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THE BEHAVIOUR OF MONEY SUPPLY IN ETHIOPIA

(1964/65-2003/04)

BY

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**ADDIS ABABA UNIVERSITY
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**The Behaviour of Money Supply in Ethiopia
(1964/65-2003/04)**

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ACRONYMS*

B = Base money or high powered money

cd = currency to deposit ratio

CPI = Consumer Price Index

DC = Domestic Credit (a summation of DCP and NDCG, claim by the banking system)

DCP = Domestic Credit to the Private sector (claim by the banking system)

DR = Deposit interest Rate (nominal)

EX = Exchange rate (nominal)

FX = Foreign Exchange receipts

GDP = Gross Domestic Product

LR = Lending interest Rate (nominal)

m = money-multiplier

NDCG = Net Domestic Credit to the Government (claim by the banking system)

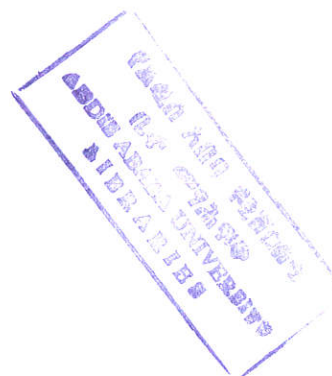
NFA = Net Foreign Asset (claim by the banking system)

NGDP = Nominal Gross Domestic Product

OIN = Other Items Net (of the banking system)

rd = reserve to deposit ratio

TOT = Terms of Trade



*Refers to abbreviations that are used in the study

Abstract

This paper has aimed to examine three important things: i) to identify the determinants of money supply in Ethiopia over the period 1964/65Q1-2003/04Q4, ii) to review the stability of the money-multiplier so as to respond to the question of whether money supply can be controlled and be correctly predicted using the money multiplier approach. And iii) to see the effectiveness of monetary policy after the reform period of 1992 with regards to given targets. Based on these objectives, the study used the money-multiplier approach of money supply determination and found that money supply is related significantly with base money through the money-multiplier. However, the money-multiplier is found unstable and moved inversely with the movements of base money indicating that the control of money supply and correctly predicting its changes is questionable. Also from actual versus target comparison, the target for domestic credit to the government was not able to be achieved although money supply and total domestic credit were near their respective targets suggesting that monetary policy wasn't able to achieve its objectives effectively. After identifying the inappropriateness of the money-multiplier model of money supply determination, the paper used the disaggregated counter parts approach of money supply determination and found that money supply is determined by nominal income, price level, foreign exchange receipts, lending interest rate, nominal exchange rate and overall domestic credit expansion. Moreover, money supply is found to be influenced by seasonal fluctuations and political instabilities. This indicates that factors such as foreign exchange receipts might limit the control monetary authorities have over money supply. Especially, the nonexistence of a well developed secondary market and the non-monetization of the economy might impose serious constraints on the implementation of monetary policy in Ethiopia.

Key words: Money supply, Money-Multiplier, Asset Counterparts, Stability, Ethiopia

Chapter One: Introduction

1.1 Background of the Study

When the Derg regime came into power in 1973/74, one part of the move to the centrally planned economy was nationalizing the emerging private banks and insurance companies (Eshetu & Mekonen 1992, Gebrehiwot 1999). Monetary policy was designed to serve the target of the central plan¹ (PMGE, 1974, 1984) and hence the largest portion of bank credit was diverted to the public sector (Gebrehiwot 1999, PMGE 1984). As the main objective was socialization, the private sector was marginalized from getting bank loan and the bulk of investment decisions were made within the public sector (Tsegaye, 1992) as was asserted in the ten year perspective plan of the then government in 1984:

“Prior to the revolution, the activities of financial institutions were urban-biased and largely served the private sector of the economy.... The granting of loans and credit by banks depended upon the size and quality of collateral, ...rather than the impact of the activities on productivity and economic growth.... After the revolution, The condition for credit is no longer the availability and quality of collateral but the justification of the activity for which credit is sought that it will promote economic growth. Priority in allocation is accorded to the state and cooperatives sectors.” (PMGE, 1984, p.187)

In consequence, a large part of production remained in the hands of state enterprises and the private sector development, which had started flourishing in the previous regime, was greatly hindered (Tsegaye 1992, Admit & Getachew 1996). All private enterprises at medium and large scale levels and all industrial activities were nationalized. Monetization² of the budget deficit was rationalized as being resource supplement for plan implementation, which is for example, indicated in the ten-year plan:

“The operation of banks and insurance services are expected to generate the necessary funds for domestic credit expansion envisaged in the ten year plan. ...Regarding the use of these resources, the plan envisages that close to 73 per cent of the cumulative credit

¹ Can be also referred from Negarit Gazeta No.99/1976

² Monetization of the budget deficit refers to a situation where a central bank gives money to the government either in the form of direct advances or by buying bonds so that the government finances its deficit by the additional money supply injected into the system.



expansion would be allocated to state, cooperatives, and private enterprises.... The remaining 27.3 per cent is expected to be extended to the central government, in the form of direct advances, T-bills and bond purchases.” (PMGE, 1984, pp.192-193)

And the impact of this monetization on the price level was ignored, and hence giving priority to achieve planned growth targets by considering inflation only as a secondary matter that can be managed with increased production as a result of plan implementation, and price controls. For example from 1989/90-1990/91, broad money grew significantly by 18.1 percent as a result of bank financing of the fiscal deficit (TGE, 1992). From 1974/75 to 1989/90, the increase in broad money supply was 5.8 fold, and its share in GDP rose from 20.7 per cent to 53.3 per cent. During the same period the components of broad money, quasi money and narrow money showed an increase of 5.4 fold and 6.0 fold respectively. The major factor for this growth was the dramatic expansion of domestic bank credit that increased almost eleven fold during the same period, rising from 13.4 per cent of GDP at the beginning of the period to 63.3 per cent at the end of the seventeen years where its share over broad money increased from 62.7 per cent to 112.2 per cent. And this expansion was in turn largely influenced by a 24-fold increase in government’s share of total domestic credit. This share increased from 28.3 per cent in 1974/75 to 63.1 per cent in 1989/90, which is inconsistent with the growth rate of production (Eshetu & Mekonen, 1992).

At this period, all prices (to mean interest rate, exchange rates, and prices of commodities) were administratively fixed. Moreover, salaries of civil servants earning more than Birr 636 a month and employees of public enterprises earning more than Birr 650 a month were frozen (PMGE, 1984). As a result of these income and price policies, and due to good performance of agriculture in certain years, although a stagnant economy, with growing monetization of budget deficit would be expected to generate inflationary pressure, Ethiopia had been a low inflation country. The inflation rate during the seventeen years ending 1990/91 averaged about 9 per cent (TGE, 1992). The average annual rate of inflation for Sub Saharan Africa was 19 per cent during 1980-89 while for Latin American and the Caribbean inflation rate was 160.7 per cent during the same period (Eshetu & Mekonen, 1992).

In general in this period economic sectors lost their management autonomy and the development of financial markets and institutions was curtailed. This is in agreement with Furness' (1975) observation regarding financial institutions and financial markets development in different economies. Furness argues that in centrally planned economies, financial assets, markets and banks or intermediaries have very minimal role than in market oriented free economies. This resulted from the mechanism of resource allocation in those planned economies in that in these economies it is in relation to state plan and not in relation to profitability is scarce resources allocated. (Furness, 1975)

These policy actions together with recurrent draughts and intensified civil war were held responsible for the sluggish economic performance and macro economic instability observed during the period (Eshetu & Mekonen 1992, GE 1998). Real GDP growth averaged about 1.9 per cent, from 1974/75-1990/91, while the population grew by 2.9 per cent per annum. The current account deficit deteriorated, while the stock of external debt amounted to SDR 6.4 billion, 127 per cent of GDP by the end of 1990/91 (TGE, 1992). However, sluggish economic performance and macro economic instability was not a peculiar phenomenon that occurred only in Ethiopia, other developing countries too had faced increasing BOP deficit, inflationary pressure and sluggish economic growth during the 1970's and 1980's (World bank, 1994). Following this negative development, these countries in distress had to revise their economic policies and consider the adjustment programs of the IMF and the WB Structural adjustment program (SAP) (World bank, 1994).

According to the adjustment program, those countries have to revise their economic policy to reduce the misalignment between aggregate demand and supply using both demand side and supply side policies. Supply side policies emphasize on removing structural rigidities on production that triggers supply response, while the demand side policies are aimed at reducing excess demand by affecting expenditure. Excess demand can be managed by following tight monetary policy, among others (Khan, 1987). Hence these economies at crisis, according to the program, have to follow tight monetary policy as a controlling element of monetary expansion through monetary targeting.

So the first step of the new government, which took power in 1990/91, was to adopt a market based economy and begin the implementation of a comprehensive macro-economic and structural reform in October 1992 with the support of the IMF and WB as well as other multilateral and bilateral donors (TGE, 1992). Adjusting the macro economic imbalance and fostering sustainable economic growth was the main agenda of the liberalization process (TGE, 1992). Policy measures were taken to improve the external sector imbalance, to liberalize trade and financial sector, and to remove fiscal and real sector constraints (GE, 1998). New monetary and banking law was promulgated in 1994³, which allowed private participation for nationals. And following this proclamation six private banks, twenty three Micro Financial Institutions and eight insurance companies have emerged which work with the existing two public commercial banks, one specialized bank and a government owned insurance company.⁴

The new monetary policy took net domestic assets and government credit as a major target to achieve the twin objectives of growth and price stability. As put in the policy framework paper of October, 1992:

“The objective of monetary policy will be to ensure domestic liquidity expansion that allows for reasonable credit growth to meet the needs of the productive sectors, particularly the private sector, while reducing domestic inflation and pressures on the balance of payments. Attainment of this objective will require a significant cut back in credit to the government.” (TGE, 1992, p.7)

Growth in money supply is aimed to be consistent with nominal GDP growth. And the control of money and credit is assumed to be achieved through direct control of domestic credit to the government and Open market type operations⁵ (OMO) (TGE, 1992). However, ceiling on credit to the government is programmed to be replaced by indirect control methods such as, OMO with public securities. Although the instrument OMO is not used in its standard sense, steps are taken to lay foundation by developing T-bills market which is operational biweekly with maturities of 28, 91, and 180 days. Yet OMO type operations didn't develop so as to replace

³ Can be referred from Negarit Gazeta, No, 83/1994

⁴ Can be referred from the National Bank of Ethiopia quarterly and annual bulletins

⁵ OMO refers to the purchase and sale of bonds and bills by the central bank to the public and other financial institutions

direct controls; and no other feasible indirect control substitute existed, mainly due to the under development of secondary markets.⁶ Efforts are taken to facilitate the transition from direct monetary instrument to indirect ones and to develop financial markets; the introductions of Treasury bill auction (OMO), inter bank money market and discount window facility are some examples.

Discriminatory interest rate between sectors is abandoned while differentiation is to be based on only maturity. Ceiling on lending interest rate is fully liberalized while the minimum deposit rate is still under control of the National Bank of Ethiopia (TG, 1998). The major emphasis of interest rate policy has shifted into increasing saving mobilization, controlling inflation, maintaining positive real interest rate and increasing productive efficiency (TG, 1998). Another monetary policy shift is pursuing the objective of reducing monetization of budget deficit in order to lower inflation pressure. This is supposed to be achieved by depending on non-inflationary sources of finance such as the non-bank public through sale of T-bills. In general those policy measures have been trusted to bring macro economic stability and to end the sluggish growth of the economy by improving the workings of the private sector (TG, 1998).

1.2 Statement of the Problem

There is now a general consensus that monetary authorities in developing countries should control the supply of money. This is especially strengthened by the fact that in those countries the Keynesian transmission fails to work due to the thinness of financial markets (Khan and Knight, 1981). This makes the quantity theory of money attractive. However, monetarism as a tool of monetary policy rests on two preconditions in that the demand for money function should be stable and the money supply controllable (Bolnick, 1975). There are a number of literatures done in many countries emphasizing on the money demand function and its stability assuming the money supply as an exogenous policy variable, which can effectively be controlled by the monetary authorities. There is, however, an ongoing debate among monetarists and non-monetarists regarding the monetary authorities' ability to control the money supply.

⁶ Secondary market refers to the sale of bonds and securities (T-bills) already issued for a second time.

According to monetarists, monetary authorities can have effective control over the supply of money. They argue that the behavioral pattern of the public and the banking system are stable and predictable enough to allow the monetary authorities control the stock of money. Others, on the other hand, argue that the determination of the stock of money is part of the simultaneous solution for all variables in the financial and real sectors of the economy.

Brunner and Meltzer (1972), for example, while criticizing Friedman's monetary theory, argued that the stock of money can be expressed as a function of a few variables such as income and interest rate and hence money supply is an endogenously determined variable in macro economic models of nominal income. Shetty (1990) describes this development as follows:

"New fluctuating relationships between monetary and real variables have given rise to fresh debate regarding the causality between money, output and prices, that causality is not uni-directional, that money stock does adjust to price changes, that bi-directional causality does exist between money and nominal income." (p.355)

Specifically, some authors also have doubted the ability of monetary authorities control on money supply in developing countries under conditions of limited capital markets, fixed exchange rate regime, large non-monetized sector, fluctuating exports and exchange inflows (Furness, 1975, Shetty, 1990). For example, Yohannes (1996) indicated in his study of "Foreign Exchange Inflow as a challenge to Monetary policy---" that foreign exchange inflows can have impact on the ability of monetary control in Ethiopia taking the 1994/95-coffee boom as an example. The significant rise of export proceeds challenged the monetary authorities control over money supply and in consequence to this the general price level rose dramatically.

Hence, apart from checking the demand for money and its stability, there should be studies on the behavior of money supply to identify its determinants and its controllability. Although the monetary authorities' ability to control money supply in developing countries is doubtful, so far research focus in developing countries including Ethiopia has been placed only on analyzing money demand taking money supply as exogenously given variable that does not affect the effectiveness of monetary policy. Alemayehu (1995), in an attempt to study the determinants of money supply empirically estimated the money supply function in Ethiopia using Engle-

Granger two-stage procedure. He used the two approaches of money supply determination, the money-multiplier and the counterparts approach, and concluded that, although the counterparts approach seems appropriate; both approaches can be employed for Ethiopia. However, the annual data set he used (1960-1991) doesn't include the reform program, which started on October 1992. The significant shift in monetary policy objectives, targets and monetary developments after the reform program (1992-2004), makes his findings doubtful to be employed for the current period. What is more, the Johansen methodology is superior to be used especially for the counter parts approach where the number of variables is more than two (Enders, 1995). Although these information and methodological problems should be addressed, so far, no recent study is undertaken on money supply past the reform period. And for this reason, the conduct of money supply, its determinants and its controllability, is an open research agenda that requests to be filled. So in general the purpose of this paper is to study the behavior of money supply by extending the previous work in three important ways. First, money supply and its determinants are formulated as an error correction VAR model and estimated by the maximum likelihood procedure proposed by Johansen (1988) and Johansen and Juselius (1990) in a multivariate setting. Second, the reform period where an important shift in monetary policy has occurred is incorporated. Third, large observations, 160 observations of quarterly series, are used in this study to increase the reliability of results while in the previous study only 31 observations are used.

1.3 Significance of the Study

In the policy reform the objective of monetary policy for stabilization has targeted money supply as a policy tool. Due to this objective, controlling the growth of money supply to be consistent with growth in nominal GDP gives the money stock a significant role in the effort of the growth process, which demands controlling as well as identifying the major determinants of money supply. So, this study tries to identify the major determinants of money supply in Ethiopia using the two broad approaches. And more importantly the study tries to investigate to what extent the objectives, set under the monetary reform program, are achieved in the given period of time. And in general the study reviews the behavior of money supply in Ethiopia and can motivate further research analysis in the area.

1.4 Objective of the Study

The broad objective of the study is to look at the behavior of money supply in Ethiopia. And in line with this broad objective, the study tries to:

- 1) identify the major determinants of money supply
- 2) test the controllability of money supply by checking the stability of the Money -Multiplier
- 3) assess the effectiveness of the reform program regarding monetary targeting.

1.5 Data source

The study uses secondary data, which covers periods from the first quarter of 1964/65 up to the fourth quarter of 2003/04 that will be collected from Ministry of Finance and Economic Development (MOFED), National Bank of Ethiopia (NBE), Central Statistics Authority (CSA) and the International financial statistics database of the IMF.

1.6 Organization of the Study

The study has six chapters; the opening chapter is Introduction and then follows the literature review. The third chapter reviews major monetary developments in the country from 1964/65-2003/04; what is more, the effectiveness of monetary targeting will be discussed in this section. The fourth chapter is allocated for model specification and methodology while the fifth chapter reveals the estimation results and the last chapter concludes the empirical results.

Chapter Two: Literature Review

2.1 Theoretical Literature

2.1.1 Theories of Money⁷

Although how money affects the economy is a matter of debate among economists, there is a general consensus that money, by serving its three uses: a medium of exchange, a unit of account, and a store of wealth, plays a major role in an economy (Brunner & Meltzer 1971, Friedman 1968, and Sachs & Larrain 1993). For example, regarding the uses of money, Friedman (1968), argues that:

“..., money is only a machine, but it is extraordinarily efficient machine. Without it, we could not have begun to attain the astounding growth in output and level of living we have experienced in the past two centuries-any more than we could have done so without those other marvelous machines ...” (p.12)

There are various views regarding the transmission mechanism of monetary policy in its effect on the economy and hence recommendations vary from one school of thought to the other. Although there are many classifications of theories on money supply, the next section tries to review the major developments of monetary theories classified on broader base.

Neutrality Theory of Money

This theory, which is traceable to David Hume, is the origin of the quantity theory of money, and the basis of monetarist school. In Hume's view the quantity theory of money represents only a state of equilibrium. Money was merely a medium for rating labor and commodities with no long-run influence on the stability of an economy, employment and out put even when it is in greater abundance than that necessary for rating of available labor and commodities. However the term in greater abundance is used in a more restrictive manner. Hume also expressed his fright that a flow of gold and silver in greater quantity might have an effect on the situation of neutrality of money and the long-term equilibrium. He observed that in states where the gold flow was large, labor and industry were activated and the price of labor and commodities rose by degrees in proportion to the new quantity of money. His conclusion was

⁷ For detail reading refer Friedman (1969 & 1970), Dennis (1981), Keynes (1936), Onoh (1982), Fischer (1975) and Laidler (2003)

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⁷ For detail reading refer Friedman (1969 & 1970), Dennis (1981), Keynes (1936), Onoh (1982), Fischer (1975) and Laidler (2003)

that the outcome of new money in an economy is constructive only during the time of adjustment from one-long term equilibrium to another.

However the perception of money was based on the rigid “full-bodied” concept of money at the time where transaction media was based on metal or gold, and due to its scarcity, there was little fear that gold become in excess so as to upset monetary equilibrium and to cause instability. Although the credit system existed at the time, metallic money dominated the economy. And due to this restrictive concept of money, and the absence of financial institutions which could create expansive credit, monetary evils were unknown. Therefore Hume couldn’t develop a long-term monetary theory and money was given no long-term role in the economy. The extensive credit system, made possible by the modern concept of money, raises a no of stability problems to Hume’s long term equilibrium.

Later, Wicksell and Koopmans made further contributions in the area of the neutral theory of money. Money is supposed neutral⁸ if a state of monetary equilibrium is achieved in which the market and the natural rates⁹ are equal in a market economy. At the point of neutrality of money, economic variables are believed to behave rationally¹⁰. This recent view rejects the earlier rigid theory of neutral money and considers money as neutral if economic variables are restored to their original values after a state of monetary disturbance caused by extra money injection. At the equilibrium point, when real money balances equal desired money balances, money is supposed to be neutral, however, with the introduction of credit money and deficit financing policies, the amount of money available exceeds the amount of money required for transaction purposes¹¹ and disturbs the monetary equilibrium.

Classical Theories of Money

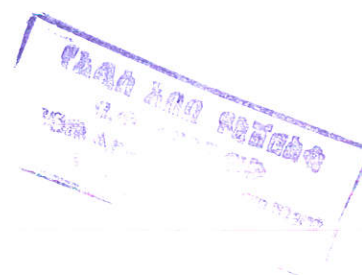
Henry Thornton acknowledged the role of the credit system in an economy. Unlike Hume, whose theory was based on long-term equilibrium and on restricted metal concept of money,

⁸ When money is neutral it has no effect on prices and no influence on economic variables and it only serves as a medium for the rating of labour and commodities.

⁹ The natural rate is a rate which makes the demand for Loan able funds equal with the supply of savings

¹⁰ Rationality in the behavior of variables implies ideal economic decisions and processes with no errors of decision and operations

¹¹ The concept of money balances no longer represents the classical transactions balances rather it includes the concept of speculative balances of the Keynesian type as will be discussed below.



Thornton's was a short-term theory and his monetary concept takes into account the expanding credit system at the time which could no longer be overlooked. He agreed with Hume that the expansion of money has real effects in the short-term, especially in a metal-based currency economy, while he expressed the long-run effect unknown. He argued, however, in an expanding economy, the credit system also expands particularly when the return on capital is positive. Further, he expressed that an economy that can be stimulated through credit expansion can also be contracted if the economy's demand structure is altered and this causes unemployment. Therefore he advocated monetary authorities to pursue a credit management system through the use of monetary instrument of interest rate to control any excessive credit expansion, which can lead to boom and then to slump. He found an indirect link between money supply and prices through the rate of interest in that the rate of interest affects money supply which in turn affects the price level. This linkage between prices, money and interest rates was the basis for Keynes's later work on the general theory of employment, interest and money.

David Ricardo ignored the expanding credit and interest rate systems under his monetary theory. Since he based his theory on metallic money, as Hume did, he did not acknowledge monetary management. In his view, the quantity of money alone determines the level of prices, and has no importance overtime in an economy. Hence, he fixed his theory to the earliest version of the quantity theory while revision was required. Due to his application of the static equilibrium¹² concept, he ignored the short term effect of money on economic activity. He opposed monetary contraction for fear that it would lead to a fall in prices which might slow down business activities. So his recommendation was that any serious fall in transactions money that significantly influences the general price level and in turn profits and employment should be avoided. However, his advice is in contrast to his monetary theory which says only the quantity of money affects the level of price which is not of real importance over time.

John Stuart Mill, like Thornton, considered credit money on a short term basis. For him growth in credit is attached to expansion of trade credit. The expansion of trade calls for a more reliable form of credit and at this point bank credits would serve the expanding trade. However, to

avoid excess expansion of credit and its consequences, like Thornton, he recommended monetary management

Irving Fischer developed his exchange equation on the basis of the quantity theory of the earliest period and although it is not a pure classical quantity theory, it is a version of it which is expressed as follows:

$$PT = MV$$

T = Demand for money in a period (volume of trade)

P = Average price of commodities and factors in a period

M = Average quantity of money in a period

V = Average velocity of money in a period

MV = Supply of money in a period

P is considered as a passive and a dependent variable, V is assumed stable¹³. The demand for money¹⁴ is taken as stable and outside the influence of monetary factors. Money supply (MV) and demand for money (T) determine the level of P. The general price level varies proportionately with the supply of money and inversely with the demand for money. This proportional relationship between general price level and money supply was also the main substance of the older quantity theory, what is original here is the inverse proportional variation of the general price level and the demand for money.

Another version of the quantity theory of money, led by Marshall and Pigou, is the Cambridge equation¹⁵, which is in some respect alike with Fischer's exchange equation. It is specified as follows:

$$M = KOP$$

M = Average supply of money in a period

O = Real income

P = Average price level

K = A fraction of cash balances out of real income

¹² The static equilibrium jumps from one equilibrium point to another without consideration of movements between two equilibria.

¹³ A variable is said to be stable if it changes only gradually over time.

¹⁴ It depends on real factors of production.

¹⁵ This equation is also called the cash balance theory.

KO = Demand for real cash balances in a period

For both the Fischer and the Cambridge equations, equilibrium is attained only when supply of money is equal to the demand for money. Both conclude that prices vary directly and inversely proportional to money supply and money demand respectively. The Cambridge theory assumes that K is constant in a fully employed economy and real income changes only very slowly. Hence the two working variables remain P and M and when M increases P will continue to rise until the demand for money equates the supply of money.

The constancy of this fraction K , analogous to the V of the Fischer equation¹⁶, is questioned by some economists who argue that this fraction varies depending on the level of employment or unemployment. This theory argues that an increase in money supply will result in excess money balances which itself depends on the values of K and M . Not all the excess money balances are paid out on consumer and capital goods; they could also be held as financial assets. When the demand for financial assets rises, their prices increase and interest rate falls.

These quantity theories of money regard the role of money as a decisive factor of the absolute price level with no role on output or income. Under the transmission mechanism of money in the classical version, long-run equilibrium is disturbed during an injection of additional money where the actual real money balances exceed the desired one.¹⁷ Real wage rises, assuming the price level remains stable in the short run. The excess real money balance holding will be spent on consumer durables or invested in financial assets. Under the assumption of stable money demand in the short run, the general price level continuously goes up till it ensures a long-run equilibrium. And prices mount proportionally with the rise in money supply between the two equilibriums. In the short run, money is not neutral to the economy as it has impact on the real wage rate and consecutively on employment and out put. However, at the long-run equilibrium, where the price level has risen in the same proportion to equate actual and desired real money balance, money is neutral. Real wage and interest rates are not influenced by monetary expansion in the long-run. Although the rate of interest falls in the short run, due to a boost in money supply and its outcome of rising bond prices, it will take its previous equilibrium

¹⁶ K is the reciprocal of velocity (M/GNP) where $GNP=PT=MV$ from the Fischer equation and hence $V=(GNP/M)$, from the Cambridge, $M=KOP \Rightarrow MV=OP \Rightarrow MV=PT$ which implies the two equations are the same

¹⁷ Long-run equilibrium is assumed where actual real money balances are equal to desired real money balances.

position as the issue of bonds increases to match the excess demand induced by the incremental money supply.

Classicalists divide the economy into two sectors¹⁸, the real and the monetary sectors. In the real sector, which is associated with the short-run monetary theory, real wages, output and employment are influenced and money is not neutral to the economy. While in the monetary sector, which is associated with the long-run theory, the interest rate plays no role and money is neutral to real variables but affects nominal variables such as absolute prices and the money wage rate. In general, the classical version of the quantity theory of money discusses about an increase or decrease in money supply without explaining how the increase or decrease can be achieved.

The Keynesian Revolution

In Keynesian monetary theory, an increase or decrease in money supply is attributed to the open market purchase or sale of government debt instruments by the central bank. And government purchase of securities, which is strongly based on the prices of those securities, results in increased money supply. Unlike the classicist's demand for money theory, which made no distinction between the various motives for holding money, Keynes made a clear distinction between the three motives of holding money, the demand for transaction, precautionary and speculative balances. The demand for money as a medium of exchange or demand for active balances is motivated by transactions and precautionary needs. The demand for money as a store of wealth or the demand for idle balances is motivated by the speculative motive. This speculative motive is the key element of Keynes's liquidity theory and distinguishes Keynes from the classical school of thought, in which money is considered neutral to the economy in the long run. Similar to the Cambridge equation, Keynes considered investment in financial assets as an alternative investment if money rose. Financial assets are replaced for money because money has nil return. The return of a financial asset is the sum of the capital gain¹⁹ and the interest yield of the asset. Owners of wealth look at both capital gain and the interest yield to make a decision on whether to buy financial assets or to hold

¹⁸ The division of the economy into real and monetary sectors is called classical dichotomy

¹⁹ Capital gain is the difference between the current price of a financial asset, and its expected new value. Capital gain occurs if the difference between the original price and the new value of the financial asset is greater than zero



speculative or idle balances. This demand for idle balances is reliant on the rate of interest. At a higher interest rate wealth owners hold less idle balances since a larger share of idle balances is changed to bonds in the anticipation that the rate of interest will fall and capital gain will rise.

From his notion of idle balance theory, Keynes concluded that, contrasting the ideas of the quantity theorists, a rise in money supply does not result in a direct proportionate increase in prices since part of it is held as idle balances. For Keynes, the general price level is determined by labor costs. Keynesians also differ from the classical monetary school in their view of the transmission mechanisms in the monetary sector. For the classicists the level of money supply determines prices, wages and employment. A cut in the money wage rate or the money stock will increase the employment level. For Keynes, on the other hand, those variables are determined through the rate of interest. An increment in money supply will augment the quantity of idle balances that will reduce the rate of interest, consequently increasing borrowing for investment purposes. An increase in investment, in turn, will raise the level of income and boosts demand that will cut unemployment. The classical school doesn't state a thing about the sources of extra money in an economy, while Keynes identified sources such as open market operations by the authorities, increased exports and deficit expenditure. Unlike classicists who believed in wage cuts to diminish unemployment, Keynes recommended an increase in prices which he believed will shrink the real wage rate and increases the demand for labor.

Keynes's theory traced the source of the difficulties of the depression years to the private sector. For Keynes deficit fiscal policies and demand management policies re-establish stability by drawing into use idle resources, capital and labor. This suggestion worked during the depression years of the 1930's. Public expenditure induced demand and reduced unemployment while increased prices, as is in the recommendation of Keynes, reduced unemployment initially. However, after some time, unemployment, which was expected to move inversely with price increases, began to move in a similar direction. Contrary to expectation, the cheap-money policy of Keynesians could not mop up unemployment, rather created monetary instabilities caused by inflation.

The Monetarists

With the desertion of Keynes's theories, especially since the late 1960s and 1970s, the monetarists' theory, developed by Milton Freidman, got importance. Money supply, which has been given a limited direct role in an economy, received a prominence position. The monetarists'²⁰ theoretical formulation is based on the old quantity, Cambridge cash balance, and the Keynesian liquidity preference theories. Similar to the old quantity theorists, the monetarists believe that money plays a significant role in an economy and influences the periodic movements of economic activity and particularly income and price levels. While for the old quantity theorists, an increase in money supply results in a direct proportionate increase in prices, for the monetarists the general price level determines the purchasing power or real money balances a community holds. If prices rise, a community's demand for real balances increases, since more money is required now to purchase commodities.

The monetarists' model is fundamentally a model for the demand of money and not a money-supply model. Unlike the Keynesian model, their model doesn't deal with changes in output, employment, money income or the price level. They consider money as an asset (wealth) with implicit yields such as convenience and safety and treated it like production factors or commodities. The demand for money depends on total wealth, the prices and yields of money assets in terms of other alternative assets, tastes and preferences. They regard money as any other commodity in which tastes and preferences play a significant role in the decision to buy or not to buy. For this reason, their model follows the general macroeconomic demand for goods equation where the quantity of a commodity is dependent on its price, prices of other commodities, and on tastes and preferences. Generally, monetarism postulates that variation in money supply brings disturbance to prices and hence influences resource allocation. Growth in prices occurs only as an outcome of expansion in money supply which implies that rigid monetary policy results in a stable environment for the performance of an economy. Friedman assigns three roles for monetary policy 1) to restrain money itself from being a central cause of economic disorder 2) to present a stable background for the workings of the economy and 3) to counterbalance major instabilities from other sources (Freidman, 1968). The monetarists alleged monetary policy to provide a universal remedy to all business-cycle evils. And

²⁰ The monetarists also referred as the modern quantity theorists

monetary policy was primarily to be directed to encouraging the banking system into satisfying the monetary demands of the business community.

2.1.2 Money Supply Determination

Furness (1974, 1975) and Shetty (1990) identified two approaches to the determination of money supply: The money-multiplier and the counterparts (structural) approaches. The latter approach disaggregates money supply into its counterparts and tries to clarify the individual counterparts²¹ consequence to the change in money supply including public sector borrowing, domestic credit and net foreign assets (Furness, 1974, 1975; Shetty, 1990). For this reason, money supply determination process under this approach involves sorting out factors that determine these counterparts and in turn the money supply. On the other hand, the money multiplier approach tries to define the relationship between the money supply and the monetary base by simply assigning a linear relationship between the two through the money multiplier coefficient (Sachs and Larrian, 1993).

Even if both approaches appear to vary slightly, the disparity might start from the basic differences between the monetarists and structuralists, especially concerning inflation (Shetty, 1990, Beenstock, 1989). For monetarists, the source of inflation is excess growth of money supply, for example, through government deficit financing activities as a result of heavy involvement of the government in the economy. So, for them, it is better to take action only through monetary policy, not fiscal policy, to manage the economy. However, for structuralists, budget deficit or government involvement is unavoidable for countries where the major objective is economic growth. Hence, money supply passively acts to the change in the economy.

²¹ Money supply in this study refers to the broader definition, which in the case of Ethiopia is a summation of currency outside banks and total private deposits (demand deposits, saving deposits, and time deposits net of government deposits). And this liability side is equal to its counterpart on the asset side net foreign assets plus domestic credit minus other items net. Hence any change in money supply is also reflected by change in its counterparts.

2.1.2.1 The Money-Multiplier Approach of Money supply Determination

This approach focuses its interest on analyzing the relationship between base money²² and money supply through the money-multiplier. The money –multiplier theory has three main assumptions: (i) money supply is a highly stable increasing function of base money. (ii) factors that influence base money and its changes are by and large policy controlled and (iii) the money-multiplier is influenced by endogenous behavioral factors, the choices of the public and banks concerning their holdings of different financial assets (Mujumdar, 1976).²³ And those explanatory variables are proximate determinants that should be analyzed to have broader idea of the money-multiplier.

The relationship between money supply (M) and base money (B) can be put as follows:²⁴

$$\text{Money supply} = \text{currency outside banks (Cy) plus total private deposits (D)} \quad \text{----- (2.1)}$$

$$\text{Base money} = \text{Currency outside banks (Cy) plus total bank reserves (R)} \quad \text{----- (2.2)}$$

Cy and R can be put in terms of total private deposits

$$Cy = cd \text{ of total deposits (} cdD \text{) and}$$

$$R = rd \text{ of total deposits (} rdD \text{)}$$

Where cd = currency to total deposits ratio

$$rd = \text{total reserves to total deposits ratio}$$

Then equation (2.1) can be written as:

$$M = (cd + 1) D \quad \text{----- (2.3)}$$

Similarly equation (2.2) can be written as:

$$B = (cd + rd) D \quad \text{----- (2.4)}$$

Rearranging equation (2.4) to get total deposits gives:

$$D = \frac{B}{rd + cd} \quad \text{----- (2.5)}$$

Substituting this in (2.3) gives

$$M = \frac{(cd + 1)}{(cd + rd)} B \quad \text{----- (2.6)}$$

²² Base money (also named Reserve money or high powered money) is a summation of currency outside banks plus commercial banks total reserves, where reserves include local cash held by banks plus reserves (both required and excess) at the Central bank.

²³ Cited by Shetty 1990

²⁴ For detail reading refer Sachs & Larrian, Furness (1975), & Branson (1989)

$$M = mB \quad \text{-----} \quad (2.7)$$

Where $m = \frac{(cd + 1)}{(cd + rd)}$ is the money-multiplier.

Equation (2.7) says that money supply is some multiple of base money, with the factor of proportionality given by m , the money-multiplier. Since the numerator is always greater than the denominator²⁵, the money-multiplier ratio is greater than one implying that the consequential change in money supply is greater than the change in base money due to the banking sectors money creation process.

The Process of Money Creation

The process of money creation can be illustrated as follows. Let base money changes by an amount ΔB , say, due to an open market purchase of bonds. According to proponents of this theory, central bank can control base money in three ways: i) open market operations, through selling and buying securities from the public ii) discount window operation, by changing the discount rate at which commercial banks get loans or access to the discount facility and iii) foreign exchange intervention, by selling and buying foreign currencies (Sachs & Larrian, 1993). For example, to increase money supply, the central bank buys securities from the public, decreases the discount rate and/or buys foreign currencies. However, these instruments are not well developed in developing countries.

After this cash injection and the resultant increase in base money, the public who got this money hold part of it as currency and the other as bank deposits. If the process was all this, the change in base money will be exactly matched with an equal change in money supply. However, the banks that received deposits put only part of it as reserves while lending the rest to the public. Borrowers also put part of the loan in currency while depositing the rest into the banking system. Further, expansion stops after deposits have risen to the point at which the whole of the cash injection is absorbed by either the need to increase reserves by banks or/and additional currency holdings of the public. Hence, the amount of the change in money supply is influenced by the strength of the two leakage ratios, currency and reserve ratios in relation to

deposits (Hewson & Sakakibara, 1974). If those two demands for cash are smaller than the total increase in deposits, then the increase in the money supply induced by a change in base money will be larger.

An increase in reserve to deposits ratio (rd) lowers the multiplier, because the higher the rd , the lower the amount of new loans that the banking system is able to disburse from an initial deposit.²⁶ This ratio is a function of four main variables, 1) the required reserve ratio²⁷, 2) the market interest rate, 3) the discount rate and 4) the inter bank rate. A higher value of required reserve ratio, discount rate and inter- bank rate and a lower market interest rate induce higher rd . The money-multiplier theory assumes that commercial banks are required to hold some minimum stated rd ratio, and they will not have more than this ratio since it will increase their cost and they will miss the profit opportunity. This implies that banks respond to any increase in their reserves by boosting lending under the constraints of the need for higher reserves and currency to deposits that cause cash drain.

A rise in cd ratio implies that the public holds more money on hand than depositing at banks that adversely affects the banks' ability to create additional loans and deposits resulting in lower money-multiplier. The money-multiplier is expected to have a lower value in developing countries, since cd ratio is higher due to the significance of currency in total transactions and the limited development of non-cash payments such as cheques and credit cards (Narasimham, 1990). Lack of confidence on the soundness of the banking system and the expansion of illegal activities increase the cd ratio, while higher market interest rate adversely affects it. The money-multiplier theory assumes that agents want to hold a constant ratio between their holdings of cash and deposits.

²⁵ The reason is that the reserve to deposit ratio is always less than one, since banks hold as reserves only a fraction of their deposits. The total amount of reserves banks hold is composed of required reserves and excess reserves

²⁶ For example, if, in an extreme case, a reserve deposit ratio is 100 per cent, there will be no deposit creation and hence the change in money supply equals the change in high- powered money.

²⁷ It is the legal reserve requirement set by the central bank as an instrument of monetary control and as a matter of prudence, to guarantee that the banks have enough reserves to meet the needs of their depositors

Table 2.1. The Process of Deposit Creation by Banks

| Rounds | Increase in Deposits |
|---|--|
| 1)-OMO operations (the central bank buys bond from the public ²⁸) | ΔB |
| 2)-Banks retain $rd\Delta B$ and lend $\Delta B (1-rd)$ -The public demand for currency increases by $cd\Delta B$ so from the total loan $cd\Delta B$ amount of currency is held ²⁹ | $\Delta B - rd\Delta B - cd\Delta B \Rightarrow \Delta B(1-rd-cd)$ |
| 3)-Banks retain $rd\Delta B (1-rd-cd)$ and lend $\Delta B(1-rd-cd)(1-rd)$ -The public demand for currency increases by $cd\Delta B (1-rd-cd)$ | $\Delta B (1-rd-cd)(1-rd) - cd\Delta B (1-rd-cd) \Rightarrow \Delta B (1-rd-cd)^2$ |
| - The process continues and the sequence becomes | $\Delta B + \Delta B (1-rd-cd) + \Delta B (1-rd-cd)^2 + \Delta B (1-rd-cd)^3 + \dots$ Which when summed to large numbers attains $\Delta B \left(\frac{1}{rd + cd} \right)$ ³⁰ |

This sum in the last row is the total change in deposits (ΔD) due to the deposit creation effect of commercial banks:

$$\Delta D = \Delta B \left(\frac{1}{rd + cd} \right) \quad \text{----- (2.8)}$$

And the total change in currency will be

$$\Delta Cy = cd \Delta D^{31}$$

$$\Rightarrow cd \Delta B \left(\frac{1}{rd + cd} \right) \quad \text{----- (2.9) by substituting } \Delta D \text{ from equation (2.8)}$$

²⁸ Assuming the public will put all of their money into banks.

²⁹ The public demand for currency rises by cd , while the banks reserve need increases by rd of the increase in deposits.

³⁰ A series $X (1+Y+Y^2+Y^3+\dots+Y^n)$ is a geometric series where the summation ends up being $X \left(\frac{1}{1-y} \right)$. In the above summation, X is ΔB while Y is $(1-rd-cd)$ so the resultant sum will be

$$\Delta B \left(\frac{1}{1 - (1 - rd - cd)} \right) = \Delta B \left(\frac{1}{rd + cd} \right)$$



Total change in money supply can be decomposed into changes in total deposits and currency outside banks.

$$\Delta M = \Delta D + \Delta Cy \quad \text{----- (2.10)}$$

Substituting (8) and (9)

$$\Delta M = \Delta B \left(\frac{1 + cd}{rd + cd} \right) \Rightarrow \Delta M = m \Delta B \quad \text{----- (2.11)}$$

Weaknesses

The money-multiplier theory, discussed above, has an attractive feature in that, it gives a clear relationship between money supply and base money, and hence simplifies the effect of changes in base money. For example, in a simple way it illustrates how excess reserve holding by banks can lead to further monetary expansion. Furness (1975) expresses this simplification as follows:

“The traditional multiplier theory,..., has the academic advantage of appearing to offer a neat solution to the determination of changes in money-supply”(p.101)

However, this theory reduces the process of the actual money supply determination into simple algebraic manipulation. Furness (1975) argues:

“...As an explanation of the changes in money supply that occur in practice the theory is misleading in giving the impression that the cause of change is simple and the extent of change predictable with reasonable accuracy.” (p.101)

For the money multiplier approach to work, there are three assumptions that need to hold: 1) the central bank works independently, 2) the money-multiplier is stable and 3) domestic and foreign assets, which govern high-powered money, are policy controlled (Shetty, 1990). Hence, the appropriate approach of money supply determination depends on the institutional feature and economic situations of a country; what is fitting for developed countries may not be appropriate for developing countries. Since all the three assumptions may not hold, the money-multiplier approach seems less successful to work in developing countries than developed ones. In many developing countries, the central bank is not an independent unit and fiscal rather than monetary authorities influence government borrowing. Moreover, the money multiplier tends to

³¹ Since the ratio $\Delta Cy/\Delta D = cd$ then $\Delta C = cd\Delta D$

be unstable since its behavioral³² components, currency to deposit and reserve to deposit ratios, lack constancy. Furness (1975), for example, after checking how much currency to deposit ratio fluctuates among countries and over periods apart from seasonality variation, which is observable almost in all countries, concluded that since the preference of holding cash at hand compared to deposits falls with increase in income over time, the currency to deposit ratio declines faster in developing countries through the growth process, while developed countries have more or less stable ratio. Moreover, since time and saving, and sometimes demand deposits, bear interest, the currency deposit ratio may vary from time to time in response to changes in the opportunity cost of holding money. The other component, reserve to deposits ratio, too fails to stay constant contrary to the assumption that banks keep a constant ratio and excess reserves are zero at all times. This is unrealistic to most developing countries where actual reserves are greater than required reserves.

The third assumption can be easily rejected for developing countries since they have far less control over the flow of foreign exchange due to underdevelopment of financial markets that can serve to implement sterilization techniques (Khan and Knight, 1981). Khan and Knight (1981) argue that the relevance of this technique has been weakened by the absence and the thinness of financial markets for government bonds and T-bills in most developing countries.

Shetty (1990) also argues that the basic assumptions of the money-multiplier theory do not hold. One reason he mentioned is that the approach doesn't explain about the causes underlying the money supply variations. Moreover, the basic assumption of the theory that factors that influence the money-multiplier and the change of the money-multiplier itself are endogenous is a faulty assertion. In that the factors are, as Shetty describes, "neither endogenous nor they are characterized by an element of "automaticity"." He elaborates this point by citing the inability of banks to affect their reserves to deposit ratio as they want due to demand factors for credit and quantitative credit ceilings, and reserve requirements. He argues further, by citing Park

³² Currency to deposit and reserves to deposit ratios are called behavioral or proximate determinants of money supply. They reflect the behavior of the non-bank public (currency to deposit ratio) and the banking system (reserves to deposit ratio).

(1980)³³, that in general the equation $M = () B$, which simply puts the money supply as a linear function of base money, is an equilibrium condition than the supply function of money.

Furness (1975) generalizes four defects of the money-multiplier theory.

- 1) The theory assumes that it is always gainful and possible for banks to increase their lending continuously until the rd ratio reaches the required minimum. And hence any change in these reserves induces a predictable multiple change in bank loans and deposits. However, banks can increase their lending only if they get unsatisfied demand and customers with relevant collateral. Moreover, credit demand even for those with sufficient collateral, by itself, depends on prevailing economic activities, cost of borrowing and the existence of alternative sources of finance. In addition to this, in developing countries, banks may not be able to extend their credit level to keep the ratio constant due to government policy actions, such as credit ceiling
- 2) The theory assumes that banks have no means of adjusting their reserves by their own initiative. Rather, they passively respond to exogenous change in their reserve holdings. However, banks can increase their reserves by borrowing from the Central bank, which is lender of last resort and hence raising their reserves and loans. Hence change in base money may not play a causal role. Although, in most banking systems, banks are discouraged from borrowing other than temporarily, yet still the existence of the facility gives banks considerable flexibility regarding their reserves, and it eliminates any permanent relationship between exogenous changes in base money and changes in money supply.
- 3) The theory assumes that public demand for currency varies with variation in bank deposits and the proportionate relationship remains stable. This might be true in advanced countries where the need for currency is expected to vary with the change in deposits as a result of a well-established tradition of holding money as between deposits and currency. However, in developing countries, since the banking system is yet expanding, banking habit expands with branch networks resulting in frequent

³³ Park, Y Chul (1980): "The ability of monetary authorities to control the stock of money in LDCs"

adjustments between currency and deposits. Besides, currency being the major medium of exchange and payment by cheque is undertaken only between business and government organizations, and where increment in bank deposits show growth in personal savings, there is no enough reason to maintain a stable relationship between holding of currency and bank deposits.

- 4) The theory assumes that exogenous shocks on base money occur infrequently so that the banking system gets time to adjust and reach a new equilibrium loan and deposit levels. Actually, base money is subject to continuous shocks for example from governments' budgetary operations, inflow and outflows of external payments and national debt transactions. Hence, it is more difficult for banks to move to a new equilibrium level with every shift in base money.

Due to these shortcomings of the money-multiplier theory, authors like Shetty (1990), Goodhart (1975, 1984); Furness (1974, 1975), Fry (1988) and Brunner (1961) have suggested that the money supply determination should follow a some-what disaggregated approach. Goodhart (1975) suggested that another accounting identity taken from the accounts of the flow of funds³⁴ is appropriate. Goodhart (1984) also argues:

“The theory of the determination of the money stock ought to be treated as one branch of the more general theory of portfolio adjustment in response to relative price changes.... The only facets of their portfolio distribution choices, which seem to affect the results at all, are the public's desired cash/deposit ratio and the bank's desired reserve ratio.... All that is, to be blunt, absolute baloney. The determination of the money stock involves a process of general portfolio adjustment in response to relative interest rate changes.”(pp.190-200)

Shetty (1990) argues that the supply function of money in developing countries should be broadly disaggregated to estimate currency, bank deposits, change in domestic credit, and net foreign assets by sorting out factors that determine them so that the resultant value represents the size of money supply.

2.1.2.2 The Counterparts Approach of Money supply Determination

The counterparts approach is a broader, disaggregated and more realistic money supply determination process. This approach is based on the fact that the total claim held by banks including the central bank is the counterpart of money supply. These claims are held on the government, private sector, and the foreign sector (Furness, 1974, 1975; Fry 1988). Furness (1975) describes the money supply process in the counterparts approach as follows:

“In a modern community, money is created by banks, including the central bank, crediting deposits or paying out currency in exchange for a variety of claims.... The total stock of claims held by banks is therefore the counterparts of the stock of money. Any net change in this stock of claims is matched by an equal change in the quantity of money.”(p.107)

The counterparts approach is derived from the consolidated balance sheet of the Central bank and commercial banks (Gowland, 1984) where

Money supply = Currency outside banks + Total private deposits (Demand, Saving and Time deposits)

$$M = Cy + D \quad \text{----- (2.12)}$$

And the change in money supply is brought about by a change in its counterparts (Fry 1988, Furness 1974, 1975; Adenikinju and Ogun 1995; Gowland 1984).

Money supply (M) = Claims on foreign sector (net foreign assets) NFA + Net claim on government³⁵ (NDCG) + Claim on the private sector (DCP) - Other items net (OIN)

And hence any change in those counterparts leads to a change in money supply.

$$\Delta M = \Delta NFA + \Delta NDCG + \Delta DCP - \Delta OIN \quad \text{----- (2.13)}$$

Hence, explanations for changes in domestic credit to the private sector and the government, net foreign assets and other items net in combination would explain the total change in money supply and in order to factor out the determinants of money supply, the four factors should be separately studied.

³⁴ Flow of funds describes how the financial deficit or surplus of each sector is financed by flow of funds through the various financial markets

³⁵ Government deposit is excluded because when government expenditure is financed by running down government bank deposits, money supply increases.

Claims on the private sector:

Commercial banks offer deposits in exchange for claims on the private sector, which may be partly or wholly withdrawn in currency. Therefore, bank lending leads to the creation of either deposits or currency in circulation (Furness 1974, 1975).

Net claims on the government:

The central bank increases government deposits either by giving direct advance or buying securities. So, when the government utilizes this claim, it either increases currency in circulation or bank deposits of the private sector. Commercial banks also offer deposits by buying T-bills or bonds and hence expenditure of these deposits by the government increases the money supply.

Claims on foreign sector:

The central bank, as well as commercial banks provide deposits or pay out currency in exchange for foreign currency, foreign bank deposits or foreign securities. Thus, the extra foreign exchange may be held by banks as additional foreign assets or may be used to pay foreign liabilities where the net change influences the change in money supply. Net foreign assets are affected both by current account transaction and net capital receipts and aid from abroad (Furness 1975). A net rise in current account, for example, leads to a rise in commercial bank deposits, which, on the asset side, can be matched by a rise in cash reserves or foreign assets. In both cases, the rise in cash reserves increases the liquidity position of commercial banks activating more lending that increases either currency in circulation or bank deposits. Besides, the commercial banks can sell their foreign assets to the central bank and increase their reserves with a similar effect on increasing loans. However, other types of foreign assets, such as grants and aid, have influence on money supply only at the time of usage. And hence they will be put in other items net as an offsetting item, indicating not the entire rise in net foreign assets leads to a rise in money supply. So, according to Furness (1974, 1975), OIN, instead of being categorized as claims, is treated as an offsetting factor.



The monetary approach to the balance of payments³⁶ indicates that net foreign assets are affected negatively by an increase in domestic credit (DC) and positively by factors that increase the demand for money, that is since the demand for money is influenced positively by GDP and negatively by deposit interest rate, then net foreign assets rise with rise in GDP while fall with an increase in interest rates (Khan, 1977; Fry, 1988).

Claims on the private sector is dependent on the overall economic activities which can be represented by GDP. Another factor is foreign exchange receipts. These receipts, apart from their influence on net foreign assets position of the banks, also augment imports. The demand for imported raw materials and machinery in turn increases the demand for credit to finance higher level of imports (Fry 1988; Adenikinju and Ogun 1995). Domestic credit expansion to the government and terms of trade are the other relevant variables, which can influence domestic credit to the private sector. Credit expansion to the government might erode the liquidity position of banks resulting in lower lending to those sectors. Fry (1988) also puts terms of trade as another explanatory variable, in that deterioration in the terms of trade leads to higher credit demand to finance increased costs (Fry 1988; Adenikinju and Ogun 1995). Lending real interest rate is another variable which can negatively influence domestic credit expansion to the private sector as higher costs of borrowing deters private sectors interest to take loans (Killick and Mwege, 1990)

Government domestic credit can be influenced by lags in revenue collection and inflationary conditions (Aghevli & Khan 1978; Kiguel 1989). Lags in revenue collection can be explained by lagged changes in GDP (Adenikinju and Ogun, 1995). A delay in revenue collection increases the desire of the government to finance its budget deficit from the banking system. Inflation conditions also induce government borrowing by either eroding the tax base or raising government expenditure or by increasing the real cost of borrowing. On the other hand foreign exchange receipts might have a likely negative impact on government domestic borrowing since either government revenue increases from rise in export taxes or alternative finance is generated from public transfer payments both reducing the need for higher bank lending.

³⁶ This approach postulates that balance of payment disequilibrium is a monetary phenomenon which can be explained by the imbalance between demand for and supply of money. Rise in domestic credit widens the divergence while rising money demand narrows it.

2.2. Empirical Literature

Bolnick (1975) undertook a study on the proximate determinants of money supply in Kenya during 1967-IV to 1973-IV, using the money-multiplier approach. Based on his result, he concluded that this approach is inappropriate for Kenya, since base money cannot be controlled in an attempt of controlling total money supply. He further suggested that the borrowing from the central bank and foreign exchange position, which is also affected by sudden capital flows and imports have been a challenge for monetary authorities to have control on monetary base and in turn on money supply.

Bhatia (1971) in his study “ Factors Influencing changes in Money supply in BCEAO³⁷ Countries.” during the period 1962-68 in seven countries, divided factors that influence money supply into behavioral and non-behavioral. He treated rd and cd ratios as behavioral, while change in net foreign assets, credit to the government, and other policy changes by the central bank as non-behavioral. From his result, he concluded that although for many individual countries the change in money supply came from the non-behavioral factors, general conclusion couldn't be derived since the result depends on the general feature of each country.

Al-Loughani and Moosa (1996) used the money-multiplier model for Kuwait using an error correction model covering a monthly data from January 1970-August 1994. And they concluded that the money-multiplier framework for monetary policy is inappropriate in the case of Kuwait. This is due to the inability of the central bank to control the net foreign assets and government's deposits. They further found that the relationship between the money supply and monetary base is not unidirectional and changes in the base money affect the value of the multiplier, which further weakens the relationship for policy purposes.

Fry (1988) used the counterparts approach of money supply determination for Turkey covering periods from 1951 to 1985 using a partial adjustment model and concluded that money supply movement is influenced by changes in domestic credit both to the private sector and the

³⁷ The seven countries (Dahomey, Ivory coast, Mauritania, Niger, Senegal, Togo and Upper Volta) have a common Central bank named, the Banque Centrale des Etats de l'Ouest (BCEAO)

government, net foreign assets and other items as well as by factors which influence these variables such as income growth, foreign exchange receipts, terms of trade and price level.

Adenikinju and Ogun (1995) on their study of “Money supply Mechanisms in Nigeria (1970-1989)” followed counterparts approach of money supply determination using a partial adjustment model and concluded that inflation, lags in tax revenue collection and foreign exchange receipts were influential factors for the expansion of domestic borrowing to the government and the private sector and hence in turn the growth in money supply.

In Ethiopia, efforts were taken to study money supply during the imperial regime (pre 1975) by Duggar (1974) and Furness (1974). Furness used a money supply function by merely regressing money supply by its components, domestic credit and net foreign assets for the period of 1964-1971. Based on his result, he concluded that the main factors for change in money supply in Ethiopia are private sector credit expansion and growth in net foreign assets. Similarly, Duggar (1974), who simply analyzed changes in money supply from 1948 upto 1963 through ratios not including models, found a similar result.

Two studies were under taken after 1975: Teklewold (1988) and Alemayehu (1995). Teklewold in his thesis “Statistical Methods in Estimating the Demand for and Supply of Money in Ethiopia.” during 1964-1985 used both the multiplier and counterparts approach. He arrived at a conclusion that base money, domestic credit and the rate of change of prices are the main determinants of money supply in Ethiopia. Unlike Duggars’ and Furness’, study result, which put net foreign assets as a main determinant of money supply in Ethiopia, Teklewold didn’t include net foreign assets.

Alemayehu (1995), noticing the limitations of the above studies in Ethiopia such as omission of an important variable (foreign asset) and the regression of money supply by its component (domestic credit) in Teklewold’s study; the shallowness of the study and simple regression results of money supply on its components by the earlier studies of Duggars and Furnesses respectively; and a clearly observable time break in all the three studies, did a study on determinants of money supply in Ethiopia from 1960-1991 applying both approaches using the

Engle granger two stages estimation technique. He disaggregated money supply into its counterparts following Fry's (1988), and Killick and Mwege's (1993) models. On the basis of his result, he concluded that under the money-multiplier approach, money supply is significantly influenced by base money and with an almost stable relationship except some disruptions during drought periods. Under the counterparts approach, he concluded that money supply in Ethiopia is determined by the level of income, price level, the fiscal position of the government, foreign exchange inflow and the level of exchange rate. Besides, he concluded that since those variables are hardly under the control of monetary authorities, monetary targeting might not be achieved.

However, there is still unresolved issue regarding the reliability of his results to work for the present period starting 1991. This period has observed shifts in monetary policy from the socialist oriented development plan towards a free market economy bases. Banking activity in socialist system and market economy is very different (Furness 1975, Sachs & Larrian, 1995) which implies that a further updated recent study is still needed to fill the observed gap. What is more, the suggested superior method of estimation technique under large number of variables with a likely simultaneity bias is the Johansen³⁸ maximum likelihood estimation technique and the reliability issue also should be seen from this angle too.

In general, revising the time frame so as to involve periods after the reform and applying a better methodology is desirable, either to factor out the major determinants of money supply or to pick out the appropriate approach for money supply determination to investigate the controllability of money supply, as in Alemayehu's study, a confusion occurs in his argument that the money-multiplier is stable which indicates the controllability of money supply while on the other hand he concluded that money supply can not be effectively controlled. Consequently the present study is believed to bring earlier studies up to date by extending its coverage to include new developments by using a better methodology.

³⁸ The methodology part gives a detail comparison between this method and its alternative the Engle-Granger two stage procedure.

Chapter Three: Monetary Developments in Ethiopia

3.1 Monetary Developments

This section tries to describe about the developments of monetary aggregates: monetary liabilities, asset counterparts and the money multiplier in Ethiopia during the period 1964/65-2003/04. This time is classified into three periods to reflect the three distinct policy regimes. The first period, which runs from 1964/65 up to 1973/74, represents the last decade of the imperial era and relatively stable years in the country with comparatively free market economy. The second period, ranging from 1974/75-1990/91, represents instability in the country where it recorded an Ethio-Somali conflict in 1976/77 and uninterrupted civil war that ended in 1990/91. The period from 1991/92-2003/04 represents a relatively stable period except years 1997/98 and 1998/99 Ethio-Eritrea border conflicts. However, all the three periods have witnessed famines in various years; the first period in 1973/74, the second in 1984/85 and the last in 2001/02. Tables 3.1 up to 3.5 summarize the data.

3.1.1 Developments in Monetary Liabilities

Money supply (broadly defined) attained a value of Birr 34.7 billion at the end of 2003/04 starting from its level of Birr 432 million in 1964/65, which is about 80 fold, growing on annual average of 12 per cent from 1964/65-2003/04. Narrow money supply (namely the summation of currency outside banks and net demand deposits) was Birr 355 million in 1964/65 while it reached Birr 19.1 billion in 2003/04, which is 54-fold higher; rising by an annual average growth rate of about 11 per cent during the same period. The other component of money supply, quasi- money (the summation of saving deposits and time deposits) with a value of Birr 77 million in 1964/65 reached Birr 15.6 billion in 2003/04, a 202-fold increment growing at average annual rate of 15 per cent

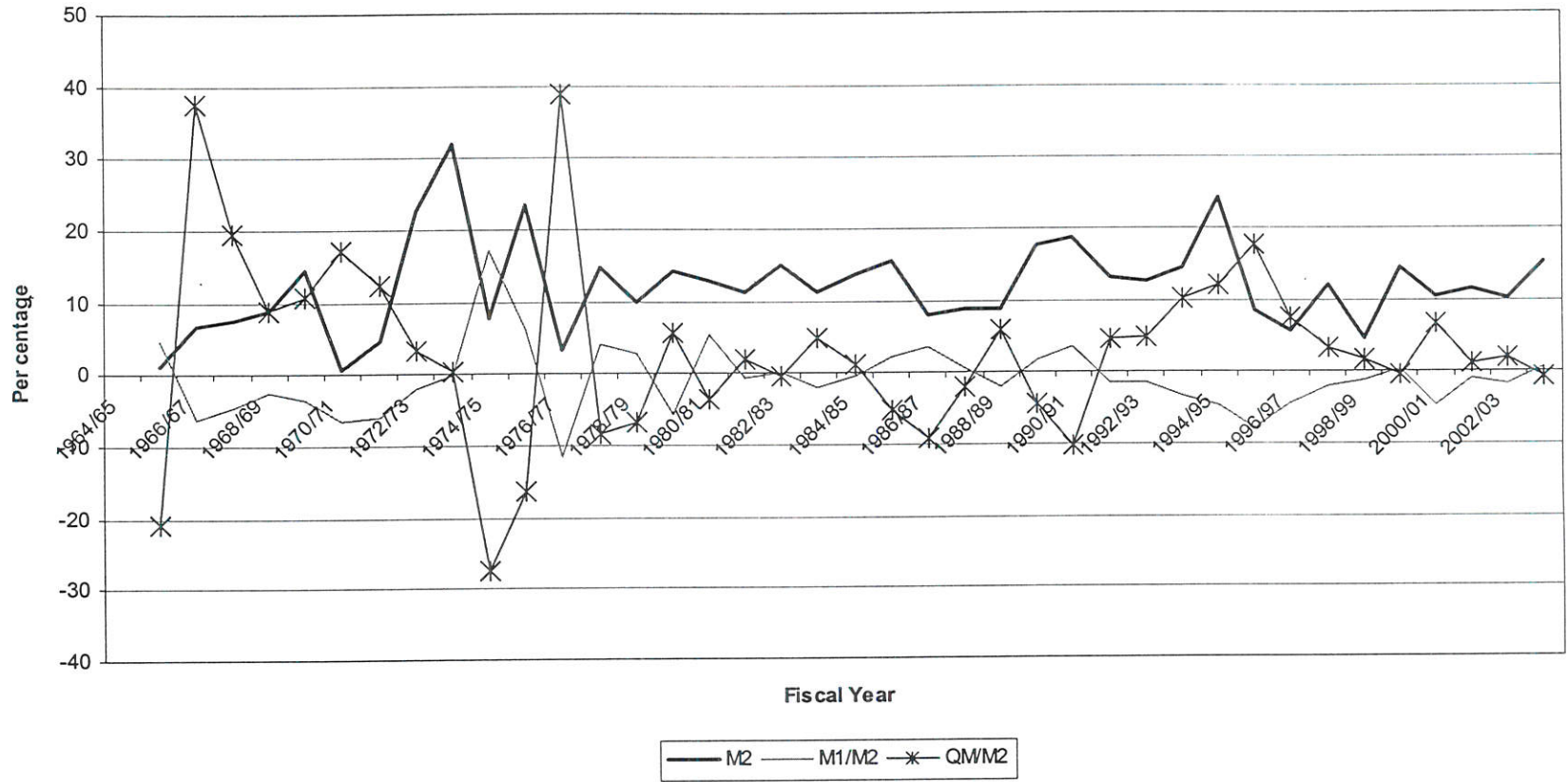
The higher rate of growth of quasi-money over narrow money is consistent with the Aghevli et al (1979) remark regarding the holdings of financial assets in the forms of quasi money in developing countries. They argue that owing to the thinness of financial markets in those countries, agents in short of other safe alternatives hold their financial wealth in the forms of interest earning bank deposits. This tendency is distinctively observed for the first and the last periods where the growth rate of narrow money was 8 and 9.3 per cents while that of quasi

money was about 22 and 18 per cents for the first and the last period respectively. During the second period, the growth rate of narrow money increased to 14 per cent while that of quasi money declined to 10 per cent which might have resulted from the fact that the return for saving deposits over Birr 100,000 was only 1 per cent in order to discourage large savers (Eshetu and Mekonen, 1992). However, in an absolute amount, quasi-money continued to grow through out the whole period even if the deposit interest rate was fixed at 6 per cent for substantial period of time during this period as a result of forced saving, which in turn is caused by monetary deepening³⁹ (Eshetu and Mekonen 1992, and World Bank 1990).

In line with the above development, the ratio of narrow money to broad money indicated a declining trend from 72.60 per cent in the first period to 72.31 and 62.6 per cents in the second and third periods respectively. On the other hand, the ratio of quasi money to broad money ratio rose from 27.4 per cent to 27.54 per cent and 37.4 per cent respectively within the same periods of time. This implies the development of banking habit through out the periods, particularly in the last period with the entrance of new private banks side by side with the existing banks branch expansion showing higher access to and growing public confidence on deposit mobilizing banks. On the average, 69.2 per cent of broad money is composed of narrow money while quasi money takes the remaining 30.7 per cent share through out the period under review.

³⁹ The steady increase in the ratio of money balances to GDP or the decline in the velocity of circulation.

Chart 1. Average per centage changes of Monetary aggregates



When comparing the levels of output versus the available money in the economy, broad money on average grew by 11 per cent in the first period while nominal GDP grew by 6.3 per cent. During the next period the divergence further increased since broad money grew by 12.6 per cent while nominal GDP grew at an annual average of 6.8 per cent. Broad money grew by 12.1 percent on average in both periods before the last reform summing the two periods from 1964/65-1990/91 and a period after the last reform ranging from 1991/92-2003/04. At the same time nominal GDP grew by 6.6 per cent in the former period while it grew by 10.7 per cent from 1991/92-2003/04 which shows a somewhat consistent growth rate of money supply with nominal GDP growth rate in the last period rather than periods before it. Through out the total period under study, broad money grew at an annual average rate of 12.1 per cent while nominal GDP grew by 8 per cent. In a similar manner, the ratio of broad money to nominal GDP or monetary deepening increased from 0.12 in the first period to 0.28 and 0.44 respectively in the next two periods with an annual average growth rate of 4.1 per cent. However as can be indicated from the significance tests of mean differences in table 3.1, through out the whole period, the average annual growth rates did not show statistically significant variations since we couldn't reject the null hypothesis of mean difference zero.

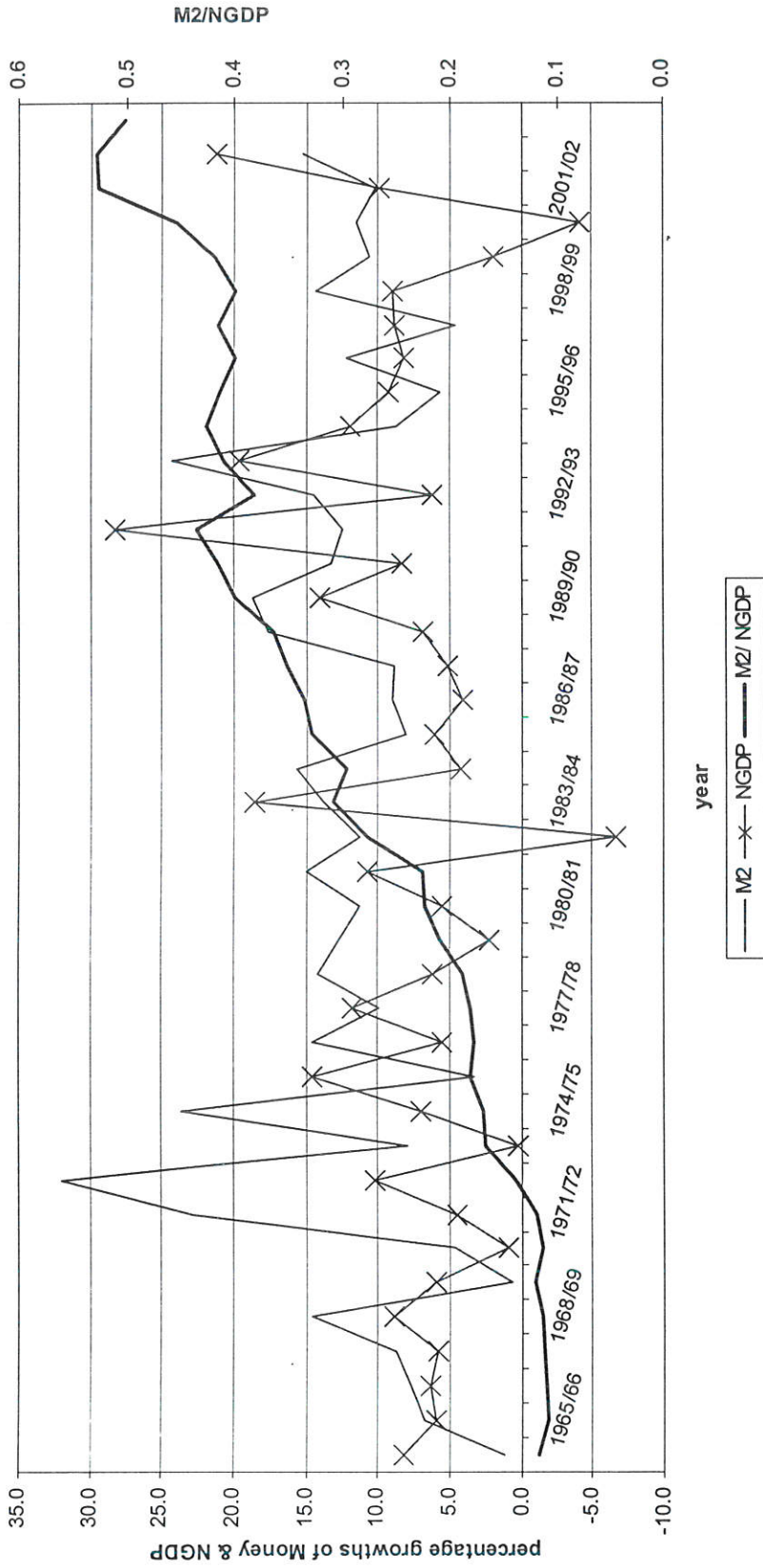
Table 3.1. Average annual growth rates and Ratios of Components of Money supply, NGDP and M2/NGDP (1964/65-2003/04)

| Average annual growth rates | | | | | | | | Ratios | | |
|--|------------|------------|------------|---------------|---------------|--------------|-----------------|--------------|--------------|----------------|
| <i>Periods</i> | <i>M1</i> | <i>QM</i> | <i>M2</i> | <i>M1/M2</i> | <i>QM/M2</i> | <i>NGDP</i> | <i>M2/NGDP</i> | <i>M1/M2</i> | <i>QM/M2</i> | <i>M2/NGDP</i> |
| 1964/65-1973/74 | 7.7 | 21.7 | 11 | -3.1 | 9.9 | 6.3 | 4.4 | 72.6 | 27.4 | 12.2 |
| 1974/75-1990/91 | 14.4 | 10 | 12.6 | 1.5 | -2.1 | 6.8 | 5.7 | 72.3 | 27.5 | 27.2 |
| 1991/92-2003/04 | 9.2 | 18.2 | 12.1 | -2.5 | 5.4 | 10.7 | 1.7 | 62.6 | 37.4 | 43.8 |
| Total Average | 11.1 | 15.4 | 12.1 | -0.9 | 3.2 | 8 | 4.1 | 69.2 | 30.7 | 28.8 |
| Significance test of growth rate differences (Hypothesis: Mean=0) | | | | | | | | | | |
| Growth rate differences ⁴⁰ | <i>DM1</i> | <i>DQM</i> | <i>DM2</i> | <i>DM1/M2</i> | <i>DQM/M2</i> | <i>DNGDP</i> | <i>DM2/NGDP</i> | | | |
| Sample Mean | 0.268 | 0.900 | 0.371 | -0.100 | 0.526 | 0.342 | 0.042 | | | |
| t-statistic | 0.143 | 0.290 | 0.259 | -0.096 | 0.186 | 0.224 | 0.0260 | | | |
| Probability ⁴¹ | 0.887 | 0.774 | 0.797 | 0.924 | 0.854 | 0.824 | 0.9794 | | | |

⁴⁰ D represents difference of annual growth rates over the total sample period.

⁴¹ The reported probability value is the p-value, or marginal significance level, against a two-sided alternative. If this probability value is less than the size of the test, say 0.05, we reject the null hypothesis (in this case mean is equal to zero).

Chart 2. Money supply to NGDP ratio and percentage growths of money supply and NGDP



3.1.2 Developments in Monetary Asset Counterparts

Table 3.2 below compares the developments of money supply asset counterparts in the three periods. The ratio of each component to broad money (M2), the ratio of claims on the private sector (DCP) and net claims on the government sector (NDCG) to total domestic credit (DC) are illustrated to examine the relative share of net foreign asset (NFA), DC and other items net (OIN) to money supply; and the proportion of DCP and NDCG to DC throughout the period.

NFA grow by 18 per cent, 34.6 per cent and 50 per cent within the three periods successively. Its contribution to money supply which was 40.8 per cent in the first period declined to 17.8 per cent in the second period, while it again revived to 28.1 per cent in the third period. The movement of NFA to M2 ratio varied inversely with the movement of DC to M2 which increased to 103 per cent in the same period and remained almost stable in the third period. This inverse relationship arises as domestic credit expansion motivates the need for higher imports that negatively affects NFA. As to the monetarist's argument, the expansion of DC results in the decline in NFA for two reasons, one is that foreign exchange declines due to import financing and the other is when credit is extended for domestic activity, the demand for import increases resulting in a decline in foreign reserves. During the first and the third periods, NFA, which is affected mainly by foreign exchange inflows and domestic credit expansion, had a higher relative weight in its influence over the total money supply as measured by the ratio of NFA to M2. The foreign exchange inflow is composed of net exports, net capital inflows and net transfer payments. Hence, the decline in the second period might be due to the combined effect of a relatively greater share of DC to M2 and the relative increase in imports over exports. NFA which attained an amount of Birr 13 billion at the end of 2003/04 registered its lowest value of about Birr 50 million in 1989/90 falling by 88 per cent from the previous year balance. However, after this period NFA stepped up in association to the aid flowing into the country in support of the reform program. The total average share of NFA over money supply is 26.9 per cent under the whole period

DC is the dominant component of M2 in all periods as indicated by a period annual average ratio of DC to M2 of 96.1 per cent from 1964/65-2003/04. In the first period, its share was 73.4 per cent while during the second and the third period; it grew up and gave a value of more than

100 per cent⁴². However, the OIN to M2 ratio which grew by 21.3 and 32.2 per cent in the two periods respectively counterbalances the difference. DC grew at an annual average rate of 8.3 per cent, 18.1 per cent and 10.3 per cent respectively in the three periods. Although its relative importance increased during the second and the third period, a significant shift was observed during the second period which can be somewhat attributed to the decline in the relative share of NFA to M2 and partly due to the absolute increase in the DC itself.

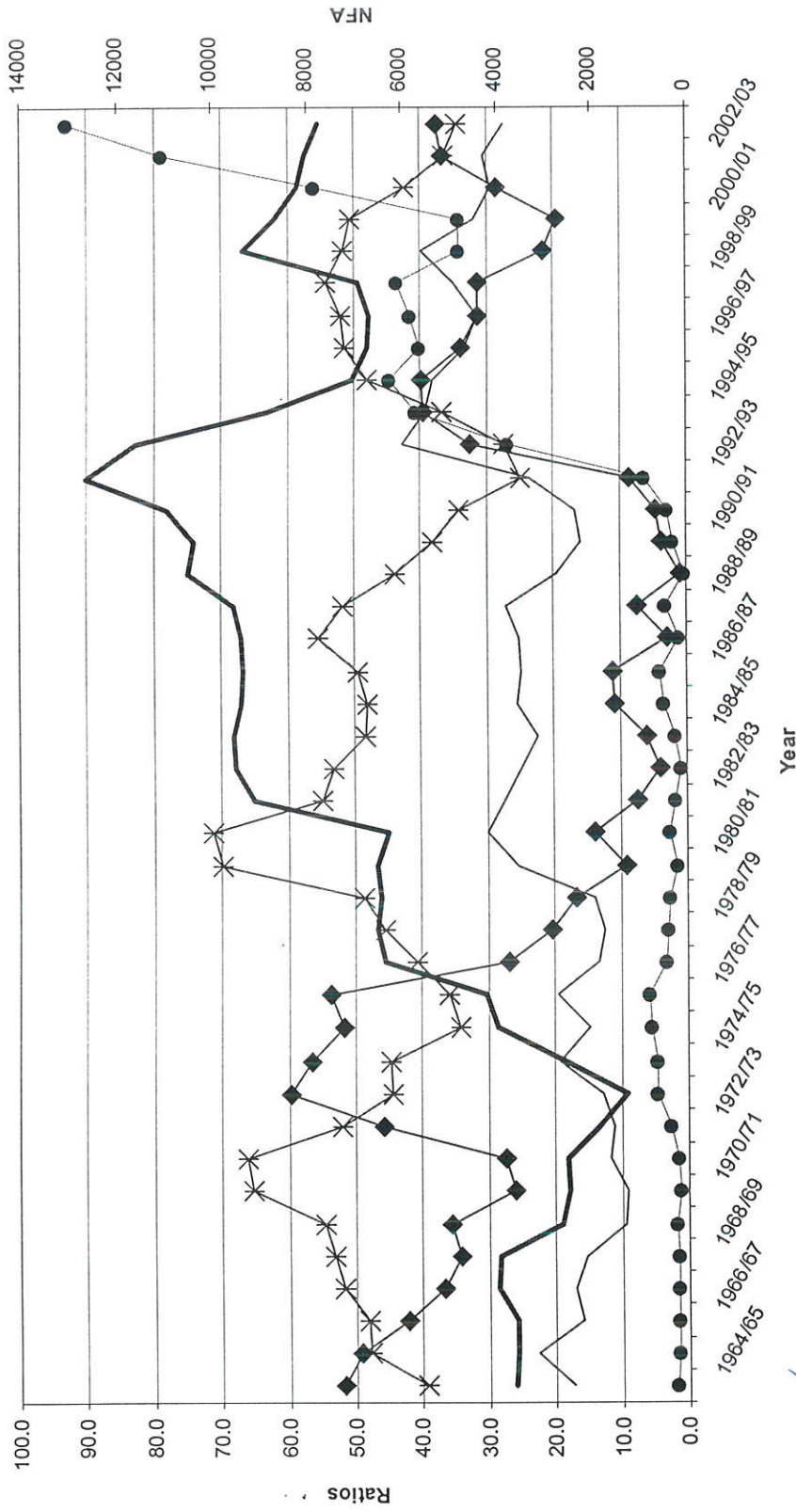
When coming to the composition of domestic credit (DC) between claims on the private sector (DCP) and claims on the government sector (NDCG), a significant change has been observed from the beginning period. The ratio of DCP to DC was higher in the first period, about 71 per cent of DC, and lower in the two periods 48.5 per cent and 40.5 per cent respectively in which the significant fall is observed in the second period. And on average it constituted 41.3 per cent of DC. The opposite holds for NDCG to DC ratio which was lower in the first period about 29 per cent of DC, while it increased to 51.6 and 59.5 per cents in later periods also in this case the significant shift is observed during the second period. On period average, NDCG constituted about 59 per cent of DC. This may be attributed to the huge public sector expansion observed during the second period and the subsequent inability to reduce certain expenditures such as the provision of infrastructure net work (road facility, electric power and telecommunication services), lay outs for health and education facilities and other related expenses in the last period due to the low level of those facilities in the country. Moreover, although the sources of revenue did not show much improvement, a rehabilitation and reconstruction effort caused downward inflexible government expenditure forcing domestic bank borrowing as a good alternative to finance deficit. This reverse trend that is observed on the development of the ratio of DCP and NDCG to DC might imply financial crowding out of the private sector by the government.

⁴² The share of NFA, DC and OIN to broad money supply add up to 100 per cent, hence although the share of DC to broad money plus the share of NFA to broad money gave a value above 100 per cent, since the share of OIN is an offsetting item the overall sum results just 100 per cent.

**Table 3.2. Average annual growth rates and Ratios of Monetary aggregates
(1964/65-2003/04)**

| Average annual growth rates | | | | | | | Ratios | | | | | | |
|-----------------------------|------------|-----------|-------------|------------|------------|-----------|--------------------------|------------------------|-------------------------|---------------------------|-------------------------|-------------------------|---------------------------|
| <i>Periods</i> | <i>NFA</i> | <i>DC</i> | <i>NDCG</i> | <i>DCP</i> | <i>OIN</i> | <i>M2</i> | <i>NFA</i> <i>/M2</i> | <i>DC</i> <i>M2</i> | <i>DCP</i> <i>M2</i> | <i>NDCG</i> <i>/M2</i> | <i>OIN</i> <i>M2</i> | <i>DCP</i> <i>DC</i> | <i>NDCG</i> <i>/DC</i> |
| 1964/65- 1973/74 | 18.0 | 8.3 | -0.9 | 12.3 | 10.3 | 11.0 | 40.8 | 73.4 | 52.2 | 21.2 | 14.2 | 71.4 | 28.6 |
| 1974/75- 1990/91 | 34.6 | 18.1 | 30.8 | 12.6 | 17.2 | 12.6 | 17.8 | 103 | 49.0 | 54.4 | 21.3 | 48.5 | 51.6 |
| 1991/92- 2003/04 | 50.0 | 10.3 | 10.6 | 12.9 | 20.0 | 12.1 | 28.1 | 104 | 41.9 | 62.2 | 32.2 | 40.5 | 59.5 |
| Total Average | 35.9 | 13.2 | 16.8 | 12.6 | 16.5 | 12.1 | 26.9 | 96.1 | 42.5 | 61.0 | 23.1 | 41.3 | 58.7 |

Chart 3. Contributions of Asset Counterparts to Money supply and NFA



Legend:
 ◆ NFA/M2
 — DCP/M2
 * DCG/M2
 — OIN/M2
 ● NFA



To generalize causality relationships between monetary aggregates, the Granger causality test is presented in table 3.3 below. According to the result, there is a tendency for DC to influence NFA during the observed period since we reject the null hypothesis DC doesn't granger cause NFA at 5 per cent and 10 per cent significance levels. However, during the same period, when DC is disaggregated, the causality test from NDCG to NFA is significant at all levels while DCP is found to influence NFA at 10 per cent significance levels. From the reverse causality, a strong causality from NFA to DCP is found. Killick and Mwega (1990) has identified two reasons for this reverse causality to occur. One is that with the decrease in NFA, base money decreases and thus lowers the reserve base on which commercial banks undertake their lending. However commercial bank lending is not as such responsive to reserve base since their already exists excess reserves above the requirement. The other possible reason might be the crowding out effect of government credit which cuts DCP during a decline of NFA before NDCG is cut. In general therefore from the causality test observations, a direct and also an inverse link has been identified between NFA and DC.

The movement of the NFA is found to be influenced by DC expansion as argued by the monetarists in the monetary approach to the balance of payment. This relationship is established between NDCG and NFA, which is consistent with the adjustment program's effort to control NDCG. A change in NFA has also been found to pressurize the expansion of DC positively which implies that any discretionary monetary policy, particularly for the management of NDCG, at least in the short-run is challenging. The existence of this reaction outcome highlights the existence of a self-correcting mechanism between change in NFA and change in DC.

**Table 3.3. Pair wise Granger Causality Tests between DC and NFA
(1964/65-2003/04)**

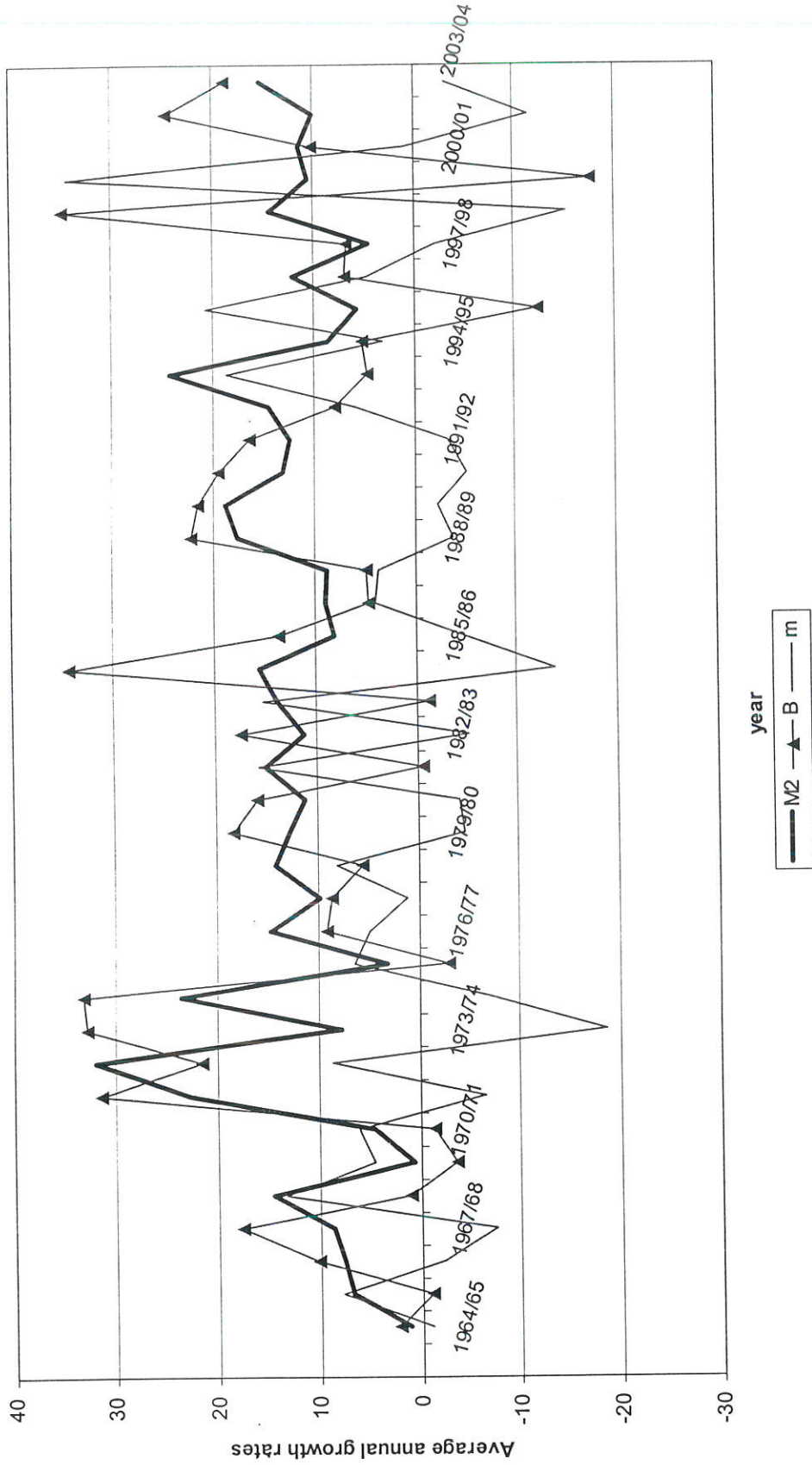
| Sample: 1965 2004 | | | |
|---------------------------------|-----|-------------|-------------|
| Lags: 4 | | | |
| Null Hypothesis: | Obs | F-Statistic | Probability |
| NFA does not Granger Cause DC | 36 | 0.70366 | 0.59634 |
| DC does not Granger Cause NFA | | 3.64673 | 0.01683 |
| DCP does not Granger Cause NDCG | 36 | 5.20496 | 0.00306 |
| NDCG does not Granger Cause DCP | | 6.23329 | 0.00109 |
| NFA does not Granger Cause NDCG | 36 | 6.22261 | 0.00111 |
| NDCG does not Granger Cause NFA | | 5.23168 | 0.00298 |
| NFA does not Granger Cause DCP | 36 | 4.70171 | 0.00521 |
| DCP does not Granger Cause NFA | | 3.64017 | 0.01696 |

3.1.3 Developments in the Money-Multiplier

As can be seen from table 3.4, the average annual growth rate of base money (B) in all the three periods is virtually related to the growth rate of money supply (M2). The average values of the money multiplier (m) is 1.7 for the earlier two periods while it increased to 2.2 for the last period, registering a 1.8 value for the whole period. After growing by 2.5 per cent in the first period, the money-multiplier growth rate declined by 0.3 per cent in the second period, this may be due to the rise in base money as a result of the required lending banks should make at the time to the government according to the central socialist plan.

During the second period, reserve to deposit (rd) and currency to deposit (cd) ratios, contributed to the negative growth rate of the money-multiplier (m) mounting by 2.7 per cent and 8.5 per cent respectively. The cd ratio fell on annual average of 2.4 per cent through out the whole period; however, it was positive during the second period. This is because of the decline in the growth rate of quasi-money during this period and that the growth rate of deposits is decreased. The rd ratio growth rate was positive through out the whole period, averaging by 5.6 per cent while it registered higher growth rate in the second period. Generally the money-multiplier and its proximate determinants are observed to be random during the period implying that the money-multiplier approach is not a reliable method for the analysis of money supply.

Chart 4. The Relationship between m, B and M2



Moreover, as can be depicted from the above chart, the average growth rates of the base money and the money-multiplier moved inversely during the period. This implies that the movement of the money-multiplier tends to counter-balance that of the base money creating a complexity to monetary control using the base money as a policy tool (Al-loughani & Moosa (1996), Killick & Mwega (1990)).

Table 3.4. Average Annual Growth Rates and Ratios of the Money-Multiplier, its Determinants and Monetary Aggregates(1964/65-2003/04)

| <i>Periods</i> | Average annual growth rates | | | | | Ratios | | |
|-----------------|-----------------------------|-----------|-----------|----------|-----------|----------|-----------|-----------|
| | <i>m</i> | <i>cd</i> | <i>rd</i> | <i>B</i> | <i>M2</i> | <i>m</i> | <i>cd</i> | <i>rd</i> |
| 1964/65-1973/74 | 2.5 | -5.7 | 3.1 | 8.6 | 11 | 1.7 | 1.1 | 0.2 |
| 1974/75-1990/91 | -0.3 | 2.7 | 8.5 | 14.0 | 12.6 | 1.7 | 0.8 | 0.3 |
| 1991/92-2003/04 | 3.7 | -6.7 | 3.4 | 9.7 | 12.1 | 2.2 | 0.5 | 0.2 |
| Total Average | 1.7 | -2.4 | 5.6 | 11.3 | 12.1 | 1.8 | 0.8 | 0.2 |

3.2. Target versus Actual Comparison for the Reform Period (1992/93-2003/04)

The effect of a program can be analyzed by comparing the actual values of some macro economic variables with the targets specified at the beginning of the program. The variables dealt with in this analysis are domestic credit (DC), both DCP and NDCG, and broad money, which were the monetary targets for the adjustment program. As important instruments of stabilization, quantitative targets on the growth rate of bank credit to central government, domestic credit and broad money supply were set as performance criteria (TGE, 1992). The program visualizes implicitly that the money-multiplier approach of money supply determination is appropriate. This is because the program gives monetary authorities a higher position in money supply management. However there is still a confession that the control is partial since management of net foreign assets (NFA) is outside the monetary authorities control and hence it is only through the net domestic asset part by controlling the NDCG that the stabilization and BOP objective can be achieved.

As shown in table 3.4 below, net bank credit to central government that was in general planned to reach at an annual average growth rate of -0.1 per cent calculated for the whole period registered an annual average growth rate of 9.8 per cent. However, due to the relatively lower growth rate in claims on the private sector (DCP), the target set for domestic credit (DC) as a whole was achieved with slight disparity. The growth rate of credit to other sectors has declined from 1994/95 onwards from 66.9 per cent in 1994/95 to 8.8 per cent in 2003/04. The growth rate of domestic credit was 10 per cent on average during the period, which is somewhat higher than the targeted average growth rate of 8.9 per cent.

Similarly, the growth rate of money supply was slightly higher than the target. During the period money supply grew at an annual average rate of 11.8 per cent against the targeted growth rate of 11.6 per cent. A relatively significant change in the growth rate of money supply under the review period is observed in the fiscal year of 1994/95 in consequence of the windfall gain from coffee export and the substantial increment in credit expansion to the private sector by about 66.9 percent. The El Nino weather condition and the Ethio-Eritrean conflict during the period 1997/98 and later, also the draught that occurred during the year 2001/02 were believed to have an effect on the growth rate of money supply and its counterparts. The non-existence of capital and money market, the institutional set up and the limited absorptive capacity of the economy in cases of large flows of export revenue have made money supply control uneasy task for monetary authorities (Yohannes, 1996). As a result, the growth rates of money supply, domestic credit and credit to the government have exceeded planned target growth rates.

Table 3.5. Target versus actual values of monetary aggregates (annual percentage changes) (1992/93-2003/04)*

| Year | Money Supply | | | Domestic Credit | | | Net Credit to the Gov't | | |
|----------------|---------------------|---------------|--|------------------------|---------------|--|--------------------------------|---------------|--|
| | <i>Target</i> | <i>Actual</i> | <i>Disparity (Actual minus Target)</i> | <i>Target</i> | <i>Actual</i> | <i>Disparity (Actual minus Target)</i> | <i>Target</i> | <i>Actual</i> | <i>Disparity (Actual minus Target)</i> |
| 1992/93 | 19.6 | 12.7 | -6.9 | 18.3 | 14.4 | -3.9 | 6.4 | 29.8 | 23.4 |
| 1993/94 | 13.4 | 13.8 | 0.4 | 9.7 | 10.4 | 0.7 | 2.2 | 7.7 | 5.5 |
| 1994/95 | 12.6 | 24.3 | 11.7 | 10 | 12.9 | 2.9 | -0.4 | -3.9 | -3.5 |
| 1995/96 | 8 | 8.3 | 0.3 | 8 | 14.5 | 6.5 | -1.6 | -1.9 | -0.3 |
| 1996/97 | 7.1 | 3.7 | -3.4 | 5 | 0.4 | -4.6 | -2.9 | -8.6 | -5.7 |
| 1997/98 | 9 | 12.8 | 3.8 | 8.6 | 10.4 | 1.8 | -0.3 | 6.5 | 6.8 |
| 1998/99 | 11 | 5.8 | -5.2 | 8.1 | 8.7 | 0.6 | -1.0 | 9.4 | 10.4 |
| 1999/00 | 9.2 | 13.9 | 4.7 | 6.9 | 31.8 | 24.9 | -0.3 | 53.6 | 53.9 |
| 2000/01 | 12.5 | 9.6 | -2.9 | 7.0 | 2.4 | -4.6 | -1.2 | -1.3 | -0.1 |
| 2001/02 | 13.2 | 12.3 | -0.9 | 7.0 | -0.5 | -7.5 | -4.2 | 4.7 | 8.9 |
| 2002/03 | 10.6 | 10.4 | -0.2 | 8.3 | 2.5 | -5.8 | -4.0 | 9.8 | 13.8 |
| 2003/04 | 13.4 | 14.2 | 0.8 | 9.7 | 11.8 | 2.1 | 5.6 | 12.1 | 6.5 |
| Average | 11.6 | 11.8 | 0.2 | 8.9 | 10.0 | 1.1 | -0.1 | 9.8 | 10.0 |

* Collected from different years of Policy Frame work Papers; and the figures are as of July 7 balances

In general, as can be seen from table 3.5, when a 12.1 per cent average growth rate of money supply is compared to a 10.7 per cent nominal GDP growth rate, monetary policy during the reform period could be considered to be relatively tight. This is highly attributed to the somewhat limited growth in total domestic credit that was 10 per cent on the average per annum against the targeted 8.9 per cent growth rate. However, the component of domestic credit (NDCG) showed larger disparity, signifying that the target for domestic credit is almost met only at the expense of domestic credit to the private sector (DCP) which is not a nice-looking phenomenon.

Chapter Four: Methodology and Model Specification

4.1. Model Specification

Earlier we have seen that there are two approaches of money supply determination, the money-multiplier and the counterparts. In this sub-section, we specify the two models.

4.1.1. The Money-Multiplier Model

As described in the literature part, the money multiplier model describes the relationship between money supply and base money without conveying any behavioral content to the multiplier or its components. A stable and predictable relationship between money supply (M) and base money (B) indicates a stable and predictable multiplier (m) which asserts the possibility of controlling money supply by controlling base money (Al-Loughani & Moosa, 1996). Further, Al-Loughani & Moosa (1996) argue that one more condition for the feasibility of controlling money supply is that changes in base money do not affect the value of the multiplier for instance through the effect of interest rates on currency and reserve ratios. For the monetarists, the money-multiplier is stable and predictable and, therefore, the impact of changes in base money on money supply can be estimated with a reasonable degree of precision (Al-Loughani & Moosa, 1996).

In its deterministic form the money-multiplier model can be specified as

$$M_t = m * B_t \dots\dots\dots (4.1)$$

Where $\frac{\partial M}{\partial B} > 0$, $(\frac{\partial M}{\partial cd} < 0$ and $\frac{\partial M}{\partial rd} < 0)$

Thus the stability of the money-multiplier depends on the stability, or otherwise of its components cd and rd .

Equation (4.1) can be written in a stochastic logarithm as follows:

$$\triangleright \text{Log } M_t = \beta_0 + \beta_1 \text{Log } B_t + \varepsilon_t \dots\dots\dots (4.2)$$

Where $\beta_0 = \log m$ is the constant term while ε_t is error term.

For the money multiplier model to hold as a stable long-term relationship, $\text{Log } M_t$ and $\text{Log } B_t$ must be co-integrated such that $\beta_0 > 0$ and $\beta_1 = 1$. Co-integration is the basic condition, while the coefficient restrictions signify the sufficient condition (Al-Loughani & Moosa, 1996).

4.1.2. The Counterparts Model

This approach is drawn from the consolidated balance sheet of the central and commercial banks such that money supply in the liability side (Cy + D) is equal to the sum of its asset counterparts DCP, NDCG, NFA less the offsetting liability component OIN. Where the variables are as defined earlier. Variation in the money supply is a consequence of overall changes on these counter-parts. For this reason, explanations about changes on each of those counter-parts would combine to explain the overall changes in the money supply.

$$\Delta M_t = \Delta DCP_t + \Delta NDCG_t + \Delta NFA_t - \Delta OIN_t \dots\dots\dots (4.3)$$

Where Δ represents change, the subscript t refers to time period and the other variables are as defined earlier.

The complete model is given by the four structural equations below following Fry (1988), Killick and Mwega (1990), and Adenikinju and Ogun (1995).

$$1) \Delta DCP_t = \pi_0 + \pi_1 \Delta NGDP_t + \pi_2 \Delta FX_t + \pi_3 \Delta NDCG_t + \pi_4 \Delta TOT_t + \pi_5 \Delta RLR_t + \pi_6 \Delta DCP_{t-1} + \varepsilon_t \dots\dots\dots (4.4)$$

Where $NGDP_t$ = Nominal GDP as a proxy for income

TOT_t = Terms of Trade

FX_t = Foreign exchange receipts

RLR_t = Real lending interest rate

ε_t = the error term

Domestic credit to the private sector is positively related to the level of income, foreign exchange receipts and the preceding credit position, while it is negatively linked to domestic credit expansion to the government, and cost of borrowing (represented by lending interest rate). One more factor, terms of trade, is connected with DCP in that deterioration in the terms of trade (TOT) stimulates higher lending to meet increased costs that arose due to higher values of imports. Thus the expected signs of the coefficients are $\pi_1, \pi_2, \pi_6, \geq 0$ and $\pi_3, \pi_4, \pi_5, \leq 0$

In the same way this partial adjustment model can be modified in an alternative form so as to incorporate long run relationships as follows:

$$\text{➤ } \text{LNDCG}_t = \alpha_0 + \alpha_1 \text{LNGDP}_t + \alpha_2 \text{LCPI}_t + \alpha_3 \text{LFX}_t + \alpha_4 \text{LNDCG}_{t-1} + \varepsilon_t \dots \dots \dots (4.7)$$

Where $\text{LNGDP}_t = \text{Log}(\text{NGDP}_t)$

$\text{LCPI}_t = \text{Log}(\text{CPI}_t)$

$\text{LNDCG}_{t-1} = \text{Log}(\text{NDCG}_{t-1})$

And the others are as defined earlier

However, in this alternative specification NGDP (a proxy for income) is replaced in place of lagged changes in NGDP, a proxy for lags in revenue collection so as to look at the long run influence of NGDP on NDCG. Yet in this alternative specification, the expected sign for the coefficients of NGDP will be indeterminate. This is because domestic government bank borrowing can be related with NGDP in two different ways (Bohoun and Kouassy, 1993). One is that with an increase in NGDP, revenue collection will be higher through the tax base effect which implies lower government borrowing requirement from the banking system. On the other hand, a rise in income motivates public expenditure and hence induces higher government borrowing; subsequently the net effect depends on to what extent the revenue, generated from the extra income, is able to cover the higher expenditure. Accordingly, the second specification is expected to have the coefficients with signs of:

$$\alpha_2, \alpha_4, \geq 0, \alpha_1 \geq / \leq 0 \text{ and } \alpha_3 \leq 0$$

$$3) \Delta \text{NFA}_t = \mu_0 + \mu_1 \Delta \text{FX}_t + \mu_2 \Delta \text{NGDP}_t + \mu_3 \Delta \text{RDR}_t + \mu_4 \Delta \text{DC}_t + \mu_5 \Delta \text{NFA}_{t-1} + \varepsilon_t \dots \dots \dots (4.8)$$

Where $\text{RDR}_t = \text{Real deposit interest rate}$

Net foreign asset is influenced positively by an increase in foreign exchange receipts, by factors accounting growth in the demand for money such as income level (NGDP), and by preceding NFA level. In contrast, NFA is negatively related with domestic credit expansion and deposit interest rate. The expected signs of the coefficients are:

$$\mu_1, \mu_2, \mu_5, \geq 0; \mu_3, \mu_4 \leq 0$$

The alternative specification is given as:

$$\text{➤ LNFA}_t = \mu_0 + \mu_1 \text{LFX}_t + \mu_2 \text{LNGDP}_t + \mu_3 \text{LDR}_t + \mu_4 \text{LDC}_t + \mu_5 \text{LNFA}_{t-1} + \varepsilon_t \dots\dots\dots (4.9)$$

$$\mu_1, \mu_2, \mu_5 \geq 0; \mu_3, \mu_4 \leq 0$$

Where $\text{LDC}_t = \text{Log}(\text{DC}_t)$

$$\text{LNFA}_{t-1} = \text{Log}(\text{NFA}_{t-1})$$

$$\text{LDR}_t = \text{Log}(\text{DR}_t) \text{ where } \text{DR}_t \text{ is nominal deposit interest rate}$$

$$4) \Delta \text{OIN}_t = \beta_0 + \beta_1 \Delta \text{NFA}_{t-1} + \beta_2 \Delta \text{EX}_t + \beta_3 \Delta \text{OIN}_{t-1} + \varepsilon_t \dots\dots\dots (4.10)$$

Where $\text{EX}_t = \text{Nominal exchange rate}$

The requisite of depositing in advance certain amount of money (import pre deposits) prior to importation, as in import licensing, compose an important component of other items net. However, since they are actions intended to maintain foreign exchange, they would vary inversely with changes in net foreign assets. Authorities raise the pre-deposits when NFA declines to depress imports. The other variable nominal exchange rate influences other items net through the valuation effect. When the nominal exchange rate rises the values in the liability side increase some what indicating higher income for the banking system. Hence, the expected signs of the coefficients are $\beta_1 \leq 0$ and $\beta_2, \beta_3 \geq 0$

Alternatively, as was done in the previous three equations, the above partial adjustment expression given by Fry (1988), and Adenikinju and Ogun (1995) can be modified as:

$$\text{➤ LOIN}_t = \beta_0 + \beta_1 \text{LNFA}_t + \beta_2 \text{LEX}_t + \beta_3 \text{LOIN}_{t-1} + \varepsilon_t \dots\dots\dots (4.11)$$

$$\beta_1 \leq 0; \beta_2, \beta_3 \geq 0$$

Where $\text{LOIN}_t = \text{Log}(\text{OIN}_t)$

$$\text{LNFA}_t = \text{Log}(\text{NFA}_t)$$

$$\text{LOIN}_{t-1} = \text{Log}(\text{OIN}_{t-1})$$

$$\text{LEX}_t = \text{Log}(\text{EX}_t)$$

4.2. Methodology

4.2.1 The Nature of the Data

To factor out the determinants of money supply and to look at the behavior of its components, quarterly time series data covering the period 1964/65-2003/04 is used. For the purpose of the study, certain adjustments or transformations will be done on certain variables. Since, quarterly data on Nominal/Real GDP is not available interpolation will be made from the annual series using a technique suggested by Goldstein and Khan (1976) as is shown in appendix I. Although

the quarterly interpolations produced by this technique may differ from the unobserved true quarterly GDP values, they are reasonable and unbiased representation of these values in that they have the same stochastic and trend properties as the original annual GDP data.

The price level that will be used in the analysis is the Addis Ababa retail price index which is available with two different base years, the previous series uses base year 1963 while the series for recent years is based on base year 2000. To have a continuous and consistent figure and to match the quarterly real GDP figures with 1980/81 base year, the CPI found in both series will be converted to the same base year.

Data on the terms of trade ($TOT = \frac{XUVI}{MUVI} * 100$) or on both of its components (export unit value index (XUVI) and import unit value indices (MUVI)) are not available. Hence in this study effort will be made to construct the export and import unit value indices on quarterly basis by using figures of values and volumes of exports and imports. Although, there are a number of formulae used in the construction of index numbers, this study uses the most common technique, namely Fischer's index formula. This formula is simply the geometric mean of the other two most commonly used techniques, the Laspeyres' and the Paasche formulas, which corrects the deficiencies of the other two as will be shown in appendix II (Gupta, 1981). The base year selected will be 1980/81 to match with the real GDP figures and the CPI.

4.2.2 Time Series Characteristics of the Data

4.2.2.1 Testing for Unit Roots

For the assumptions of the classical model to hold, the stationarity of the time series variables under consideration is crucial. This is because if non-stationary variables are regressed using OLS, the results obtained will be spurious⁴³. This is an implication that the variables involved have common trend in time and they may not have long run economic or causal relationship (Maddala, 1992, Gujarati, 1995).

⁴³ Spurious regression may give high R^2 and significant t-ratios even without true relationship among the variables.

Data stationarity test is commonly undertaken using the Dickey fuller (DF) and Augmented Dickey fuller (ADF) unit root tests. The Dickey fuller test is used for regression with random walk, by adding drift and both drift and a time trend.

$$\Delta Y_t = \gamma Y_{t-1} + \varepsilon_t \dots\dots\dots (4.12)$$

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + \varepsilon_t \dots\dots\dots (4.13)$$

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + a_2 t + \varepsilon_t \dots\dots\dots (4.14)$$

Testing for unit roots using equation (4.12) assumes that the data generating process of Y_t is a simple first order autoregressive process with zero mean and no trend component. If in the above equations $\gamma = 0$, then the Y_t sequence contains a unit root. After estimating the equations using OLS, the resulting t-statistics is compared with the critical value given in Dickey Fuller tables. If the t-calculated is less than the critical value, then the null hypothesis of there is unit root will not be rejected (Enders, 1995).

The Augmented Dickey Fuller test is the same as the Dickey Fuller test except including a series of lag (p) to account for possible occurrence of autocorrelation (Enders, 1995). The current study uses the second test so as to overcome the defects of the simple Dickey Fuller test.

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{i=2}^p \beta_i \Delta Y_{t-i+1} + \varepsilon_t \dots\dots\dots (4.15)$$

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + \sum_{i=2}^p \beta_i \Delta Y_{t-i+1} + \varepsilon_t \dots\dots\dots (4.16)$$

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + \sum_{i=2}^p \beta_i \Delta Y_{t-i+1} + a_2 t + \varepsilon_t \dots\dots\dots (4.17)$$

4.2.2.2 Co-integration Tests

Although most time series variables are non-stationary, their linear combination can be stationary, implying the variables involved have long run behavioral relationships. One way to determine whether or not a long run equilibrium relationship exists among the variables in a

model is to test empirically that the series are co-integrated using co-integration⁴⁴ tests (Enders, 1995). There are two kinds of tests for the existence of co-integration. These are the Engle Granger (1987) two-stage procedure and the Johansen (1988) maximum likelihood estimation procedure. Under the Engle Granger procedure, first we estimate the long run static model if the variables are of the same order of integration⁴⁵ and obtain the residuals. Then, test the stationarity of the residual, which is the linear combination of the variables. If it is found stationary, the variables are said to be co integrated to mean they have long-run relationship. The second step is to estimate the error correction model (ECM): the first difference of the variables with their appropriate lags, and lag of the residual obtained from the static model, are regressed.

However, the Engle-Granger procedure has a number of limitations; Enders (1995) puts them as follows. One is that this procedure assumes a predetermined one-way relationship between variables. Since it assumes only one co integrating vector, it has no systematic procedure for a separate estimation of multiple co integrating vectors. The assumption of one co integrating vector implies that there is only one equilibrium relationship among the variables found in the vector auto regression opposed to the case of multiple co integrating vectors which implies more than one linearly independent relationships. The case of one co integrating vector can be easily rejected especially in cases of regressions with more than two variables, as it is possible to have more than one co integrating vectors. Another limitation of this procedure is that given that it uses a two-step estimator; the error introduced from the first step is used in the regression of the second step. This is problematic because any error made in the first step is carried on to the second step.

The Johansen (1988) maximum likelihood estimation procedure overcomes the limitation of the Engle-Granger (1987) two-stage procedure. It relaxes the assumption of at most one co-integrating vector and avoids the use of two steps estimation. In this procedure, the existence of co-integration relationship is tested using vector error correction mechanism (VECM) and arbitrary selection of dependent and independent variables is avoided. In this regard the present

⁴⁴ The concept of co integration implies that time series variables may be non-stationary but their linear combination can be stationary.

⁴⁵ The variables should be stationary in levels or by differencing once or so.

α and β , such that $\Pi = \alpha\beta'$, with each matrix (nrx). β -matrix designating the long-run coefficients of r distinct co-integrating vectors that makes the linear combination $\beta'X_t$ stationary, even if X_t is non stationary, while the α -matrix represents the coefficients of the speed of adjustment to disequilibrium (Harris, 1995).

The number of co-integrating vectors is identified based on Lambda trace (λ_{trace}) and Lambda max (λ_{max}) statistics (Enders, 1995; Harris, 1995). These tests are given as follows:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i)$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})$$

Where $\hat{\lambda}_i$ = the estimated values of the characteristics roots (Eigenvectors)

T= the number of observations

The null hypothesis under λ_{trace} is that the number of distinct co integrating vector is less than or equal to r against the general alternative, while λ_{max} tests the null hypothesis that there are r co integrating vectors against the alternative of $r+1$ and it is a more powerful test than λ_{trace} (Enders,1995).

4.2.3 Stability Tests

In this study effort will be made to check the validity of the money-multiplier model as is specified in the objective. The whole purpose of this stability test is to check whether the monetarists' explanation of stable and predictable relationship holds so as to use the money multiplier model for policy purpose of controlling money supply. The existence of stable money multiplier is necessary to effectively control money supply. The most well known tests of stability⁴⁷ of regression parameter are the chow tests, which include Chow's breakpoint test and Chow's forecast tests, and the recursive least square graphic test. In the case of Chow's breakpoint test⁴⁸, the sample data is arbitrarily divided into two groups and the two groups are

⁴⁷ Stability refers to constancy of regression parameters and constant or smaller change in the variance of the error term over the specified sample period.

⁴⁸ The chow breakpoint test is an analysis of variance test. It is an F-distribution with degrees of freedom $K+1$ & $T-2K-2$ and in the simplest case involving a single break point is computed as

estimated independently to see if there are significant differences in the estimates of the two equations and compare proportionate increase in the sum of squared residuals. In Chow's forecast test⁴⁹ too the sample data is divided into two periods. But here the second sub-period sample size is less than the number of regressors. Regression is undertaken only on the first period and the model is used to predict the values of the dependent variable in the second period. And if large gap is observed between the actual and the predicted values, then it is an indication of instability (Thomas, 1993).

However, Chow tests fail to indicate whether the instability is in the intercept or in which variable coefficient. Hence, they cannot show when the instability occurred in the sample data. Recursive least square method circumvents this limitation, as there is no need to divide the sample data into sub-periods. Moreover, in recursive least square method each variable coefficient is estimated for small sub-sample that is greater than the number of parameters (Thomas, 1993). Here by increasing the sub sample size, estimation of the parameters continues until the total sample data is completed. And the paths of the estimates overtime are plotted. In these recursive plots, there are two standard error bands around the selected estimated coefficient. If significant variation occurs in these bands as the sample size increases then the coefficient is not stable over the sample period. On the other hand, if the variation diminishes, then the coefficient is stable over the entire period. And the recursive residual graph, for stability to occur, should be within the critical error bands to indicate the constancy of the variance of the estimated models.

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

Where RRSS= residual sum of squares from pooled data,
URSS= sum of residual sum of squares from the two separate regressions and K= number of parameters in the regression

⁴⁹ Chow's forecast test is an F-statistic given by $F = \frac{(RRSS - URRSS_1)/n_1}{URRSS_1/(n_1 - (K + 1))}$ Where n_1 is the number of

observations in the first period, RRSS is residual sum of squares from the pooled data and URRSS₁ is residual sum of squares from the first period

Chapter Five: Empirical Results and Interpretation

5.1. Time Series Characteristics of the Data

5.1.1 Tests for Stationarity

Since time series data is used in the current study, it is obligatory first to test the stationarity of variables that will be used in regression. The reason is that the existence of non-stationary variables would give a spurious result. Hence test for unit roots is a necessary condition before going to tests of cointegration. Table 5.1 below, lists the augmented Dickey Fuller statistics calculated for the variables in the analysis. However, before proceeding to the formal test statistics of augmented Dickey Fuller, we can simply observe those variables diagrammed over time and determine their stationarity by just observing their behavior over time. A stationary time series data fluctuates around its long run mean and has a finite variance and covariance so that the variation doesn't depend on time (Enders, 1995).

As can clearly be seen from the diagrams in appendix III, all the variables involved here, except the logarithm of terms of trade (LTOT), are non-stationary in levels while they are stationary in first differences. Supplementary test using augmented Dickey Fuller test also ascertains this point and gives the order of integration.

Table 5.1. ADF Statistics for Testing a Unit Root

| Variables (1964/65Q1- 2003/04Q4) | Without Drift | | With Drift | | With Drift and Trend | |
|--|----------------------|------------|----------------------|------------|----------------------|------------|
| | Order of Integration | | Order of Integration | | Order of Integration | |
| | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| LM | 8.058664 | -2.724586* | 0.665526 | -6.456758* | -3.284275 | -6.468458* |
| LB | 5.504135 | -4.571656* | -0.118332 | -6.186255* | -1.867345 | -6.164742* |
| LDC | 5.545597 | -3.682742* | -1.104529 | -6.478866* | -0.667017 | -6.503852* |
| LDCP | 4.453718 | -3.937128* | -1.032940 | -5.097582* | -1.855616 | -5.107375* |
| LNDCG | 3.169976 | -4.979742* | -0.470598 | -5.751900* | -1.530153 | -5.705860* |
| LNFA | 0.696678 | -6.228561* | -0.788640 | -6.281263* | -1.866778 | -6.314466* |
| LOIN | 2.576668 | -6.782175* | -0.462219 | -7.318134* | -2.954789 | -7.241588* |
| LCPI | 3.686736 | -3.693095* | -0.743106 | -4.474308* | -1.034182 | -4.482911* |
| LNGDP | 4.883617 | -5.057961* | 0.228594 | -7.997984* | -1.785573 | -7.935709* |
| LFX | 4.206444 | -5.638207* | 0.724119 | -6.251842* | -1.768104 | -6.306076* |
| LEX | 1.295355 | -5.980684* | 0.211734 | -6.139751* | -1.386695 | -6.375722* |
| LTOT | -0.143341 | -9.241665* | -4.276975* | -9.212917* | -4.267669* | -9.186250* |
| LLR | 0.120545 | -6.174740* | -1.993269 | -6.164982* | -2.185663 | -6.144356* |
| LDR | -0.468917 | -6.211956* | -1.976006 | -6.195005* | -1.629826 | -6.332708* |
| Critical Values (1%) | -2.5788 | -2.5789 | -3.4733 | -3.4735 | -4.0193 | -4.0197 |
| (5%) | -1.9419 | -1.9419 | -2.8800 | -2.8801 | -3.4392 | -3.4394 |

Note: * represents the rejection of unit root at 1% and 5% significance level with a lag length of three.

Based on the augmented Dickey Fuller (ADF) test shown above in table 5.1, all the variables that will be used in regression, except the natural logarithm of terms of trade (LTOT), are found to be integrated of order one $I(1)^{50}$ while the LTOT is found to be stationary in levels and hence the order of integration is mixed with $I(0)$ and $I(1)$. However, the Johansen procedure also permits series that are integrated of mixed orders up to $I(1)$, so as both data that are stationary in levels $I(0)$ and stationary in first differences $I(1)$ can be entered jointly for tests of co

⁵⁰ Order of integration of one implies that the variables will be stationary after being differenced once while order of integration of zero implies the series is stationary without being differenced.

integration (Harris,1995, Johansen,1995). Hence, in the next section all the variables will be used in the co integration analysis.

5.1.2 Co-integration Analysis

After determining the order of integration of the variables using the Augmented Dickey fuller test in the above section, the next step is to test for the presence of co-integration. Thus in this section, co-integration tests for both the money multiplier and the counterparts models will be carried out.

A) The Money-Multiplier Model

The money-multiplier model as specified in the previous section in log linear form can be put as follows.

$$\text{Log } M_t = \beta_0 + \beta_1 \text{Log } B_t + \varepsilon_t, \dots\dots\dots (5.1)$$

The results of the maximal (λ_{\max}) and the trace (λ_{trace}) tests for multiple co-integrating vectors are summarized in table 5.2. As can be observed from the table, the null hypothesis of no co-integration is rejected by both the λ_{\max} and λ_{trace} statistics at 95 per cent critical level and λ_{\max} , the more powerful test⁵¹, suggested the existence of one co-integrating vector since it didn't reject the existence of only one co-integrating vector.

Table 5.2 Tests for the Number of Co-integrating Vectors for Money Supply

| Ho: rank=r | n-r | Eigenvalue (λ_i) | λ_{\max} | λ_{\max} (95%) | λ_{trace} | λ_{\max} (95%) |
|------------|-----|----------------------------|------------------|------------------------|--------------------------|------------------------|
| r == 0 | 2 | 0.166704 | 27.9** | 15.7 | 33.57** | 20.0 |
| r <= 1 | 1 | 0.0363549 | 5.666 | 9.2 | 5.666 | 9.2 |

Number of lags used in the analysis: 6

Variables entered restricted: Constant

Vector AR 1-5 F(20,258) = 1.3267 [0.1618]

Vector normality Chi²(4)= 80.204 [0.0000] **

Vector Xi² F(72,338) = 0.76121 [0.9193]

Vector Xi*Xj F(270,141) = 0.67601 [0.9968]

⁵¹ Refer Enders,1995

After establishing that there is one co-integrating vector, what is important for our analysis is the first column of α -matrix (which is the matrix of speed of adjustment coefficient) and the first row of the β Eigenvectors (which are long-run coefficients of the variables). Linear restrictions are imposed on α -coefficients to identify which entries of α -matrix are statistically zero. Such test for zero-restriction on α -coefficients is called weak exogeneity (Harris, 1995) which helps to identify endogenous and exogenous variables in the model; rejection of weak exogeneity implies that the variables under investigation are endogenous.

Table 5.3 Standardized β Eigenvectors and Zero-restriction tests on β Coefficients

| i) Standardized β Eigenvectors | | |
|--|------------------|----------|
| LM2 | LB | Constant |
| 1.0000 | -1.1735 | -0.91611 |
| -0.89377 | 1.0000 | -0.30890 |
| ii) Zero-restriction tests on β Coefficients | | |
| | LR-test $X^2(1)$ | P-value |
| LB | 5.117 | 0.0237* |
| Constant | 2.028 | 0.1544 |

*Rejection at 5 per cent level of significance

Note: While interpreting the relationship sign, the opposite sign should be taken for the β coefficients other than the coefficient of 1.00. This is because the relationship occurs only by normalizing the variable with coefficient of 1.00 on the other side of the equality sign not as it is in the matrix table, refer the normalized equation below.

Another linear restriction test on the first row of β Eigenvectors is conducted to check the significance of each variable and rejection of zero restriction implies that the variable is significant in explaining the normalized variable, a variable with a coefficient of 1.00, in this case money supply (LM2). As can be seen from table 5.4, base money (LB) is found to be weakly exogenous from the α -coefficient test since we didn't reject the null "LB is weakly exogenous". Base money (LB) is also significant in explaining the variation in money supply (LM2) as is verified by the β -coefficients test in table 5.3 since we rejected the null that "the coefficient of base money (LB) is statistically zero". Hence base money (LB) enters as an exogenous variable in our equation that normalizes our variable of interest money supply

(LM2) so as to give us the equation for the long-run relationship between money supply (LM2) and base money (LB) where the constant term, which is found insignificant, and base money (LB) coefficients indicate long-run elasticities since they are in logarithmic forms.

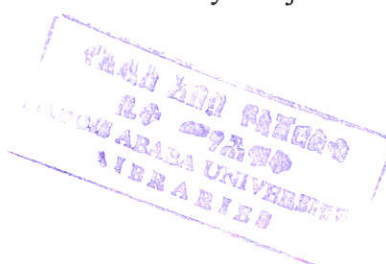
$$LM2_t = 0.91611 + 1.1735LB_t$$

Table 5.4 Standardized α Coefficients and Zero-restriction tests on α Coefficients

| i) Standardized α Coefficients | | |
|---|------------------|-----------|
| LM2 | -0.022782 | -0.025285 |
| LB | 0.0021811 | -0.12032 |
| ii) Zero-restriction tests on α Coefficients | | |
| | LR-test $X^2(1)$ | P-value |
| LB | 0.045222 | 0.8316 |

Thus under the money multiplier model, money supply is positively related with base money and the observed relationship is significant. The speed of adjustment coefficient or feed back effect ($\alpha_{11} = -0.022782$), which indicates the adjustment to the long-run equilibrium, has a negative sign as is theoretically expected indicating that economic agents adjust towards long run steady state by about 2.3 per cent per quarter whenever there is a shock in the system. However, this adjustment is very weak with an adjustment of 9.2 per cent per annum implying that full adjustment takes many years. This lower adjustment can be ascribed to the rudimentary nature of the financial sector, the inexistence of a well developed secondary market and in general the non-monetization of the economy which is an impediment for effective implementation of monetary policy in the country.

Regarding the adequacy of the above long-run model, diagnostic tests from pcfiml co-integration test results are reported under table 5.2. As can be seen from the diagnostic test results, it is possible to conclude that there is no problem of autocorrelation (AR) (i.e. the error terms are not serially correlated) and vector heteroscedasticity (Vector X_i^2) (i.e. no clusters of large and small errors) which implies that the estimators are BLUE (Thomas, 1985). There is no vector functional misspecification (Vector $X_i \cdot X_j$) while vector normality is rejected at 1 per cent



level of significance. The breakdown of the normality assumption doesn't restrict the estimators from having the properties of blueeness and consistency. The major importance of this normality assumption is that if the estimators are normally distributed, confidence intervals can be formed to test hypothesis about the population regression parameters. And hence non-normality implies that the hypothesis testing is no longer strictly valid. However with the rise in sample size n to infinity, the sampling distribution approaches the normal distribution regardless of the form of distribution (Thomas, 1985). Thomas (1985) argues that for large sample ($n > 50$ to be on the safe side) we can still rely on our standard testing procedures and confidence intervals even when the normality assumption breaks down.

Hence, considering our sample size of $n=160$, we are able to conclude that in our case the presence of non-normality doesn't distort our result. Moreover, as Harris (1995) argues, non-normality is an indication of the existence of outliers in the data that should be accounted using dummies (Harris, 1995). However, the functional misspecification test showed that the model has no specification error. Since one reason for functional misspecification to arise is that either too many or too few explanatory variables are included (Thomas, 1985), rejection of this functional misspecification implies that the probable omission of certain unidentified dummy variables wasn't able to influence the explanatory power of the model.

After the determination of the long-run relationship in the Johansen procedure, the next step will be to determine the coefficients of the short-run dynamics (that of Γ_i) through the estimation of a parsimonious vector error correction model (PVECM). The estimation of the short-run structure of the model also provides information on the short run adjustment behavior of economic variables, which in turn is important for policy implementation (Harris, 1995).

In the estimation of the short run model, since the variables in the error correction system are in their first differences, they are now stationary. Thus the single equation can be estimated using the ordinary least squares (OLS) technique and the use of the standard t-tests and other diagnostic tests for statistical evaluation of the results are valid (Gujarati, 1995). After a series

of elimination of statistically insignificant variables, based on Hendry's "general to specific" modeling approach⁵², the estimation result is summarized below.

Table 5.5 Modeling DLM2 by OLS

| Variable | Coefficient | t-value | t-prob |
|------------|-------------|---------|--------|
| DLM2_1 | -0.20393 | -2.936 | 0.0039 |
| DLM2_2 | -0.35650 | -5.222 | 0.0000 |
| DLM2_7 | -0.16885 | -2.508 | 0.0132 |
| CIveclm2_1 | -0.027381 | -9.275 | 0.0000 |
| DLB | 0.18627 | 5.739 | 0.0000 |

$R^2(LR) = 0.520969$

Sample size (T) = 152

F (5,147) = 31.974 [0.0000] **

Vector AR 1-5 F (5,142) = 0.95496 [0.4477]

Vector normality $\chi^2(2) = 31.384$ [0.0000] **

Vector χ^2 F (10,136) = 0.92537 [0.5121]

Vector χ^2 F (20,126) = 1.3485 [0.1615]

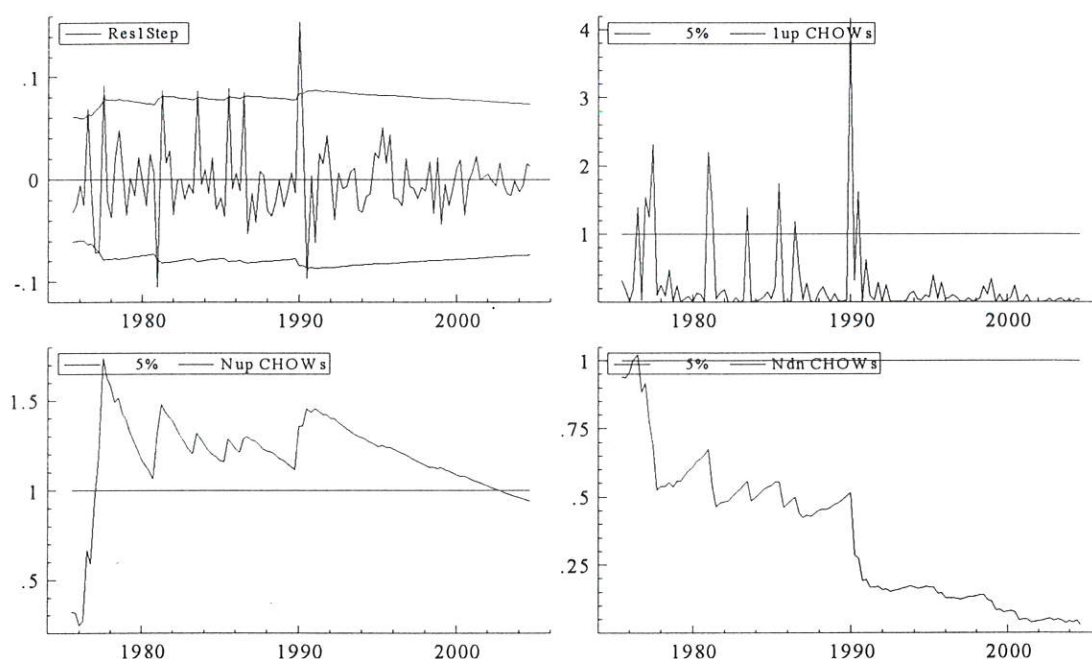
Note: D-difference operator; **-denotes significance at 1% level

In this PVECM, the coefficient of base money has been found to affect money supply significantly. The coefficients indicate elasticities since they are in logarithm terms and have a value lower than their long run relationship. Money supply has also been found to be influenced by its lagged values negatively indicating the influence base money has on the money multiplier, that is, the money multiplier, as is shown in chart 4, moves in opposite direction to the movements of base money delivering a counter balance influence for instance through the effect of interest rates on currency and reserve ratios. This violates one condition for the feasibility of controlling money supply (Al-Loughani & Moosa, 1996) and is against the monetarist argument that "the money-multiplier is stable and predictable and hence the impact of changes in base money on money supply can be estimated with a reasonable degree of precision". This can be further verified using chow tests and recursive residual graph shown in chart 5 below. Here, the above error correction model is re-estimated using the recursive Fiml over successive time periods by increasing the sample period by one additional observation.

⁵² In this approach as many lags as possible are included and the insignificant lags will be eliminated subsequently until we find a parsimonious model, refer Gujarai (1995).

Chart 5 plots the test statistics for recursive chow tests and recursive residual graph with a critical value of rejection the hypothesis of stability at 5 per cent level. The test for one step residual graph showed that in some periods, the graph is outside the critical value indicating that we can reject the hypothesis of stability. In the other chow tests too, except the forecast chow test, the graph is outside the critical value leading us to a similar conclusion. However, the forecast chow test showed only a one time value above the critical values while in all the other times the graph was inside the critical value, yet we can reject the hypothesis of stability in general since all the other tests rejected it.

Chart.5 One Step Residual Recursive graph, 1Step chow tests, Break point and Forecast chow tests



The estimated coefficient of the error correction term (CIveclm2_1), which measures the speed of adjustment to equilibrium has the correct negative sign showing weaker adjustment of about 2.7 per cent per quarter or 10.8 per cent per annum where full adjustment takes many years. The significance of the coefficient of the error correction term asserts the previous result that money supply is co-integrated with base money. The diagnostic tests are good except the normality problem which couldn't still make the model unfit since, as is explained above, for a

sample size n greater than 50, the distribution approaches normal distribution (Thomas, 1985). Moreover, the vector mis-specification test revealed no specification problem implying that although the normality problem might suggest the non-inclusion of some dummy variables, their omission didn't affect the validity of our model due to the insignificance of these variables. The F-statistics which jointly tests the significance of the variables in explaining the model under the null the coefficients are statistically zero is rejected at 1 percent level of significance, the reported R^2 showed 52 per cent of the variation in net foreign asset is explained by the model.

B) The Counterparts Model

Domestic Bank Credit to the Private Sector (LDCP)

The results of the maximal and trace tests for multiple co-integrating vectors for domestic bank credit to the private sector (LDCP) are summarized below in table 5.6. As can be observed from the table, the null hypothesis of no co-integration is rejected by λ_{\max} while λ_{trace} was unable to reject the null. However since λ_{\max} is a more powerful test than λ_{trace} , we conclude that there is one co-integrating vector (Enders,1995). In testing co-integration relation, terms of trade (LTOT) has been entered in unrestricted form similar to the constant term since it is a stationary variable as indicated in the unit root tests in table 5.1 and its influence is shown only in the short run dynamics. On the other hand, lending interest rate has been entered in restrictive form to show that it is fixed for a long period of time despite the economic situation of the country and remained exogenous (refer Appendix III).

Table 5.6 Tests for the Number of Co-integrating Vectors of LDCP

| Ho: rank=r | n-r | Eigenvalue (λ_i) | λ_{\max} | λ_{\max} (95%) | λ_{trace} | λ_{\max} (95%) |
|------------|-----|----------------------------|------------------|------------------------|--------------------------|------------------------|
| r == 0 | 4 | 0.177896 | 30.17* | 27.1 | 45.12 | 47.2 |
| r <= 1 | 3 | 0.123672 | 20.33 | 21.0 | 19.65 | 29.7 |
| r <= 2 | 2 | 0.0161834 | 2.513 | 14.1 | 2.491 | 15.4 |
| r <= 3 | 1 | 0.00284013 | 0.438 | 3.8 | 0.3697 | 3.8 |

Vector AR 1-5 $F(80,400) = 1.0484 [0.3774]$

Vector normality $\chi^2(8) = 11.910 [0.1553]$

Vector $\chi^2 F(500,658) = 0.99534 [0.5207]$

Number of lags used in the analysis: 6

Variables entered unrestricted: Terms of trade (LTOT), Constant and seasonal dummies

Variables entered restricted: Lending interest rate (LLR)

The normalized equation for domestic bank credit to the private sector (LDCP) in the long-run with an adjustment coefficient of about 2.7 per cent per quarter or 10.8 per cent per year can be written as:

$$LDCP_t = -0.026922LNDCG_t + 2.3403LFX_t - 1.5258LNGDP_t - 1.9735LLR_t$$

Table 5.7 Standardized β Eigenvectors & Zero-restriction tests on β Coefficients

| i) Standardized β Eigenvectors | | | | |
|--|-----------|-----------|----------|----------|
| LDCP | LNDCG | LFX | LNGDP | LLR |
| 1.0000 | 0.026922 | -2.3403 | 1.5258 | 1.9735 |
| -2.3117 | 1.0000 | -0.054440 | 1.4737 | 0.62725 |
| -0.24598 | -0.37604 | 1.0000 | -0.64425 | 1.7571 |
| -0.32235 | -0.097662 | -0.18668 | 1.0000 | -0.40000 |
| ii) Zero-restriction tests on β Coefficients | | | | |
| | LNDCG | LFX | LNGDP | LLR |
| LR-test $\chi^2(1)$ | 0.41824 | 6.1392 | 3.1637 | 6.3128 |
| P-value | 0.5178 | 0.0132* | 0.0753 | 0.0120* |

*Rejection at 5 per cent level of significance

The long run relationship shows that, as theoretically expected, domestic bank credit to the private sector is negatively related with government bank borrowing due to the crowding out

impact. Similarly lending interest rate significantly affects private sector borrowing negatively since it is cost of borrowing and higher cost implies lower borrowing. Foreign exchange receipts have positive and significant influence on private sector credit, since higher receipts lead to more import that need more finance. However, unlike theoretical expectations, domestic credit to the private sector showed a negative relationship with nominal income suggesting that with the rise in income, the dependence on bank borrowing declines which might indicate the importance of alternative forms of financing at higher levels of income and inadequate financial provision by the formal financial sectors. Yet, the effect of this income with unexpected sign and government domestic borrowing are not significant as shown by the restriction tests on β coefficients.

The insignificance of government domestic bank borrowing indicates that the crowding out impact is minimal due to the persistent accumulation of excess reserve holdings of commercial banks. For instance from 1971/72-2003/04, excess reserve had grown on annual average rate of 32 per cent. Government domestic bank borrowing together with nominal income are found to be weakly exogenous while weak exogeneity is rejected for foreign exchange receipts (LFX) which implies all the given variables except LFX are exogenous to the given model.

Table 5.8 Standardized α Coefficients & Zero-restriction tests on α Coefficients

| i) Standardized α Coefficients | | | | |
|---|------------|-----------|------------|------------|
| LDCP | -0.026614 | 0.040392 | 0.0077256 | 0.0079485 |
| LNDCG | -0.0072734 | -0.032780 | 0.012247 | -0.048828 |
| LFX | 0.14756 | 0.039862 | 0.0055659 | -0.0092786 |
| LNGDP | 0.0012727 | 0.0098448 | -0.0034272 | -0.010635 |
| ii) Zero-restriction tests on α Coefficients | | | | |
| | LNDCG | LFX | LNGDP | |
| LR-test $X^2(1)$ | 0.27423 | 6.2432 | 0.48512 | |
| P-value | 0.6005 | 0.0125* | 0.4861 | |

*Rejection at 5 per cent level of significance

When we come to the short run dynamics, the estimation procedure will be conducted using the two stage least squares method (2SLS) instead of OLS since the rejection of weak exogeneity for foreign exchange receipts (LFX) implies LFX is an endogenous variable in the model with a simultaneous relationship with domestic credit to the private sector (LDCP) suggesting that LDCP should be estimated simultaneously together with LFX⁵³. Based on Hendry's "general to specific" modeling approach, the result of the parsimonious vector error correction model (PVECM) is shown in the following table.

Table 5.9 Modeling DLDCP by 2SLS

| Variable | Coefficient | t-value | t-prob |
|------------|-------------|---------|--------|
| DLLR_2 | -0.47991 | -6.018 | 0.0000 |
| CIvecdcp_1 | -0.0022016 | -2.784 | 0.0061 |
| Seasonal_1 | 0.11156 | 7.905 | 0.0000 |
| Seasonal_2 | 0.090145 | 6.312 | 0.0000 |

Vector AR 1-5 $F(20,276) = 1.9373 [0.0917]$

Vector normality $\chi^2(4) = 0.6388 [0.7266]$

Vector $\chi^2 F(12,375) = 1.2959 [0.2183]$

Vector $\chi^2 F(15,389) = 1.0466 [0.4060]$

The model has passed all the diagnostic tests, no problem of autocorrelation, heteroscedasticity, non normality and function misspecification is reported. The vector error correction term (CIvecdcp_1) has the expected negative sign and is significant which supports the earlier conclusion of co-integration that domestic credit to the private sector (LDCP) is co-integrated with its determinants. As is indicated by the error correction term, the previous quarter error is corrected by 0.22 per cent per quarter or 0.9 per cent per annum in which case full adjustment towards equilibrium takes many years indicating the rudimentary nature of the financial sector. In the short run, domestic credit to the private sector has been found to be irresponsive to domestic credit to the government sector, terms of trade, and foreign exchange receipts variables. It only shows seasonal variation in the second and third quarters associated with harvesting and exporting activities in those quarters. This may be because traders need more

⁵³ In the case where the variables have simultaneous relationship, the estimation of the equation using OLS leads to the problem of simultaneous equation bias, refer Thomas, 1985.

money to buy exportable items. Moreover, in the short run, domestic credit to the private sector (DLDCP) is influenced negatively by the second lag of lending interest rate.

Domestic Bank Credit to the Government (LNDCG)

Co-integration test results for domestic bank credit to the government (LNDCG), as summarized below, indicates both tests reject the null of no-co integration implying that there exists one co integrating vector.

Table 5.10 Test for the Number of Co-integrating Vectors of LNDCG

| Ho: rank=r | n-r | Eigenvalue (λ_i) | λ_{max} | λ_{max} (95%) | λ_{trace} | λ_{max} (95%) |
|------------|-----|----------------------------|-----------------|-----------------------|-------------------|-----------------------|
| r = 0 | 4 | 0.188058 | 31.04* | 27.1 | 51.7* | 47.2 |
| r ≤ 1 | 3 | 0.0948569 | 14.85 | 21.0 | 20.66 | 29.7 |
| r ≤ 2 | 2 | 0.0368078 | 5.588 | 14.1 | 5.807 | 15.4 |
| r ≤ 3 | 1 | 0.00146765 | 0.2188 | 3.8 | 0.2188 | 3.8 |

Number of lags used in the analysis: 5

Variables entered unrestricted: Constant, dummies for war, drought and change in government.

Vector AR 1-5 $F(80,428) = 1.2643 [0.0756]$

Vector normality $\chi^2(8) = 11.189 [0.0670]$

Vector $\chi^2 F(400,816) = 1.0788 [0.1863]$

As expected, domestic bank borrowing to the government has shown positive relationship with domestic price level and nominal income while it is related negatively with foreign exchange receipts. A priori, the sign of nominal income coefficient can have positive or negative sign depending on the significance of revenue collection over government expenditure due to the incremental income. In this study, nominal income has been found to influence government expenditure more than it induces government revenue collection and hence increasing the government's need to finance its rising expenditure from the banking system. Foreign exchange receipts has shown a negative coefficient as is argued in the literature, higher foreign exchange receipts give the government an alternative form of finance and lowers its dependence on the banking sector.

Table 5.11 Standardized β Eigenvectors & Zero-restriction tests on β Coefficients

| i) Standardized β Eigenvectors | | | |
|--|----------|---------|----------|
| LNDCG | LNGDP | LCPI | LFX |
| 1.0000 | -3.0382 | -2.5492 | 2.2283 |
| 0.31633 | 1.0000 | -1.3038 | -0.38985 |
| -2.6845 | 2.6630 | 1.0000 | 1.2750 |
| 1.6436 | 1.7735 | -5.7404 | 1.0000 |
| ii) Zero-restriction tests on β Coefficients | | | |
| | LNGDP | LCPI | LFX |
| LR-test $X^2(1)$ | 8.8998 | 5.2019 | 13.158 |
| P-value | 0.0029** | 0.0226* | 0.0003** |

*, ** Rejection at 5 per cent and 1 per cent level of significance

All the variables are significant in explaining the variation of LNDCG as can be shown in table 5.11 under β -coefficient restriction tests. The normalized equation for long run relationship can be expressed as:

$$\text{LNDCG}_t = 3.0382\text{LNGDP}_t + 2.5492\text{LCPI}_t - 2.2283\text{LFX}_t$$

Table 5.12 Standardized α Coefficients & Zero-restriction tests on α Coefficients

| i) Standardized α Coefficients | | | | |
|---|------------|-----------|------------|-------------|
| LNDCG | -0.015952 | -0.093520 | 0.0078959 | -0.0025900 |
| LNGDP | -0.0060027 | -0.030534 | -0.0032940 | -0.00015289 |
| LCPI | 0.012813 | 0.045985 | -0.0026916 | -0.00079398 |
| LFX | -0.15319 | 0.12082 | -0.0048567 | -0.00081164 |
| ii) Zero-restriction tests on α Coefficients | | | | |
| | LNGDP | LCPI | LFX | |
| LR-test $X^2(1)$ | 0.81795 | 1.9069 | 13.606 | |
| P-value | 0.3658 | 0.1673 | 0.0002** | |

** Rejection at 1 per cent level of significance

The adjustment coefficient indicated a 1.6 per cent quarterly or a 6.4 per cent annual adjustment towards the long run equilibrium with the correct negative sign and is significant asserting the existence of co integration between LDCP and its determinants. From the weakly exogeneity test shown in table 5.12, weakly exogeneity is not rejected for nominal income and price level while the variable foreign exchange receipts is found to be endogenous. The diagnostic tests indicated that there is no problem of autocorrelation, heteroscedasticity, and non-normality although test for misspecification is not reported since the degree of freedom didn't allow pcfiml to undertake such a test.

Under the short run dynamics, LNDCG will be estimated simultaneously with LFX using the two stage least squares method (2SLS) since weak exogeneity is rejected for LFX implying a simultaneous relationship exists between LFX and LNDCG. Table 5.13 shows the result of the PVECM which is estimated based on Hendry's "general to specific" modeling approach.

Table 5.13 Modeling DLNDCG by 2SLS

| Variable | Coefficient | t-value | t-prob |
|------------------------|--------------------------------|----------|--------|
| Seasonal_1 | -0.11621 | -5.008 | 0.0000 |
| Seasonal_2 | -0.054790 | -2.351 | 0.0201 |
| CIvecndcg_1 | -0.0042594 | -5.254 | 0.0000 |
| DCHGOV | 0.085138 | 2.022 | 0.0450 |
| Vector AR 1-5 | F(20,274) = 1.5183 | [0.1877] | |
| Vector normality | Chi ² (4) = 0.85829 | [0.6511] | |
| Vector Xi ² | F(6,286) = 2.0821 | [0.0553] | |

In the short run, domestic bank borrowing to the government (LNDCG) is found to be significantly influenced by seasonal variations in the second and third quarters which can be associated with rising activities in domestic and international trade and hence relatively higher collection of revenue. The dummy variable used to account for the effects of government change and hence instability is found to affect government borrowing from the banking system significantly while price level, foreign exchange receipts and income variables have become insignificant and hence have been dropped from the model. The coefficient of adjustment has the expected negative sign and is significant further asserting the existence of co-integration

relationship between LNDCG and its determinants with an adjustment of 0.43 percent per quarter or 1.7 per cent per year where full adjustment towards equilibrium takes many years after a shock is observed. This may be due to the inexistence of a well developed financial market.

Net Foreign Assets of the Banking System (LNFA)

Co-integration test results for net foreign assets of the banking system (LNFA) as summarized below indicates that both tests reject the null of no-co integration and hence there exists one co integrating vector. Deposit interest rate is entered in restricted form in the co-integration analysis since it was fixed for a longer period of time and it doesn't as such freely move in line with the economic situations of the country (refer appendix III). The diagnostic tests indicated no problems of autocorrelation, heteroscedasticity, and non-normality; however the degree of freedom didn't allow pcfiml to undertake a misspecification test.

Table 5.14 Test for the number of Co-integrating vectors of LNFA

| Ho: rank=r | n-r | Eigenvalue (λ_i) | λ_{\max} | λ_{\max} (95%) | λ_{trace} | λ_{\max} (95%) |
|------------|-----|----------------------------|------------------|------------------------|--------------------------|------------------------|
| r == 0 | 4 | 0.179239 | 30.42* | 27.1 | 54.52** | 47.2 |
| p <= 1 | 3 | 0.113308 | 18.52 | 21.0 | 24.1 | 29.7 |
| p <= 2 | 2 | 0.0284712 | 4.448 | 14.1 | 5.579 | 15.4 |
| p <= 3 | 1 | 0.00731327 | 1.13 | 3.8 | 1.13 | 3.8 |

Number of lags used in the analysis: 6
 Variables entered unrestricted: Constant
 Variables entered restricted: Deposit interest rate (LDR)
 Vector AR 1-5 $F(80,416) = 1.1715 [0.1657]$
 Vector normality $\text{Chi}^2(8) = 13.596 [0.0611]$
 Vector $\text{Xi}^2 F(500,698) = 1.1306 [0.0681]$

As can be seen from table 5.15, net foreign assets of the banking system (LNFA) is found to be positively related with foreign exchange receipts(LFX) and nominal income (LNGDP) while it is negatively influenced by total domestic credit expansion of the banking system (LDC) and deposit interest rate (LDR) as is theoretically expected. In the long run, net foreign asset is significantly influenced by foreign exchange receipts and domestic credit expansion of the

banking system. The indicated adjustment is 23 per cent per quarter or 92 per cent per annum signifying full adjustment takes place almost in a year. The normalized equation for net foreign assets (LNFA) can be given as follows:

$$LNFA_t = 2.4438LFX_t + 2.3843LNGDP_t - 0.37747LDR_t - 2.5806LDC_t$$

Table 5.15 Standardized β Eigenvectors & Zero-restriction tests on β Coefficients

| i) Standardized β Eigenvectors | | | | |
|--|----------|---------|----------|----------|
| LNFA | LFX | LNGDP | LDC | LDR |
| 1.0000 | -2.4438 | -2.3843 | 2.5806 | 0.37747 |
| 0.49754 | 1.0000 | -4.1708 | 1.2225 | -0.77934 |
| 0.0034788 | -0.27080 | 1.0000 | -0.33020 | -0.19517 |
| -0.060507 | 0.48428 | -1.2372 | 1.0000 | -1.0671 |
| ii) Zero-restriction tests on β Coefficients | | | | |
| | LFX | LNGDP | LDC | LDR |
| LR-test $X^2(1)$ | 9.288 | 1.9369 | 8.6498 | 0.85375 |
| P-value | 0.0023** | 0.1640 | 0.0033** | 0.3555 |

** Rejection at 1 per cent level of significance

However, although nominal income and deposit interest rate have the expected sign, they are found insignificant in explaining the variation of net foreign asset. This may be due to the lower response of money demand towards its determinants, namely nominal income and deposit interest rate, which in turn might be ascribed to the non-monetization of the economy.



Table 5.16 Standardized α Coefficients & Zero-restriction tests on α Coefficients

| i) Standardized α Coefficients | | | | |
|---|-----------|------------|-----------|------------|
| LNFA | -0.23314 | -0.31328 | -0.087945 | 0.00019321 |
| LFX | 0.083143 | -0.11314 | 0.032246 | -0.0023008 |
| LNGDP | 0.0089147 | -0.0039293 | -0.032207 | 0.00089756 |
| LDC | 0.0085596 | 0.012319 | -0.015881 | -0.0037616 |
| ii) Zero-restriction tests on α Coefficients | | | | |
| | LFX | LNGDP | LDC | |
| LR-test $X^2(1)$ | 3.7405 | 2.7555 | 0.91533 | |
| P-value | 0.0531 | 0.0969 | 0.3387 | |

Since under the restriction tests on α -coefficients in table 5.16, we couldn't reject weak exogeneity for all the dependent variables, we can estimate the short run dynamics using OLS. And based on the Hendry's "general to specific" modeling approach the result of the PVECM is shown in the following table

Table 5.17 Modeling DLNFA by OLS

| Variable | Coefficient | t-value | t-prob |
|------------|-------------|---------|--------|
| DLFX | 1.0071 | 6.912 | 0.0000 |
| DLNGDP_5 | 6.1367 | 3.601 | 0.0004 |
| DLDC | -2.7125 | -3.942 | 0.0001 |
| CIvecnfa_1 | -0.28614 | -5.432 | 0.0000 |
| Constant | -1.8087 | -5.271 | 0.0000 |

$$R^2(LR) = 0.588256$$

$$F(4,147) = 20.579 [0.0000] **$$

$$\text{Vector AR 1-5 } F(5,106) = 1.3613 [0.2448]$$

$$\text{Vector normality } \chi^2(2) = 5.812 [0.0547]$$

$$\text{Vector } \chi^2 F(80, 30) = 1.6626 [0.0598]$$

In the short run, net foreign asset is found to be significantly influenced by foreign exchange receipts positively and domestic credit negatively while deposit interest rate have been found to have no significance. However, the nominal income, which wasn't significant in the long-run, showed a significant positive relationship in the short run indicating money demand is more

responsive to nominal income in the short run than the long run. The short run adjustment coefficient $CIvecnfa_1$ has shown an adjustment of 29 per cent with the expected negative sign and is significant strengthening the earlier co-integration test result which shows that net foreign asset of the banking system co-integrates with nominal income, domestic credit and deposit interest rate. The diagnostic tests showed that there is no problem of autocorrelation, heteroscedasticity, and non-normality while the degree of freedom didn't allow $pcfiml$ to report misspecification test. The F-statistics is significant at 1 percent level and the reported R^2 showed 58 per cent of the variation in net foreign asset is explained by the model.

Other Items Net of the Banking System

As can be shown in the following table both tests λ_{max} and λ_{trace} rejected the null there exists no co integrating vector suggesting that there exists one co integrating vector. Nominal exchange rate (LEX) is entered in restrictive form in testing co-integration analysis since the country was under fixed exchange rate regime for a longer period of time and even after the removal of this regime, exchange rate fluctuations remained less responsive to economic situations (look appendix III).

Table 5.18 Test for the number of Co-integrating vectors of LOIN

| Ho:rank=r | n-r | Eigenvalue(λ_i) | λ_{max} | $\lambda_{max}(95\%)$ | λ_{trace} | $\lambda_{max}(95\%)$ |
|-----------|-----|---------------------------|-----------------|-----------------------|-------------------|-----------------------|
| r == 0 | 2 | 0.099294 | 15.06* | 14.1 | 18.41* | 15.4 |
| r <= 1 | 1 | 0.0229928 | 3.35 | 3.8 | 3.35 | 3.8 |

Number of lags used in the analysis: 5

Variables entered unrestricted: Constant, dummies for exchange control, war, drought and seasonal effects.

Variables entered restricted: Nominal exchange rate (LEX)

Vector AR 1-5 $F(20,230) = 1.0807 [0.3709]$

Vector normality $\chi^2(4) = 160.96 [0.0000]**$

Vector $\chi^2 F(66,302) = 1.1238 [0.2563]$

Vector $\chi^2 F(231,138) = 1.1253 [0.2243]$

The diagnostic tests show that the model has passed all the tests except the normality problem. Yet as discussed in the previous sections, non-normality is not a problem as long as we have a sample size greater than 50. In the long run, net foreign asset (LNFA) has been found to influence other items net (LOIN) negatively as is theoretically expected. Lower level of foreign

assets lead to the imposition of restrictions on imports, for instance through import pre-deposits to preserve the available foreign exchange. The other variable nominal exchange rate (LEX) is found to affect LOIN positively with a highly elastic coefficient indicating for instance a 1 per cent rise in nominal exchange rate or depreciation leads to a 19 per cent rise in LOIN. The long-run model can be normalized as:

$$\text{LOIN}_t = -5.7977\text{LNFA}_t + 19.063\text{LEX}_t$$

Table 5.19 Standardized β Eigenvectors & Zero-restriction tests on β Coefficients

| i) Standardized β Eigenvectors | | |
|--|------------------|----------|
| LOIN | LNFA | LEX |
| 1.0000 | 5.7977 | -19.063 |
| -45.768 | 1.0000 | 162.58 |
| ii) Zero-restriction tests on β Coefficients | | |
| | LR-test $X^2(1)$ | P-value |
| LNFA | 11.704 | 0.0006** |
| LEX | 5.3525 | 0.0207* |

*, ** Rejection at 5 per cent and 1 per cent level of significance

As is shown from zero restriction tests on β coefficients in table 5.19, both LNFA and LEX are significant in explaining the variation in LOIN. The adjustment coefficient is very small and is around 0.2 per cent per quarter or 0.8 per cent per annum taking more than a year to adjust fully.

Table 5.20 Standardized α Coefficients & Zero-restriction tests on α Coefficients

| i) Standardized α Coefficients | | |
|---|------------------|------------|
| LOIN | LNFA | LEX |
| -0.0021852 | -0.038337 | 0.00079431 |
| -0.00015316 | | |
| ii) Zero-restriction tests on α Coefficients | | |
| | LR-test $X^2(1)$ | P-value |
| LNFA | 11.657 | 0.0006** |

** Rejection at 1 per cent level of significance

When we come to the short run dynamics the estimation procedure will be conducted using 2SLS instead of OLS since weak exogeneity is rejected for net foreign asset as is shown in table 5.20 which implies LOIN should be estimated simultaneously with LNFA. Based on Hendry's "general to specific" modeling approach, the result of the PVECM is shown in table 5.21 below.

Table 5.21 Modeling DLOIN by 2SLS

| <u>Variable</u> | <u>Coefficient</u> | <u>t-value</u> | <u>t-prob</u> |
|-------------------|--------------------|----------------|---------------|
| DLEX | 0.47562 | 2.726 | 0.0072 |
| DLEX_3 | 0.70691 | 4.046 | 0.0001 |
| <u>CIVECOIN_1</u> | <u>-0.0061794</u> | <u>-2.038</u> | <u>0.0435</u> |

$R^2(LR) = 0.48299$

$F(4,147) = 1.9198 [0.0010] **$

Vector AR 1-5 $F(5,109) = 0.67013 [0.8528]$

Vector normality $\chi^2(4) = 174.1 [0.0000] **$

Vector $\chi^2 F(46,67) = 0.26003 [1.0000]$

Vector $\chi^2 F(33,116) = 1.0221 [0.4482]$

In the short run, LOIN has been found to be significantly influenced by nominal exchange rate in level and at a lag of three. The adjustment coefficient (CIVECOIN_1) is negative and significant showing a 0.6 per cent per quarter or 2.4 per cent per annum adjustment to the long run equilibrium.

Interpretation of Results

The above estimation results indicate that the theoretical arguments given by Furness (1974, 1975), Shetty (1990), Goodhart (1975), Khan and Knight (1981) and others regarding the inability of monetary authorities, in developing countries, to have control over money supply due to various constraints, such as: lack of independence by the central bank; the inability of controlling foreign exchange flows due to the underdevelopment of financial markets that can help to implement sterilization techniques; and the instability of the money-multiplier as a result of the development process, can be supported empirically.

Similar to Bolnick (1975)'s study for Kenya and Al-Loughani and Moosa (1996)'s study for Kuwait where both studies concluded that in both countries money supply is not controllable since base money cannot be controlled due to inability to control either government borrowing and/or foreign exchange inflows; and hence their implication on the determination of money supply in that the money multiplier model is inappropriate, the current study also has shown that money supply is uncontrollable in the Ethiopian case for the same reason. The result indicated that although base money is significantly and positively related with money supply, the coefficient, which is interpreted as the money-multiplier, has been found to be unstable and moves in an inverse proportion to the movements of base money in almost a similar way as Al-Loughani and Moosa has found for Kuwait.

And hence the above empirical test results that question the applicability of the simple money multiplier model to correctly explain the movements of money supply in relation to changes in base money, that is uncontrollable in developing countries, leads us to search for factors that have influence on money supply using a more realistic approach suggested by Fry (1988), Shetty (1990), Goodhart (1984) and others. And similar to the empirical studies by Fry (1988) for Turkey and Adenikinju and Ogun (1995) for Nigeria, money supply in Ethiopia has been found to be influenced by factors in the financial and real sector of the economy as is also argued by Brunner and Meltzer (1972). Shetty (1990)'s argument that the causality between money, output and prices is bi-directional is supported by all the above studies together with the current one.

However, an earlier empirical study made by Alemayehu (1995) in the Ethiopian case has suggested that the relationship between base money and money supply is positive and significant where the coefficient of the money-multiplier is stable. This result might suggest that the money multiplier model is applicable since the movements of money supply can be critically predicted from the movements of base money. However, Alemayehu has argued that although there is a stable relationship, the money-multiplier model is not applicable in Ethiopia since factors in base money are outside the control of monetary authorities. This argument, however, is inconsistent with his result of stable money-multiplier. There is no evidence to reject the applicability of the money-multiplier model. However, his result as is argued in the literature section may be questionable to work for the current period since in his study the period of the reform program, which has shown significant shifts in policy area, is not incorporated. Moreover, the sample size he used is relatively small to test the hypothesis of stability.

The empirical result in the current study using the disaggregated approach of money supply determination has shown that money supply is influenced by nominal income, price level, foreign exchange receipts, lending interest rate, nominal exchange rate, seasonal factors, instabilities and credit expansion. And the implication is that since those factors are hardly under the control of monetary authorities in developing countries due to the underdevelopment of the financial institutions and financial markets, both primary and secondary, that can help to sterilize sudden changes that occur in the real and financial sectors of the economy, implementation of monetary policy becomes problematic. Effective implementation of monetary policy in those countries, therefore, necessitates the development of the financial sector so that the central bank can practice its control over money supply through the uses of indirect monetary policy instruments and manipulation of base money.

Chapter Six: Conclusion and Policy Implication

In this study, we have seen three main things as is specified in the objective section, i) sorting out the main determinants of money supply in Ethiopia, ii) reviewing the performance of the reform program in regard to the target; and iii) testing the stability of the money-multiplier so as to respond to the question of money supply controllability and hence the efficiency of the simple method of the money-multiplier approach of money supply determination. When we come to identifying the major determinants of money supply, the paper has applied the models developed by Fry (1988), Adeinkinju and Ogun (1995); and Killick and Mwege (1990). Under the disaggregated approach of money supply determination, money supply is sub divided into its four counterparts, domestic bank credit to the private sector, domestic bank credit to the government, net foreign assets of the banking system and other items net and separate equations estimated for each. And the determinants of each counterpart have then been identified accordingly.

In the long run, domestic credit to the private sector is found to be significantly influenced positively by foreign exchange receipts and negatively by lending interest rate while nominal income, although insignificant, showed a negative relationship with domestic credit to the private sector partly explaining the rudimentary nature of the formal financial sector and the importance of alternative finance. The other variable domestic credit to the government sector, although showed the expected negative relation, is found insignificant. One reason that can be cited may be the presence of persistent excess reserve holdings in the hands of commercial banks. However, in the short run it is only the lending interest rate, which is found significant while the other variables including the terms of trade showed no influence on domestic credit to the private sector. Other factors, which have influence on domestic credit to the private sector, are seasonal dummies representing the second and third quarters that may indicate higher lending during these quarters in association with the harvest season and relative higher trading activity.

Domestic credit to the government sector, in the long run, is found significantly determined by nominal income and domestic price level positively; since higher income motivates more expenditure than revenue collection in our case, and rising price indicates rising government

expenditure where in both cases leading to increased government borrowing from the banking sector. On the other hand, foreign exchange receipts is found to influence government borrowing from the domestic banks significantly and negatively as higher receipts in the form of transfers or revenue from the export sector may reduce governments need for borrowing. However, in the short run all the above determinants were not significant in explaining variations of government borrowing from the banking system, rather in the short run seasonal dummies representing the second and third quarters negatively influenced government borrowing, indicating revenue collection is higher in those seasons due to increased revenue collection in association with harvesting and increased trade activities. The other relevant dummy represented change in government regimes and hence instability indicating increased need for more financing during instabilities.

Net foreign asset, in the long run, is found to be influenced by foreign exchange receipts positively and total domestic credit expansion negatively in agreement with the monetary approach to BOP (balance of payment). The other variables which determine the demand for money, nominal income and deposit interest rate, are found insignificant in explaining net foreign asset which may indicate the lower responsiveness of money demand to these variables due to the non-monetization of the economy. In the short run, however, foreign exchange receipts, nominal income and total domestic credit have been explanatory variables indicating money demand has a better positive response to nominal income in the short run while it has low response to deposit interest rate both in the long and short runs.

Other items net, in the long run, has been found to be significantly influenced by net foreign assets of the banking system negatively; while it is positively and significantly related with nominal exchange rate. However, in the short run it is only nominal exchange rate which is found significant. In general under the disaggregated approach of money supply determination, money supply has been found to be determined by variables like nominal income, foreign exchange receipts, domestic price level, lending interest rate, nominal exchange rate, total domestic credit expansion, instabilities, and seasonal factors.

When we come to the determination of money supply using the money multiplier model, we found that money supply is positively and significantly related with base money through the money-multiplier. However to control money supply, the multiplier should be stable and shouldn't move together with the movements of base money. According to the study result, the money-multiplier is found unstable from chow tests and recursive graph; in addition to the inverse relationship observed between the money-multiplier and base money during the period. So the monetarists' argument that money supply is controllable and hence any change in base money leads to a predictable change in money supply is not supported in the current study. Rather, the result indicates that money supply is influenced by variables that are uncontrollable such as foreign exchange receipts and instabilities which impose serious limitation on the control of money supply.

Therefore, effective implementation of monetary policy in Ethiopia waits for the maturity of the financial sector and especially the development of secondary markets which are so important to sterilize sudden shocks on monetary variables. This inability to control money supply can be indicated also from target versus actual comparison of the monetary reform program. Of course the target for overall domestic credit is off the target only slightly by about 1.1 per cent. However, its component net credit to the government was off the target by 10.0 per cent and it is only due to restrained credit growth to the private sector that relatively lower expansion in domestic credit was achieved implying the inability of monetary policy to implement its objective: "to ensure domestic liquidity expansion that allows for reasonable credit growth to meet the needs of the productive sectors, particularly the private sector, while reducing domestic inflation and pressures on the balance of payments. Attainment of this objective will require a significant cut back in credit to the government." (TGE, 1992, p.7)

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APPENDICES

Appendix I: Generating Quarterly GDP from Annual GDP

Interpolation of either nominal or real GDP will be made using a technique suggested by Goldstein and M.S Khan (1976). The method of interpolation is briefly described below (as reproduced from the works of the above authors):

If X_{t-1} , X_t , X_{t+1} are three successive annual observations of a flow variable $X(t)$, the quadratic function passing the three points is such that:

$$\int_0^1 (as^2 + bs + c) ds = X_{t-1}$$

$$\int_1^2 (as^2 + bs + c) ds = X_t$$

$$\int_2^3 (as^2 + bs + c) ds = X_{t+1}$$

Integrating and solving for a, b, and c gives

$$a = 0.5X_{t-1} - 1.0X_t + 0.5X_{t+1}$$

$$b = -2.0X_{t-1} + 3.0X_t - 1.0X_{t+1}$$

$$c = 1.8333X_{t-1} - 1.1666X_t - 0.333X_{t+1}$$

Then the first two quarterly figures within any year can be interpolated as follows:

$$\text{Quarter I} = \int_1^{1.25} (as^2 + bs + c) ds = 0.0548X_{t-1} + 0.2343X_t - 0.0390X_{t+1}$$

$$\text{Quarter II} = \int_{1.25}^{1.50} (as^2 + bs + c) ds = 0.0077X_{t-1} + 0.2657X_t - 0.0235X_{t+1}$$

And corresponding formulas give the third and fourth quarter interpolation as follows:

$$\text{Quarter III} = -0.0235X_{t-1} + 0.2657X_t + 0.0077X_{t+1}$$

$$\text{Quarter IV} = -0.0390X_{t-1} + 0.2343X_t + 0.0548X_{t+1}$$

$$\text{➤ Quarter I} + \text{Quarter II} + \text{Quarter III} + \text{Quarter IV} = X_t$$

Appendix II: Constructing the Terms of Trade (TOT)

$$TOT = \frac{XUVI}{MUVI} * 100$$

And XUVI and MUVI are constructed separately using the Fischer's formula as follows:

- The Laspeyres' Price Index Formula (LPI)

$$LPI = \frac{\sum P_n Q_o}{\sum P_o Q_o} * 100$$

- The Paache's Price Index Formula (PPI)

$$PPI = \frac{\sum P_n Q_n}{\sum P_o Q_n} * 100$$

- The Fisher's Price Index Formula (FPI)

$$FPI = \sqrt{LPI * PPI} , \text{ which is the geometric mean of LPI and PPI}$$

$$\text{Where } P = \frac{IMPORT(EXPORT)Value}{IMPORT(EXPORT)Volume}$$

P_n = The current unit value (price)

P_o = Base year unit value (price)

Q_n = Current volume (quantity)

Q_o = Base year volume (quantity)

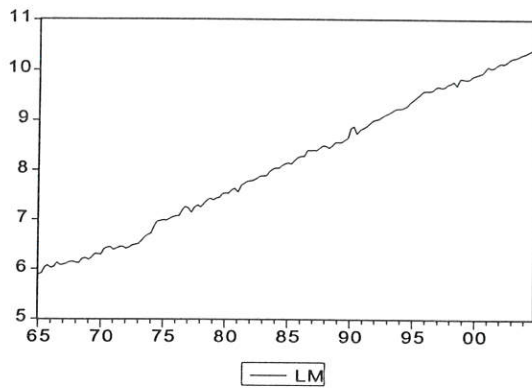
The Laspeyer's formula uses the base year as weights while the Paache's formula uses the current year quantities as weights. The Laspeyer's is biased downwards compared to other indices. On the other hand the Paache's formula is less useful for the purpose of comparison as it is based on the current weight. Hence Fisher's formula which is a geometric mean of the two is preferred as it helps to correct the deficiencies of the two.

Appendix III: Diagrammatical Test for the Stationarity of the Variables

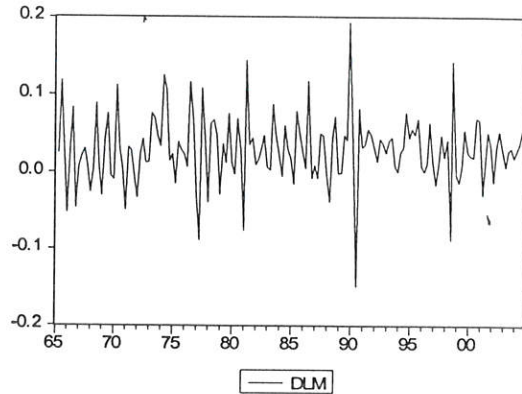
(Quarterly series 1964/65Q1-2003/04Q4)

1. The natural logarithm of Broad money =LM,

a) Level I(0) - non-stationary series

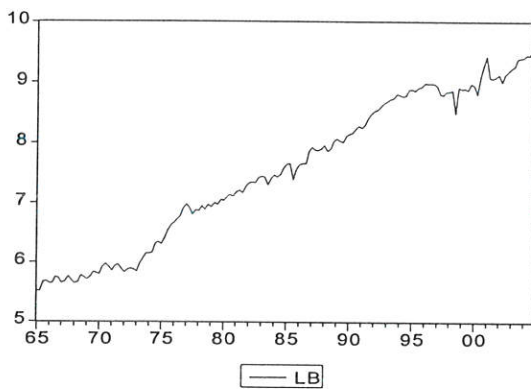


b) First difference I(1) - stationary series

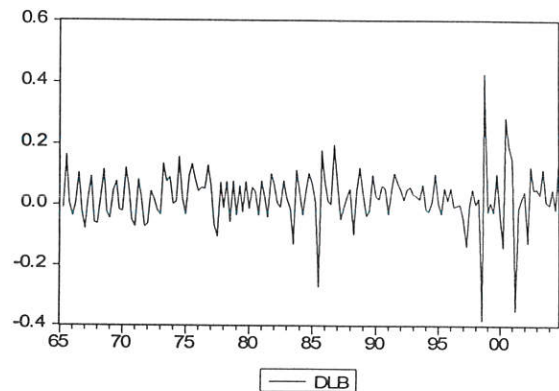


2. The natural logarithm of Base money =LB

a) Level I(0) - non-stationary series

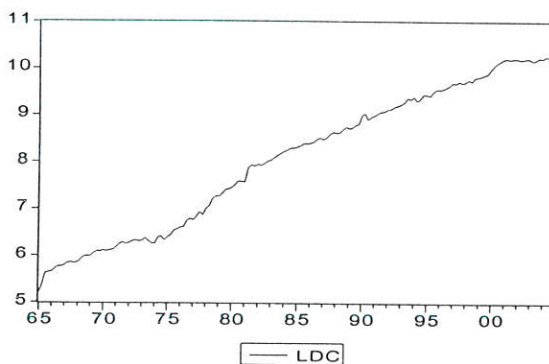


b) First difference I(1) - stationary series

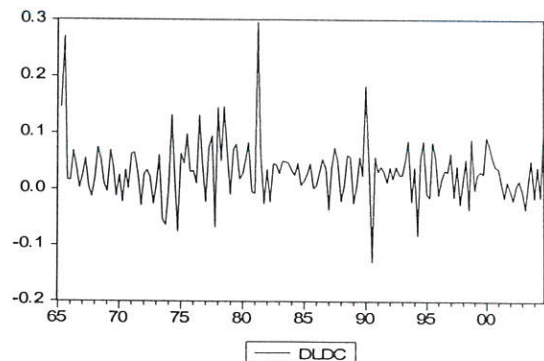


3. The natural logarithm of Domestic Credit =LDC

a) Level I(0) - non-stationary series

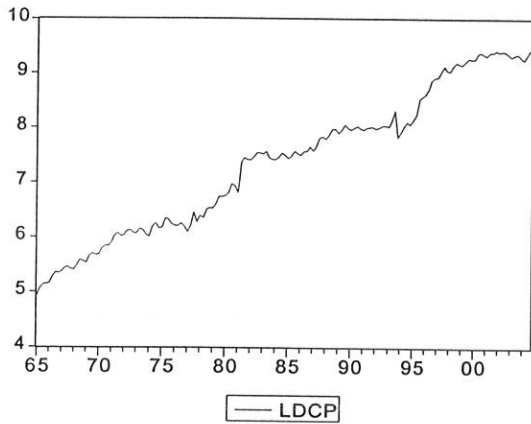


b) First difference I(1) - stationary series

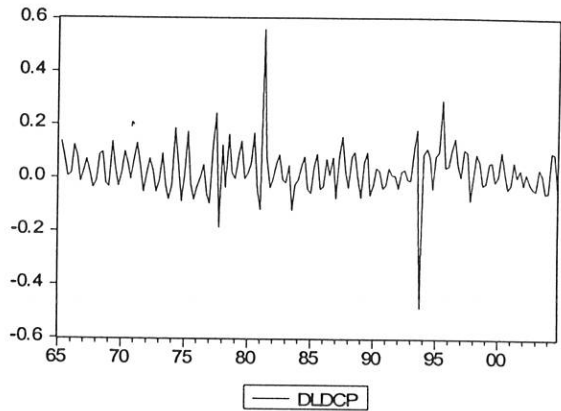


4. The natural logarithm of Claims on the Private Sector =LDCP

a) Level I(0) - non-stationary series

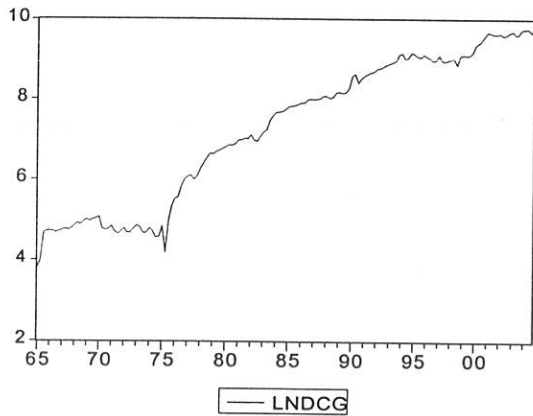


b) First difference I(1) - stationary series

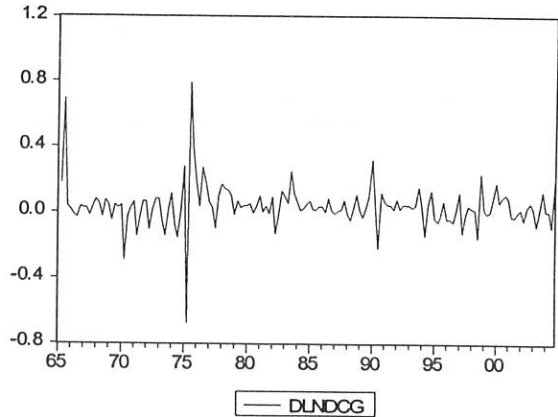


5. The natural logarithm of Net Claims on the Government =LNDCG

a) Level I(0) - non-stationary series

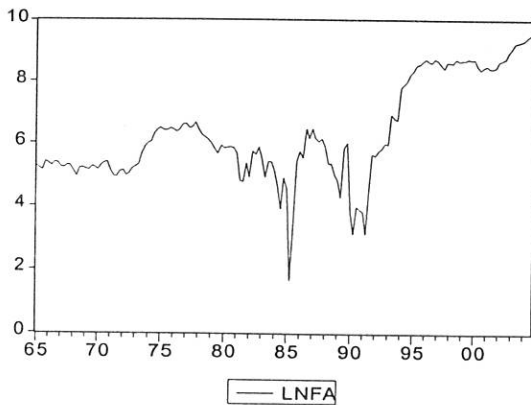


b) First difference I(1) - stationary series

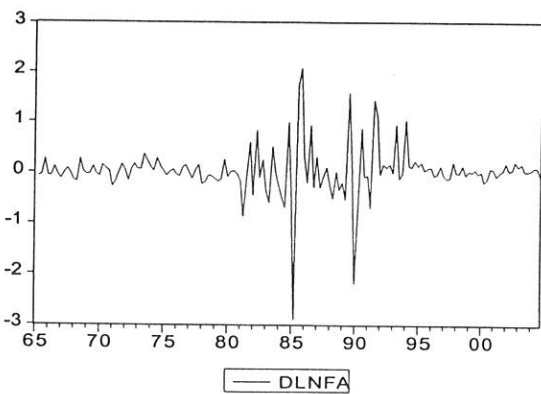


6. The natural logarithm of Net Foreign Assets =LNFA

a) Level I(0) - non-stationary series

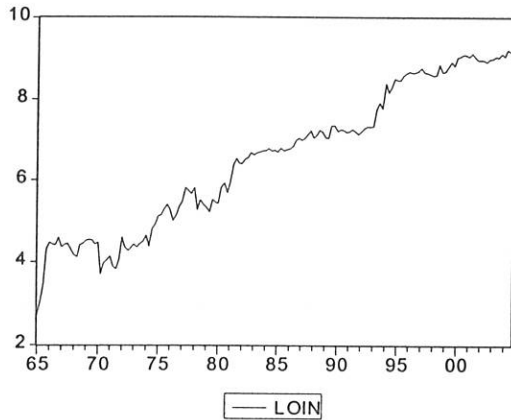


b) First difference I(1) - stationary series

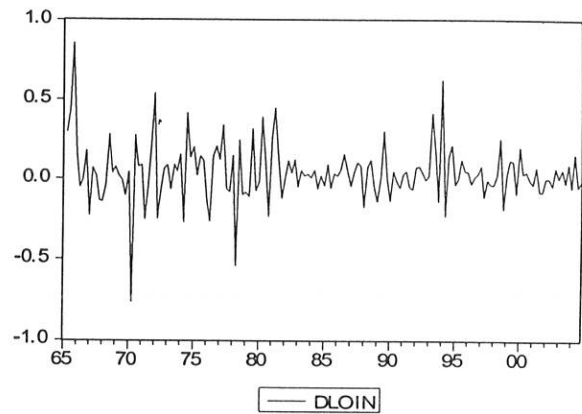


7. The natural logarithm of Other Items Net =LOIN

a) Level I(0) - non-stationary series

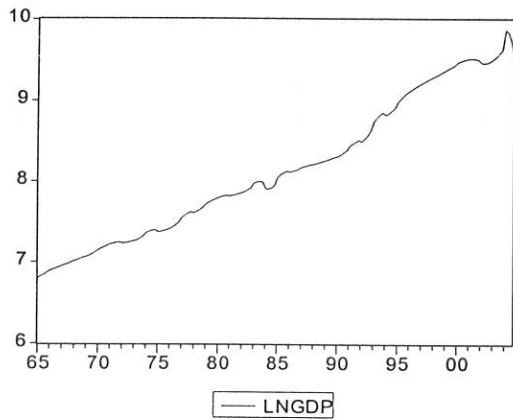


b) First difference I(1) - stationary series

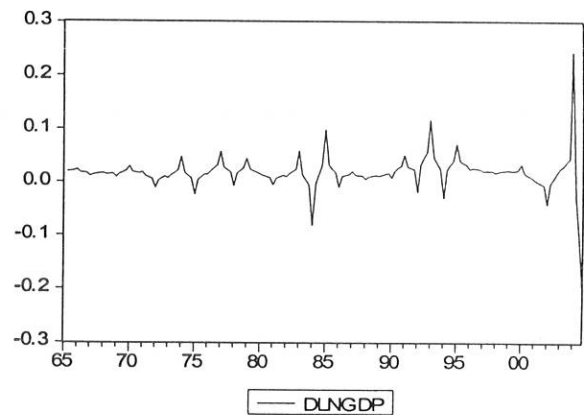


8. The natural logarithm of Nominal Gross Domestic Product=LNGDP

a) Level I(0) - non-stationary series

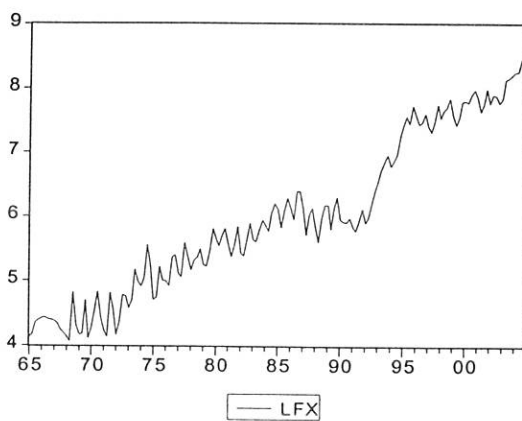


b) First difference I(1) - stationary series

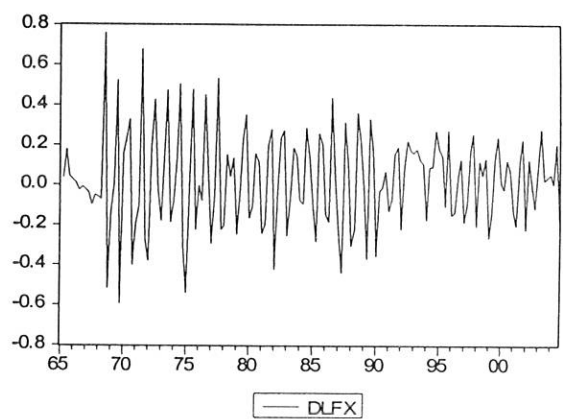


9. The natural logarithm of Foreign Exchange Receipts =LFX

a) Level I(0) - non-stationary series

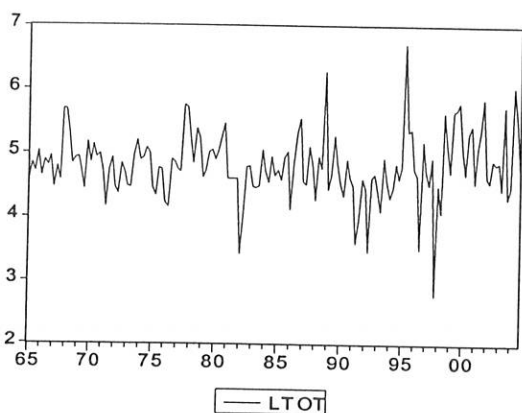


b) First difference I(1) - stationary series

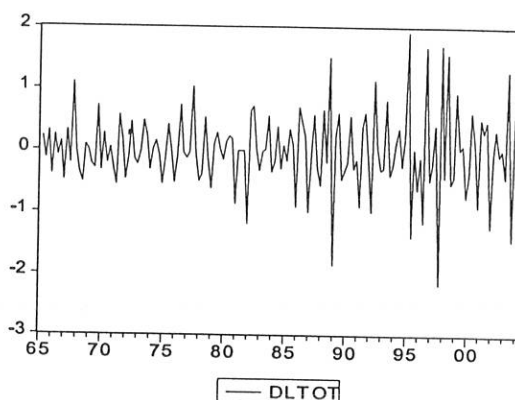


10. The natural logarithm of Terms of Trade =LTOT, a stationary series

a) Level I(0) - stationary series

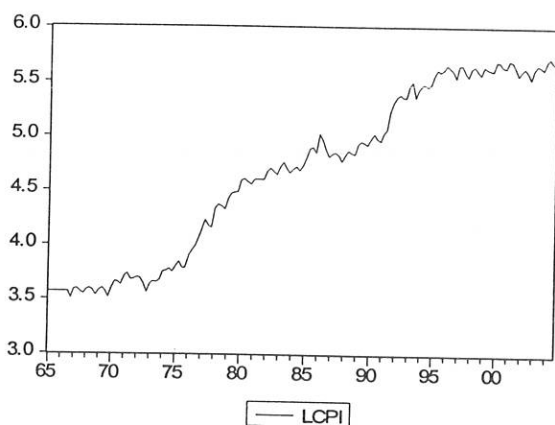


b) First difference I(1) - stationary series

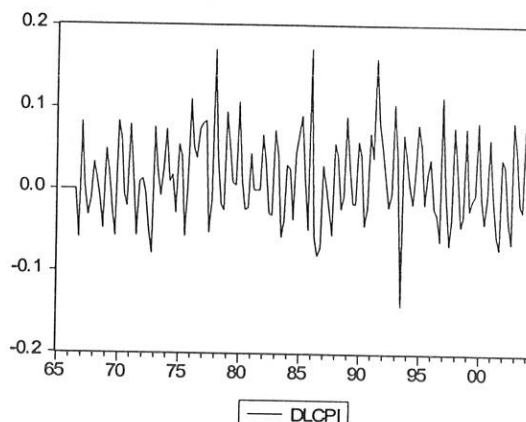


11. The natural logarithm of Consumer Price Index =LCPI,

a) Level I(0) – non stationary series

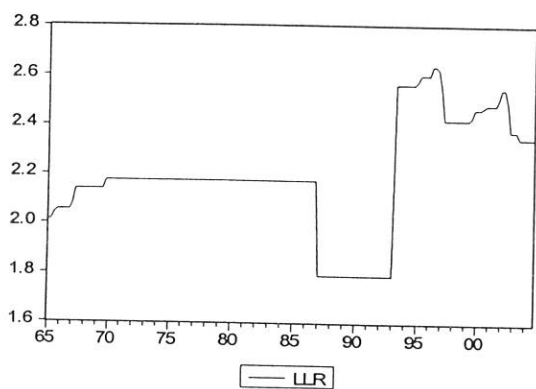


b) First difference I(1) - stationary series

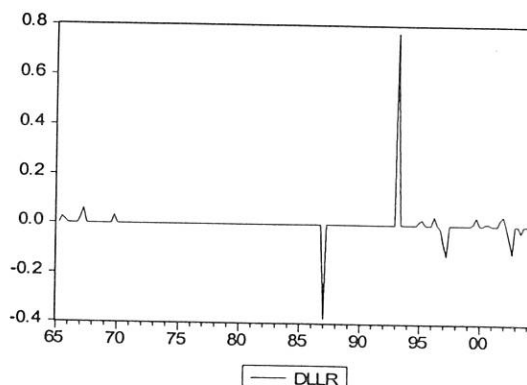


12. The natural logarithm of Lending Interest Rate =LLR

a) Level I(0) – non stationary series

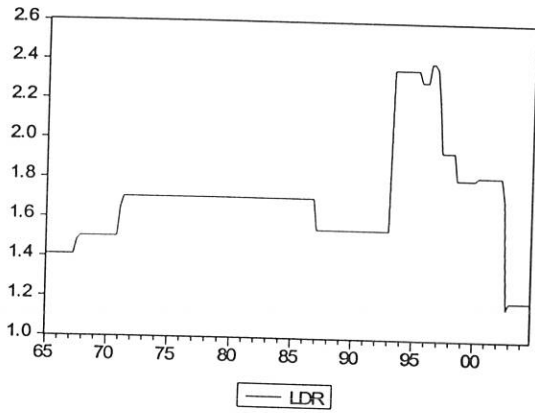


b) First difference I(1) - stationary series

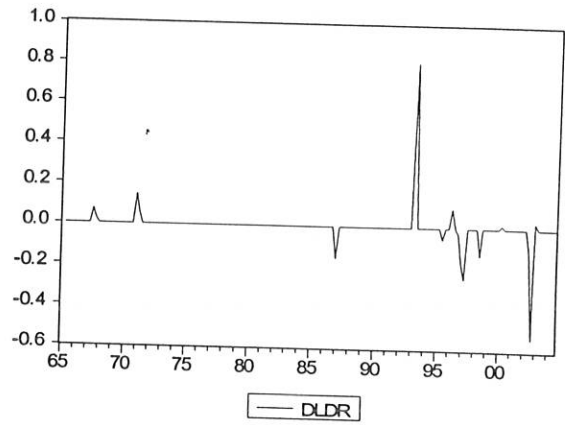


13. The natural logarithm of Deposit Interest Rate =LDR

a) Level I(0) – non stationary series

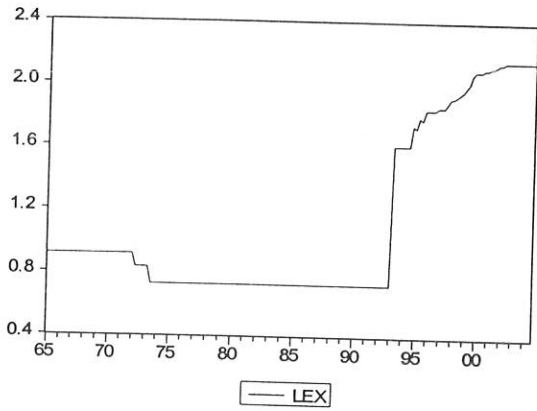


b) First difference I(1) - stationary series

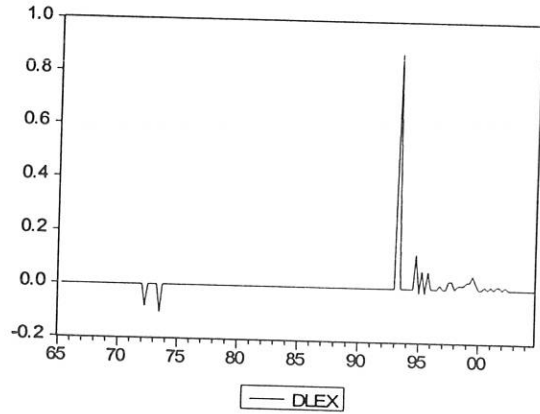


14. The natural logarithm of Nominal Exchange Rate =LEX

a) Level I(0) – non stationary series



b) First difference I(1) - stationary series



Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all source of materials used for the thesis have been duly acknowledged.

Declared by:


Name: Yaminach Adisu

Signature: 

Date: June 17, 2005

Confirmed by Advisor:

Name: Gebrehiwot Agela

Signature: 

Date: June 17, 2005

Place and date of submission: Addis Ababa, June 2005.