816)⁴ (0.12723)

From the above function one can observe that the long-run partial income elasticity of government expenditure of 1.658,

⁴ Ibid

is greater than the corresponding short-run elasticity of 1.1. This shows that government expenditure both in the short as well as in the long-run is highly income elastic. It also shows that the growth rate of nominal expenditure in the long-run is higher than the growth of real income. That is, if real income grows by one per cent, the nominal government expenditure will grow by 1.7 per cent given the price level remains constant. This is perhaps due to price effect or because of high government spending resulting from low level of economic development. High level of government spending resulted from the need for education, health, modern communication and infrastructural development. High spending have also arisen from political instability and cyclical draught which have existed during the period under investigation.

Another result observed from the expenditure function estimate is that the price elasticity of nominal government expenditure is 0.80787 and is not statistically different from unity which is in accord to our priory expectation.

With regard to government revenue equation, the short-run partial income elasticity of government revenue is 1.093 and statistically significant at 1 per cent level. Previous year

real revenue was also statistically significant at 1 per cent level and has a significant positive correlation with nominal government revenue.

The adjustment coefficient of revenue equation is $e = 0.58$ and has the mean time lags of 0.71 year in the adjustment of real revenue to the difference between desired and actual real revenue in the previous period.

The long-run function is

$$\log R_t = -12.63 + 1.8685 \log y_t + 0.71232 \text{fit} P_t$$

$$(4.09294) \quad (0.61429)^5 \quad (0.13802)$$

As can be seen, all coefficients are statistically significant at 5 per cent level. The long-run partial income elasticity of government revenue estimated at 1.8685 is greater than the corresponding short-run elasticity of 1.0929 which implies that the government could raise more revenue from the growth of real income in the long-run than in the short-run. The price elasticity with respect to revenue is 0.71232 and it is not statistically different from unity. This indicates that in the long-run nominal government revenue is highly correlated with the growth of the price level.

⁵ Ibid

In the money supply equation, all coefficients have the expected sign and are statistically significant at one per cent level, except for the coefficient of money multiplier b . Thus, the result supports the hypothesis that money supply is likely to increase, the more the revenue falls to cover government expenditure. According to the regression result, a one per cent growth of budget deficit will increase the stock of money supply by $0.52 (= 2.55 - 2.03)$ per cent assuming the other terms remaining constant. Moreover, money supply would also increase, the higher the growth rate of the "E" term which consists of change in foreign exchange reserves, changes in central bank claims on the private sector, and the stock of high power money in the previous period.

The following tables give a summary of the adjustment coefficients, long-run parameters and mean time lags of each equation.

Table 9 Long-run parameter estimates and short-run adjustment coefficients

Price Equation		Government Expenditure Equation	
λ	0.216	d	0.668
a_0	7.57	g_0	-11.393
a_1	-0.947	g_1	0.81
a_2	1.1		
Government Revenue Equation		Money Supply Equation	
e	0.5849	k_0	0.023
t_0	-12.63	k_1	2.55
t_1	1.869	k_2	-2.03
		k_3	0.385

Note: The coefficient of price level in government expenditure and revenue equations initially expected to be unity and has confirmed statistically not different from unity. The coefficient of nominal money supply in the price equation also expected to be unity and has found statistically not different from unity.

Table 10 Average time lags

Money Demand	$(1 - \lambda)/\lambda = 3.6$ years
Government Expenditure	$(1 - d)/d = 0.5$ year
Government Revenue	$(1 - e)/e = 0.71$ year

From the above two government budgetary equation one can observe that the adjustment coefficient of government function, d is 0.67 whereas the adjustment coefficient of revenue function is 0.58. The mean time lag in the adjustment of real government expenditure to the difference between desired and actual real expenditure in the previous year is 0.5 year. On the other hand, the mean time lag to that of revenue equation is 0.71 years. Thus, this comparison confirms

the basic hypothesis of this paper that nominal government expenditure adjust upwardly faster than that of revenue to keep pace with the growth of inflation. This in fact leads to the conclusion that in the short-run the lags structure in government budgetary mechanism would create a deficit in real as well as nominal terms so that two way causation between money supply and inflation hypothesized by Aghevli and Khan has been demonstrated.

The long-run partial income elasticity of real government expenditure ($1.65-0.96=.84$) and revenue ($1.869-0.712=1.157$) are not statistically different from unity as expected. This shows that even if in the long-run the government sets the target of real expenditure and revenue to match, the lag structure in the government budgetary mechanism in the short-run would create a budget deficit in the presence of inflation. That is, even though in the long-run both real government expenditure and revenue move proportionately with real income and inflation, in the short-run the structure in the budgetary mechanism would create budget deficit.

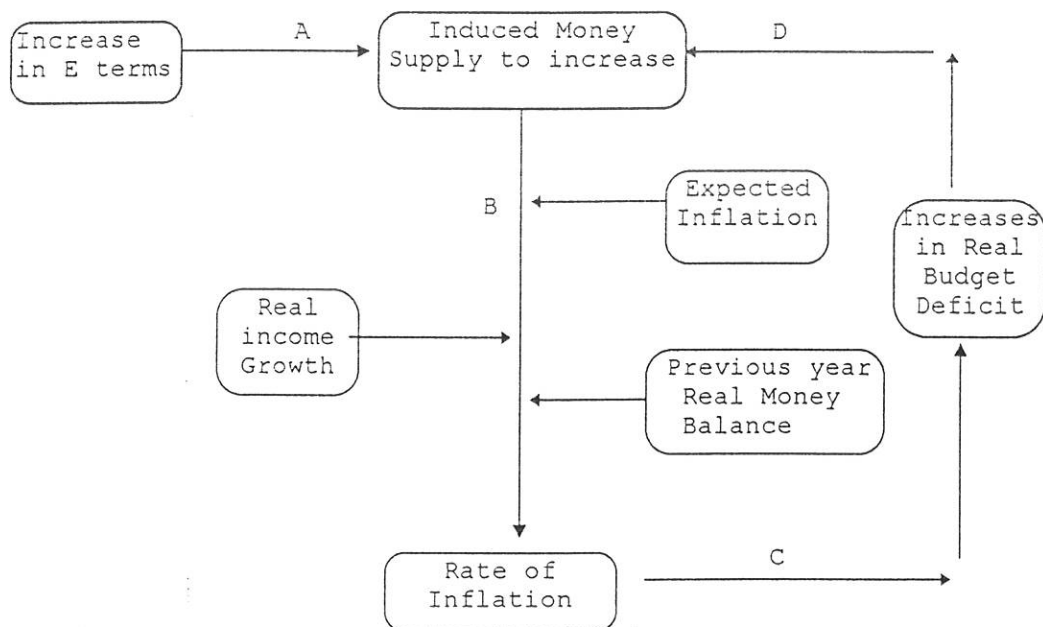
The interaction among budget deficit, money supply and inflation in these systems of equations, therefore, can be illustrated as follows. Suppose money supply increase, say due to an increase in the net foreign exchange earnings (part of E terms). This would raise the price level which in turn pushes

the government expenditure and revenue to rise. But from the estimated result we saw that the adjustment coefficient of government expenditure is greater than to that of revenue which equally means that the growth rate of government expenditure is greater than the growth rate of revenue, so that, government budgetary deficit would increase as a result. The inflated budget deficit in turn pushes the money supply to rise. This in general implies that there is a two way causation between money supply and inflation. One directional cause is from budget deficit to money supply and then to inflation. The other reverse directional cause is from inflation to budget deficit and then to money supply.

6. CONCLUSIONS AND POLICY IMPLICATION

6.1 CONCLUSION

Using Aghevli and Khan (1978) model, a two way causation between money supply and inflation in Ethiopia has been demonstrated. In summary, the self perpetuating inflationary process is shown by the flow chart below. Using the chart ,for example, a rise in E terms leads to a rise in the stock of money supply (line A)⁶. The rise in the stock of money supply



⁶ Note: The E term consists of the change in foreign exchange reserves, changes in central bank claims on the private sector, and the stock of high power money in the previous period.

in turn result an increase in the inflation rate (line B). Empirical evidence demonstrated that while government expenditures rise to keep pace with inflation, government revenues would tend to fall behind in real terms due to long time lags in tax collection so that budget deficit increases (line C). The financing of the inflation - induced deficit would then increase the money supply then the process repeats itself (line D).

Other findings of the study are:

- The monetarist paradigm of sustained inflation resulted from budget deficit by money creation has been empirically confirmed. This is a definite confirmation of monetarist conviction that in the long-run the growth of price is proportional to the growth of nominal money supply.
- Due to the effect of government borrowing and the fluctuation in the net foreign Asset , the Central Bank has been found to have a limitation in conducting an independent monetary policy.

6.2 POLICY IMPLICATION

The main finding of the study is that large and persistence budget deficit has a powerful impact on the growth of money supply and general price level in the country. The Central Bank's ability is also limited to conduct an independent monetary policy since it cannot control the credit requirement of the government and external influence such as the changes in net foreign asset. Thus, without implementing effective fiscal policy, macro-economic stability could not be realized. Therefore, the policy implications of the result of the investigation are:

- Controlling inflation requires a deliberate action by the government to eliminate budgetary deficit and increases budgetary surplus in any way possible.
- Moreover, to control inflation, more attention has to be given to reducing time lags in tax collection. This requires a policy aimed at reducing the legal lag to some 'optimal' level, and the delinquency lag to zero. This delinquency lag can be eliminated by stiff penalties applied on top of tax payments adjusted for the price change that has occurred during the delay. Stiff penalties alone are not sufficient since what

appears to be a stiff penalty when the rate of inflation is low may become insignificant when the rate of inflation becomes very high. Thus, other measures like indexation of payments in addition to the penalties may be required. Fiscal prudence and effectiveness are also indicated in improved tax administration.

- To bring down budget deficit, fiscal authority needs to install fiscal discipline and accountability in the use of public funds. The correct and timely recording and auditing of expenditure are an integral part of proper fiscal control. Such accounts would be reliable and can serve as the basis for rational public expenditure planning and budgeting system.
- Moreover, to bring down budget deficit, reducing defence expenditure which account for a substantial share in total government expenditure has to be a forefront task of the government. This in fact requires political stability and reconciliation in every corner of the country.

- It is also necessary to reform the National Bank of Ethiopia and its operation in order to reduce its subordination to the Ministry of Finance and to increase its independence. This would allow the National Bank of Ethiopia to limit banking system credit to the government and thus forcing the government to strengthen its fiscal discipline. However, this is a complicated issue given that other source of financing budget deficit, like Open Market Operation, are limited. Therefore, there is a need for a further study to determine to what extent the National Bank of Ethiopia should have independence.

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Annex I

Components and Determinant of Money Supply								COG	COS	OTHS
YEAR	C	D	M1	QM	M2	NFA	DC			
1964	221.7	81.6	303.3	68.2	371.5	180	211.6	54.1	157.5	-20.1
1965	253.9	96.2	350.1	71.4	421.5	214.2	240	47.1	192.9	-32.7
1966	267.5	96.2	363.7	85.7	449.4	206.6	269.9	40.7	229.2	-27.1
1967	250.7	105.3	356	100.3	456.3	162.7	319.8	78.1	241.7	-26.2
1968	273.7	110	383.7	125.2	508.9	170.6	383.9	96.5	287.4	-45.6
1969	319.2	112.6	431.8	150	581.8	181.8	444.1	119.6	324.5	-44.1
1970	323.2	104.7	427.9	186.6	614.5	139.5	523.7	109.4	414.3	-48.7
1971	303.8	104.8	408.6	214.6	623.2	117.7	557	108.6	448.4	-51.5
1972	339.5	114.8	454.3	265.2	719.5	203.5	593.8	123.7	470.1	-77.8
1973	403.8	179.1	582.9	363.3	946.2	421.6	603.5	112.6	490.9	-78.9
1974	532.9	161.5	694.4	380.7	1075.1	611.3	634.6	64.8	569.8	-170.8
1975	689	194	883	301.8	1184.8	618.7	754	259.3	494.7	-187.9
1976	810.2	282.6	1092.8	329	1421.8	762.2	983.2	407.5	575.7	-323.6
1977	696.6	299.7	996.3	471.6	1467.9	810.4	1085.3	443.1	642.2	-427.8
1978	857.3	329.9	1187.2	495	1682.2	475.5	1668.4	766.3	902.1	-461.7
1979	952	430	1382	506.7	1888.7	296.5	2067.9	862.3	1205.6	-475.7
1980	1062.8	435.8	1498.6	610.2	2108.8	366.3	2451.3	972.7	1478.6	-708.8
1981	1027.1	688.2	1715.3	662.3	2377.6	230.1	2629.6	1108.3	1521.3	-482.1
1982	1129.8	762.4	1892.2	751.5	2643.7	330.5	2788.8	1057	1731.8	-475.6
1983	1258.2	922.2	2180.4	860.1	3040.5	224.1	3668	1979.4	1688.6	-851.6
1984	1282.9	1096.4	2379.3	1004.1	3383.4	136.4	4092.2	2293.4	1798.8	-845.2
1985	1358.5	1333.6	2692.1	1156.9	3849	232.2	4477.6	2620.7	1856.9	-860.8
1986	1593.1	1587.7	3180.8	1268.7	4449.5	579.2	4829.6	2766.9	2062.7	-959.3
1987	1743.5	1820	3563.5	1245.3	4808.8	535.6	5554.3	3206.7	2347.6	-1281.1
1988	1908.3	2002.5	3910.8	1327.9	5238.7	152.3	6293.8	3502.3	2791.5	-1207.4
1989	2181.8	1992.6	4174.4	1530.6	5705	199.6	6790	3886.7	2903.3	-1284.6
1990	2736.3	2253.7	4990	1718.2	6708.2	46.5	7972	5027.4	2944.6	-1310.3
1991	3820.8	2314	6134.8	1827.4	7962.2	288.3	8930.3	6045.3	2885	-1256.4
1992	4315.9	2529.4	6845.3	2165.7	9011	408.7	10105.9	7033.6	3072.3	-1503.6
1993	4885	2826.9	7711.9	2810.1	10522	809.3	12166.7	7824.8	4341.9	-2454
1994	5158.9	3214.3	8373.2	3225.5	11598.7	3605.4	12789	9615.9	3173.1	-4795.7
1995	5843.3	4065.8	9909.1	4093.9	14003	4658.6	13873.4	9024.1	4849.3	-4529
1996	5656.9	4260.5	9917.4	5737.4	15654.8	6230.8	15410.7	7888.1	7522.6	-5986.7
1997	5176.3	4847.7	10024	6524.8	16548.8	5625.6	16446.1	7942.2	8503.9	-5522.9

Source: National Bank of Ethiopia Annual Report

C = Money in circulation
D = Demand Deposit
M1 = C + D
QM = Quasi Money
M2 = M1 + QM (or NFA + DC + others)
NFA = Net Foreign Asset
DC = Domestic credit
COG = Claim on central government
COS = Claim on other sectors

Annex II

Year	REVENUE	EXPEND.	DEFICIT	GDP	Deflator	DEFENCE	CPI	Inflation
1965	297.7	356.5	-58.8	5054.9	0.63	95.9	128.40	
1966	330.2	470.6	-140.4	5256.8	0.65	118.6	126.80	-1.25
1967	369.9	493.3	-123.4	5474.9	0.66	95.5	127.80	0.79
1968	385.8	542.2	-156.4	5680.2	0.68	86.8	128.00	0.16
1969	405.4	531.6	-126.2	5909.1	0.69	86.8	129.80	1.41
1970	429.1	585.2	-156.1	6123.6	0.73	85.3	143.00	10.17
1971	466	631.5	-165.5	6376.9	0.74	87.4	143.70	0.49
1972	494.7	671.7	-177	6666.1	0.70	92.8	135.00	-6.05
1973	556.2	716.2	-160	6833.9	0.74	96.0	147.00	8.89
1974	618.1	777.4	-159.3	6928.6	0.80	105.8	159.70	8.64
1975	711.6	1048.9	-337.3	6927.7	0.80	184.9	170.10	6.51
1976	781	1200.5	-419.5	7048.3	0.85	315.6	218.10	28.22
1977	1011.2	1344.4	-333.2	7123.2	0.96	383.2	255.10	16.96
1978	1187.2	1696.5	-509.3	7032	1.04	703.4	291.60	14.31
1979	1381.5	1846	-464.5	7431.2	1.08	627.6	338.40	16.05
1980	1567.5	2137.9	-570.4	7854.6	1.09	695.7	353.50	4.46
1981	1757.1	2296.4	-539.3	9986.2	1.00	727.1	375.20	6.14
1982	1876.6	2649.61	-773.01	10082.1	1.04	835.6	396.10	5.57
1983	2174.5	3807.8	-1633.3	11114.9	1.07	1062.3	394.50	-0.40
1984	2293.9	3198.1	-904.2	10539.2	1.03	939.1	429.80	8.95
1985	2323.3	3924.7	-1601.4	9503.8	1.37	926.5	509.40	18.52
1986	2806.1	4131.2	-1325.1	10424.7	1.30	929.4	459.40	-9.82
1987	2925.9	4137	-1211.1	11827.2	1.22	1011.1	448.30	-2.42
1988	3401	4997.35	-1596.35	11832.8	1.26	1350.7	480.00	7.07
1989	3899.2	5890.7	-1991.5	11872.4	1.33	1674.0	517.60	7.83
1990	3238.4	5369.2	-2130.8	12283.6	1.37	1871.7	544.20	5.14
1991	2733.3	5025.7	-2292.4	11620.1	1.45	1646.0	738.70	35.74
1992	2259.7	4256.9	-1997.2	10171.6	1.87	634.0	816.40	10.52
1993	2989	5156.7	-2167.7	11724.4	1.70	677.7	845.30	3.54
1994	3833	7983.1	-4150.1	11910.3	2.12	663.0	909.50	7.59
1995	5841.3	8551.5	-2710.2	12532.2	2.13	772.1	1000.6	10.02
1996	6839.8	10024.7	-3184.9	14120.1	2.29	761.1	946.00	-5.46
1997	7392.07	10923.4	-3531.33	15015.1	2.45	786.6		

Source: Ministry of finance, Budgetary Revenues and Expenditure.
 Ministry of Economic Development and Co operation
 Central Statistical Authority (CSA)

GDP = Gross Domestic Product at constant factor cost
 CPI = Consumer Price index

Ordinary Least Squares Estimation

```

*****
Dependent variable is LogP
24 observations used for estimation from 1973 to 1996
*****
Regressor      Coefficient      Standard Error      T-Ratio[Prob
C              1.6356          2.3099              .70809[.487
Logy          -.20445         .31391              -.65131[.523
EXPINF        .23740          .46176              .51411[.613
[LogM-LogP](t-1) -.78393         .24699              -3.1739[.005
fitM          .96626          .12263              7.8794[.000
*****
R-Squared      .95313          F-statistic F( 4, 19) 96.6049[.000
R-Bar-Squared .94327          S.E. of Regression   .1335
Residual Sum of Squares .33869         Mean of Dependent Variable 6.053
S.D. of Dependent Variable .56055         Maximum of Log-likelihood 17.074
DW-statistic  1.7884
*****

```

Diagnostic Tests

```

*****
* Test Statistics * LM Version * F Version
*****
* A:Serial Correlation *CHI-SQ( 1)= .10776[.743]*F( 1, 18)= .081181[.779
* * * * *
* B:Functional Form *CHI-SQ( 1)= 2.8161[.093]*F( 1, 18)= 2.3928[.139
* * * * *
* C:Normality *CHI-SQ( 2)= 1.3898[.499]* Not applicable
* * * * *
* D:Heteroscedasticity *CHI-SQ( 1)= 2.3039[.129]*F( 1, 22)= 2.3361[.141
*****

```

A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values
 EXPINF = Expected Inflation

Ordinary Least Squares Estimation

```

*****
Dependent variable is logG
30 observations used for estimation from 1967 to 1996
*****
Regressor          Coefficient          Standard Error          T-Ratio[Prob
C                  -7.5778                2.5785                  -2.9388[.007
logy              1.0955                .37435                  2.9265[.007
[logG-logP](t-1) .33193                .18187                  1.8251[.079
fitP              .80787                .12723                  6.3498[.000
*****
R-Squared          .97632                F-statistic F( 3, 26) 357.3162[.000
R-Bar-Squared     .97359                S.E. of Regression    .1545
Residual Sum of Squares .62099          Mean of Dependent Variable 7.684
S.D. of Dependent Variable .95093        Maximum of Log-likelihood 15.596
DW-statistic      2.1083
*****

```

Diagnostic Tests

```

*****
*          Test Statistics          *          LM Version          *          F Version          *
*****
*          *          *          *          *          *          *
* A:Serial Correlation *CHI-SQ( 1)= .17642[.674]*F( 1, 25)= .14789[.704
*          *          *          *          *          *          *
* B:Functional Form   *CHI-SQ( 1)= .42064[.517]*F( 1, 25)= .35552[.556
*          *          *          *          *          *          *
* C:Normality        *CHI-SQ( 2)= 3.4773[.176]*          Not applicable
*          *          *          *          *          *          *
* D:Heteroscedasticity *CHI-SQ( 1)= .067812[.795]*F( 1, 28)= .063434[.803
*****

```

A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Ordinary Least Squares Estimation

```

*****
Dependent variable is logR
30 observations used for estimation from 1967 to 1996
*****
Regressor      Coefficient      Standard Error      T-Ratio[Prob
C              -4.9626          2.5295              -1.9619[.061
logy          .73151          .37372              1.9574[.061
[logR-logP](t-1) .51821          .15540              3.3347[.003
fitP          .83579          .13306              6.2814[.000
*****
R-Squared      .97586          F-statistic F( 3, 26) 350.3553[.000
R-Bar-Squared .97308          S.E. of Regression .1438
Residual Sum of Squares .53770          Mean of Dependent Variable 7.294
S.D. of Dependent Variable .87641          Maximum of Log-likelihood 17.756
DW-statistic  1.1500
*****

```

Diagnostic Tests

```

*****
*      Test Statistics      *      LM Version      *      F Version
*****
*
* A:Serial Correlation *CHI-SQ( 1)= 5.7670[.056]*F( 1, 25)= 5.9495[.022
*
* B:Functional Form    *CHI-SQ( 1)= .5189E-4[.994]*F( 1, 25)= .4324E-4[.995
*
* C:Normality          *CHI-SQ( 2)= .80882[.667]*      Not applicable
*
* D:Heteroscedasticity *CHI-SQ( 1)= .84127[.359]*F( 1, 28)= .80784[.376
*****

```

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

Cochrane-Orcutt Method AR(1) Converged after 5 iterations

Dependent variable is logR
 30 observations used for estimation from 1967 to 1996

Regressor	Coefficient	Standard Error	T-Ratio[Prob
C	-7.3852	2.5668	-2.8772[.008
logy	1.0929	.37313	2.9289[.007
[logR-logP](t-1)	.41510	.20308	2.0440[.051
fitP	.71232	.13802	5.1611[.000

R-Squared	.97973	F-statistic F(4, 24)	290.0444[.000
R-Bar-Squared	.97635	S.E. of Regression	.1309
Residual Sum of Squares	.41146	Mean of Dependent Variable	7.294
S.D. of Dependent Variable	.87641	Maximum of Log-likelihood	20.553
DW-statistic	1.6942		

Parameters of the Autoregressive Error Specification

U= .47386*U(- 1)+E
 (2.3260)[.028]

T-ratio(s) based on asymptotic standard errors in brackets

Ordinary Least Squares Estimation

```

*****
Dependent variable is logM2
30 observations used for estimation from 1967 to 1996
*****
Regressor          Coefficient          Standard Error          T-Ratio[Prob
C                  .023458              .19074                  .12299[.903
fitG              2.5499              .69445                  3.6718[.001
fitR              -2.0301             .66968                  -3.0315[.006
logE              .38469              .10253                  3.7519[.001
logB              .39364              .30258                  1.3010[.205
*****
R-Squared          .99193              F-statistic F( 4, 25)  767.8603[.000
R-Bar-Squared     .99063              S.E. of Regression     .1033
Residual Sum of Squares .26726          Mean of Dependent Variable 7.837
S.D. of Dependent Variable 1.0684          Maximum of Log-likelihood 28.242
DW-statistic      1.9311
*****

```

Diagnostic Tests

```

*****
* Test Statistics *          LM Version          *          F Version
*****
* A:Serial Correlation *CHI-SQ( 1)= .3879E-4[.995]*F( 1, 24)= .3103E-4[.996
*
* B:Functional Form    *CHI-SQ( 1)= .0080533[.928]*F( 1, 24)= .0064444[.937
*
* C:Normality          *CHI-SQ( 2)= .26440[.876]*          Not applicable
*
* D:Heteroscedasticity *CHI-SQ( 1)= .38152[.537]*F( 1, 28)= .36068[.553
*****

```

A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Ordinary Least Squares Estimation

```

*****
Dependent variable is INF
24 observations used for estimation from 1973 to 1996
*****
Regressor          Coefficient          Standard Error          T-Ratio[Prob
FITINF             .94605                .12474                  7.5843[.000
INF(-1)           .055347               .11335                  .48828[.630
*****
R-Squared          .61357                F-statistic F( 1, 22)   34.9307[.000
R-Bar-Squared     .59600                S.E. of Regression     .05507
Residual Sum of Squares .066727              Mean of Dependent Variable .08190
S.D. of Dependent Variable .086646              Maximum of Log-likelihood 36.567
DW-statistic      2.1175                Durbin's h-statistic   -.34598[.729
*****

```

Diagnostic Tests

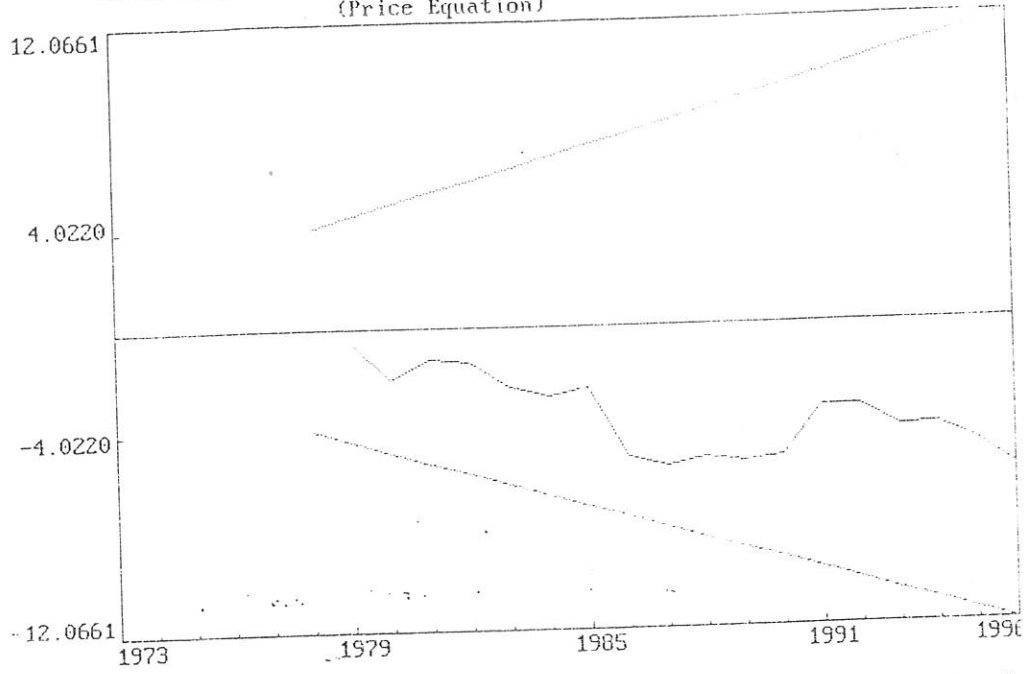
```

*****
*      Test Statistics      *      LM Version      *      F Version
*****
*      *
* A:Serial Correlation *CHI-SQ( 1)= .12009[.729]*F( 1, 21)= .10561[.748
*      *
* B:Functional Form    *CHI-SQ( 1)= .28897[.591]*F( 1, 21)= .25593[.618
*      *
* C:Normality         *CHI-SQ( 2)= .15153[.927]*      Not applicable
*      *
* D:Heteroscedasticity *CHI-SQ( 1)= 1.1153[.291]*F( 1, 22)= 1.0722[.312
*****

```

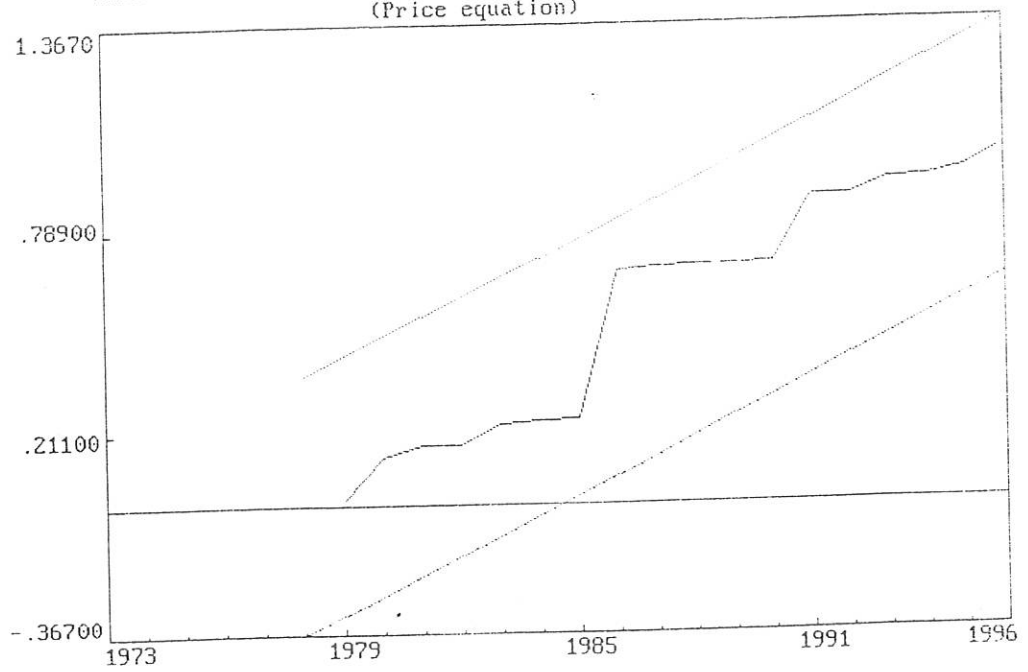
A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Annex VIII Plot of Cumulative Sum of Recursive Residuals
(Price Equation)

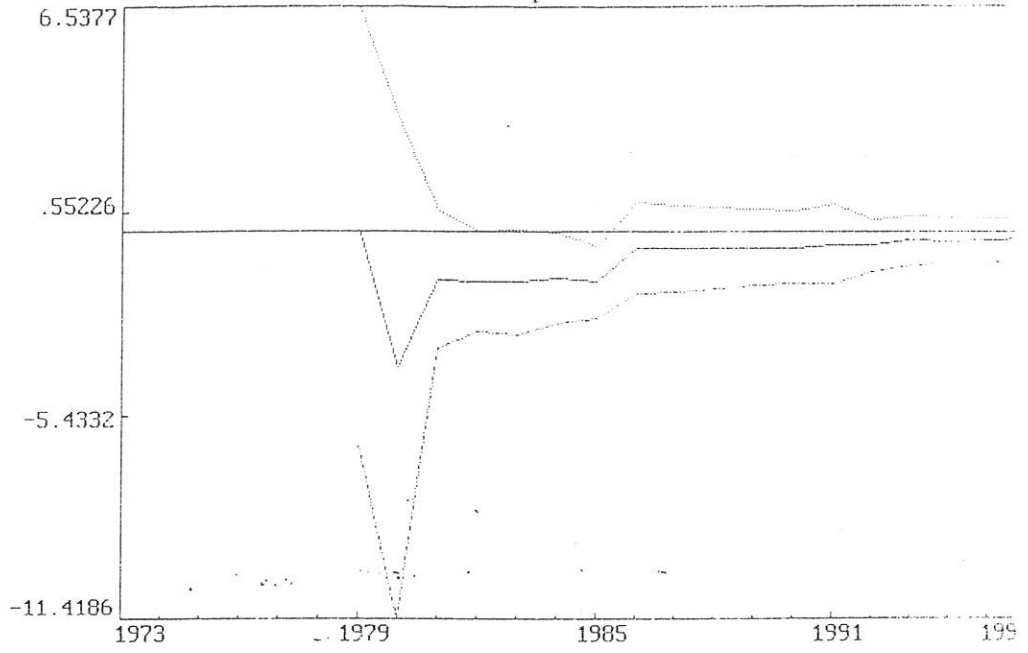


The straight lines represent critical bounds at 5% significance level

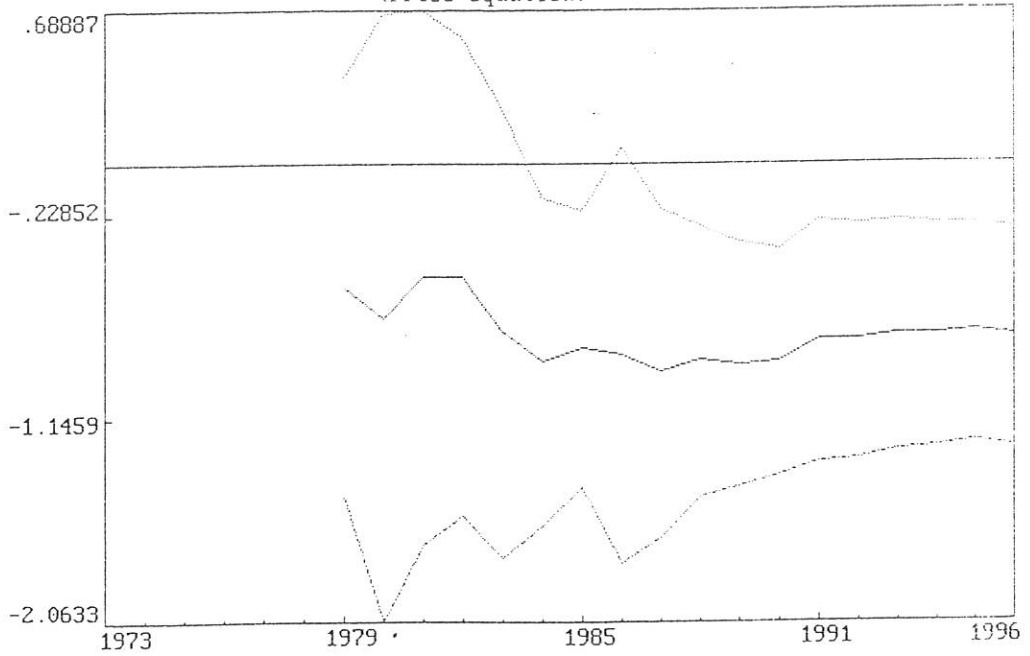
Annex VIII Plot of Cumulative Sum of Squares of Recursive Residuals
(Price equation)



Annex UU Coef. of $\log Y$ and its 2 S.E. bands based on recursive OLS (Price equation)

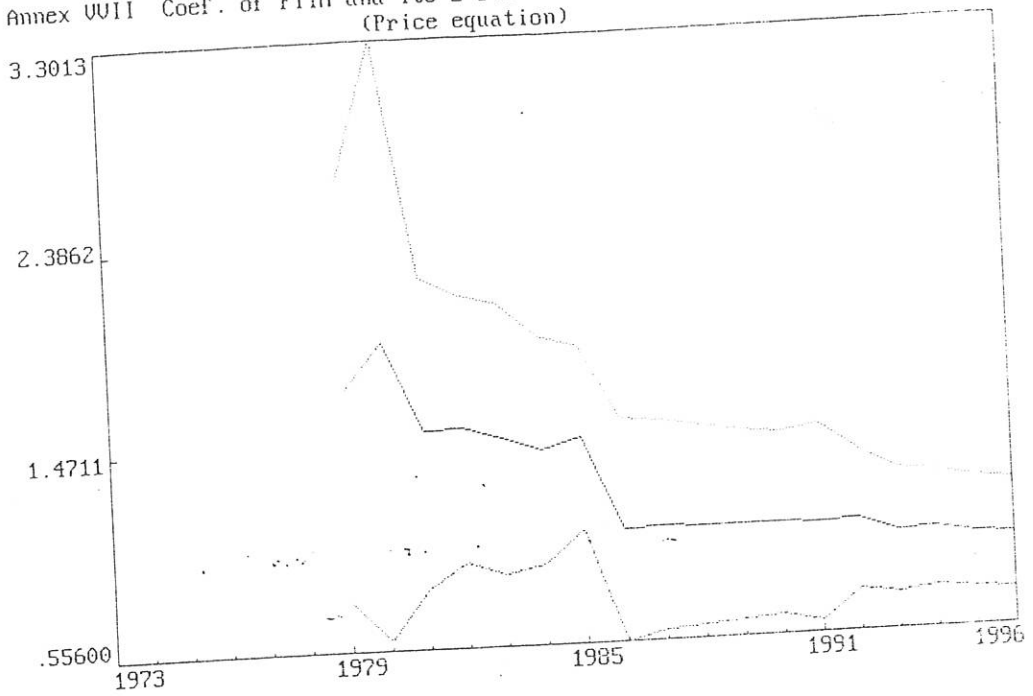


Annex UUI Coef. of $LMP(-1)$ and its 2 S.E. bands based on recursive OLS (Price equation)

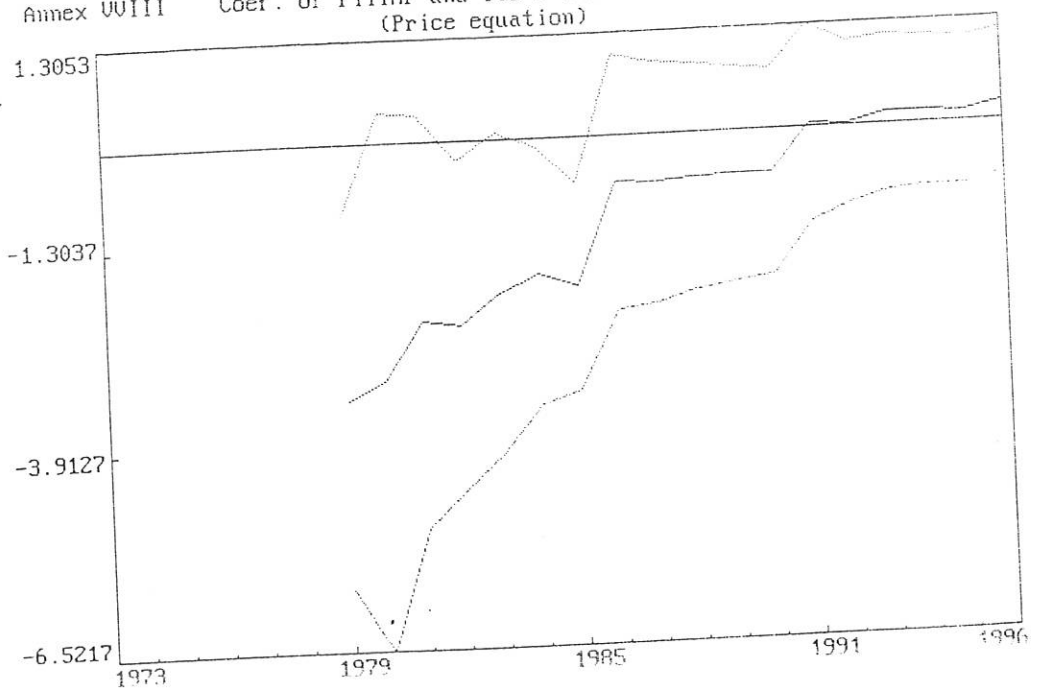


$$LMP(t) = (1 - \alpha) Y(t) + \alpha LMP(t-1)$$

Annex VII Coef. of FITM and its 2 S.E. bands based on recursive OLS
(Price equation)



Annex VIII Coef. of FITINF and its 2 S.E. bands based on recursive OLS
(Price equation)



DECLARATION

I, the undersigned, declare that this thesis is my work and has not been presented for a Degree in any other university

Name: Demirew Getachew

Signature: 

Place: Addis Ababa University

Date: JUNE, 1998