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Economic Reform and Stability of the Money demand function in Ethiopia

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Abstract

This study examines the behavior of money demand functions in Ethiopia by estimating both narrow and broad definitions of money. The objectives of the study were identifying the determinants of money demand functions and testing if the functions are stable given that Ethiopia undergone a comprehensive economic reform program as of 1992. The study utilizes annual data series for the period 1970/71 to 2002/03 and employees the Engle-Granger two stage procedure. The result suggested that income; interest rate and exchange rate are important determinants in the long run. Whereas, interest rate, income and exchange rate variables explain broad money better than narrow definition of money in the short run. The stability tests seem to suggest that the money demand functions are unstable implying that intended monetary policy actions are not predictable.

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TABLE OF CONTENTS

Page

1. INTRODUCTION

Demand for money is one of the most widely researched topics in the growing economic literature. Voluminous studies have been made with regard to the empirical investigation of the demand for money function both in developed and developing countries. Theoretical and empirical studies suggest that the demand for money is a function of scale variable (income or wealth) and opportunity cost variables such as interest rates and expected inflation. Some studies (Boughrara: 2001, Al-Saji 1998) have also investigated the importance of foreign monetary aggregates in determining money demand function such as foreign aid and foreign interest rates. Thus, real demand for cash balance depends on real income and expected yield on both physical and financial assets. Returns on financial assets and expected inflation are opportunity cost of holding money balances.

Both theory and empirical studies seem to conclude that macro-economic policies matter in influencing economic performance (Fisher: 1991). One of the reasons why the money demand function is widely researched is that demand for money lies at the heart of macroeconomic policies (Adam: 1999). Money is linked to changes in economic variables that affect all of us and are important to the health of the economy (Mishkin:1998). Moreover, testing the stability of parameters of the money demand function is important as it indicates the effectiveness of the conduct of monetary policy. This is because that the demand for money is a link between economic activities and monetary policy (Al-Saji, 1998).

Stability of the money demand function that refers to constancy of the coefficients of the explanatory variables and changes in variances are crucial to studies of money demand function. Hence, demand for money plays a pivotal role in selecting appropriate policy actions. Studies have also suggested that changes in macroeconomic policies like financial innovations, financial sector liberalization, use of indirect monetary policy instruments and some other country specific variables may cause instability in parameter estimates that in turn suggests unpredictability of policy changes.

Although conjectured in the literature that economic reform causes instability, some empirical studies on the stability of the money demand function in African countries (Adam: 1999, Randa: 1999, Jenkins: 1999, and Henstridge: 1999) however, concluded that liberalization and economic reforms have no effect on private sector portfolio holding of real money balances. These studies also found a stable demand for money functions.

After being ruled by a centrally planning socialist regime for nearly two decades, Ethiopia has been undertaking a comprehensive economic reform program since October 1992. Studying the effects of these reform measures on the demand for money is central to monetary and fiscal policies. Previous rigorous studies on the determinants and stability of money demand function in the case of Ethiopia are scanty. The purposes of this paper are, therefore, to bridge this research gap in investigating the determinants of real money balances, stability of the money demand function and proposing policy recommendations. The study applies the Engle-Granger (1987) two-stage procedure and utilizes both narrow and broader definitions of money.

The scheme of this paper is as follows: section two presents a brief review of both theoretical and empirical literatures, and section three deals about Ethiopia's macroeconomic overview while model specification and methodology are treated in section four. Section five provides estimation results and tests on the stability of the money demand function. Finally, the paper gives conclusion and proposes some policy implications.

2. THEORETICAL FRAMEWORK AND LITERATURE SURVEY

2.1 Theoretical Framework

The demand for money arises from the two functions of money, namely the role of money as a medium of exchange and as a store of value. People demand cash or real money balances either for a means of exchange or for storing (hoarding) values or both. There are two views regarding the factors those that change money demand functions (Jingan, 1983). The scale view, assumes a direct relationship of money demand to changes in

income or wealth while the substitution view considers indirect relationship of money to the relative attractiveness of assets that may be substituted for money. The classical, Keynesian, monetarist and post Keynesian approaches argue about the theory of the demand for money function differently. We shall very briefly look into these theories below.

The classical economists argue that monetary forces do not change real variables such as output and employment. For them money acts only as a medium of exchange and it facilitates transactions. According to this theory demand for money is determined by income, which is assumed to be at full employment level, because their argument is built on the basis of Say's Law of 'supply creates its own demand'. Hence, the number of transactions determines the demand for money and classicals neglect money's function as a store of value.

The Keynesian thought on the other hand, argues that changes in money supply may be transmitted to real output and employment through interest rates and investment. Money is demanded for three motives: namely, the transactions, precautionary and speculative motives. Money demanded for transactions need and precautionary motives are related to the scale view or income while the speculative motive refers to function of the substitution or opportunity cost of money view. Unlike the classical school, the Keynesian argument incorporates both the medium of exchange and store of value basic functions of money.

Monetarists' school argues in favor of the classical theory with slight deviations. They agree that money may affect real variables in the short run but only nominal variables or magnitudes change in the long run. Friedman has also studied the demand for money and he suggested that not only income and the interest rate, total wealth also affects the desire to hold real money balances. He believes that stability of the demand for money is just a behavioral fact proven by empirical evidence and the effects of changes in money supply on expenditure and income is predictable (Ghatak:1995). Although only real variables may change in the short run, monetarists believe that instantaneous adjustment will take

place and the effect of un-anticipated change in money supply only affects nominal variables in the long run.

The post Keynesian theorists argue that a transaction demand is interest elastic as opposed to the interest inelasticity belief of Keynes. On the basis of inventory theory approach, Baumol analyzed the interest elasticity of money demand. He also analyzed the speculative motives of analysis of Keynes in relation to uncertainty and risk aversion of economic agents in the bond market. Tobin brought another theory, which explains liquidity preference as behavior towards risk.

2.2 Empirical studies

There is vast literature consisting of both theoretical and empirical studies on the money demand function about developed and developing countries. This could be ascribed to the fact that the demand for money lies at the heart of macro-economic policy making (Adam, 1999). Demand for money plays a pivotal role in selecting appropriate monetary policy actions and instruments. In recent years, central banks and researchers showed heightened interest in undertaking empirical studies of money demand function on developing countries. These studies are concentrated on modeling and estimating money demand equations. Politicians and policy makers give emphases to the management of money and interest rate or the conduct of monetary policy as it affects performance of the economy. In this sub-section we shall review some recent empirical studies conducted on money demand functions on developing countries.

A study on demand for narrow and broad money in Uganda by Atingi-Ego and Mathews (1996) estimated real money balance using error correction model and obtained that credit restraint, as an opportunity cost variable is a strong determinant of real money balances. Error correction model for narrow money demand function has remained stable even in the period of reduced financial stability. The study also suggested that narrow money is a good aggregate for monetary policy purpose. However, parameter stability is not achieved when broader monetary aggregates are considered. Thus, the study indicated that broadly

defined monetary aggregate might be used as an indicator of monetary conditions rather than targets.

Djeto and Pourgerami (1990) studied the casualty and stability of the demand for money in Cote D'Ivoire and they found that stability and casualty tests indicate the money demand relation has been stable overtime and is highly influenced by foreign interest rate. The authors argued that the relative macro-economic and political stability have contributed to the stability of the money demand function.

An econometric study on financial liberalization and currency demand in Zambia suggested that the money demand equation model has been subject to a large structural break owing to the effects of liberalization measures (Adam, 1999).

A stable long run money demand function was found for Tanzania by estimating the real money balances, on real income, inflation rate and expected currency depreciation using Johansen's maximum likelihood and dynamic error correction modeling procedure (Randa, 1999). The findings of the study imply economic liberalization and relaxation of controls was not significant enough to inhibit estimates of short and long run demand for money equations.

Rother (1998) conducted an empirical study on the money demand and regional monetary policy in West African economic and monetary Union (WAMU). The objective of this study was to mitigate if regional integration, financial liberalization, and the introduction of indirect monetary policy instruments in the region cause changes in the money demand function. The empirical result suggested that demand for money in these countries is sufficiently stable to allow accurate projections. Effectiveness of monetary policy in the region hinges on the implementation of two fundamental structural conditions. For the indirect monetary policy instruments to work excess liquidity in the money market needs to be eliminated and stability of the demand for money will only continue as long as economic agents have confidence in the stability of the financial system. Thus,

maintaining optimum liquidity and financial sector soundness are indispensable tasks of the central bank otherwise monetary policy cannot be effective.

Boughrara (2001) estimated money demand equation for Tunisia using an error correction procedure. The empirical result suggested that income and treasury bills rate affect the long-run money demand equation for Tunisia. In the short-run however, neither treasury bills rate nor the deposit interest rates are significant, implying that a well developed financial and money markets are important. Hence the study proposed policies that improve financial and money markets be pursued. The study further proposed that the Tunisian financial system is in need of further reforms, especially if it is desired to achieve dual goals of price stability and financial sector development.

Al-Saji (1998) studied money demand function for Egypt, Jordan, Tunisia and the Yemen Arab Republic. He regressed real cash balance on real income, expected rate of inflation, foreign interest rate, and foreign aid. The empirical result appeared to suggest that foreign aid and foreign interest rates are found to be important determinants of real money balances in these economies. This implies that these variables need to be considered by policy makers in determining appropriate monetary polices to be adopted in achieving their objectives. The study also finds that the money demand function in these counties is found to be structurally stable.

Empirical studies on money demand function in Ethiopia are scanty. Gemach (1993) as referred in Martha (1999) estimated a money demand equation with gross domestic product as a scale variable, index of coffee production as a proxy for the effect of monetization and expected exchange rate as explanatory variables. Consistent with theoretical predictions, the study found that money demand is positively related to income, the price level and the rate of monetization and negatively to expected depreciation of the exchange rate. He also obtained a long-run high-income elasticity of 1.2, which seems to owe to limitation of asset substitution and instability due to periodic economic disorders.

A similar study by Ergete (1998) estimated money demand function for Ethiopia using quarterly dis-aggregated data by taking real income, the price level, expected inflation, parallel market exchange rate, deposits interest rate and exchange rate premium. This econometric study applies the Johansen (1988) error correction approach. The result indicated that the model revealed very low adjustment towards equilibrium and inflation has significant effect in the short run. Moreover, the parallel market exchange rate premium is found to have significant effect both in the short and long run demand for real money balances. This study tries to incorporate many explanatory variables except that it didn't pay attention to the effects of foreign monetary aggregates.

3. MACRO-ECONOMIC OVERVIEW

3.1 General Background

Ethiopia had been ruled by the centrally planning socialist regime for nearly two decades (1974 – 1991). During this period most of the macroeconomic variables such as interest rate, exchange rate and prices of major commodities were administratively controlled. This has resulted-in, as indicated in many studies, macroeconomic imbalance and generally poor performance in the economy. After the over throw of the socialist regime in May 1991, the country is now in a transition to market oriented economic system. This was the time where Structural Adjustment Program (SAP) was preached to be a stepping-stone to adjust macroeconomic imbalances and ensure sustainable economic growth. Hence, the government has accepted and implementing the Structural Adjustment Program supported by the IMF and World Bank since October 1992. According to this comprehensive economic reform program, a series of policy reform measures and deregulations have been made in view of correcting the distortions in the macro economy and fostering economic growth.

Ethiopia is one of the poorest countries in the world by ranking 169th out of a total of 174 countries in per capita basis (World Development Report 1998/99). Latest estimates have also showed that Ethiopia's GDP per capita of US$95 and nearly 60 percent of its population lives below the absolute poverty line. The agricultural sector is the mainstay of

the economy on average accounting for over 45 percent of GDP, 88 percent of the labor force and over 90 percent of the export earnings. Supply of food to urban areas and raw materials to the manufacturing sector largely depend on agriculture. Individual smallholder farmers produce nearly 97 percent of agricultural output.

The economy is characterized by recurrent drought, rapid degradation and soil erosion, deteriorating terms of trade, high population growth rate and low degree of financial deepening or transformation. Despite this however, broad money aggregate accounted for about 51 percent of GDP (NBE, 2002), which is better compared, to 20 percent average for African countries and 40 percent for non-African developing countries (Adam 1999).

Table 1: Selected Macroeconomic indicators, 1970-2000 (End of June)

Year	1970	1975	1980	1990	1992	1994	1996	1998	2000	2002
GNP Per capita growth in %	1.4	-2.5	-2.4	0.9	-6.7	-1.6	7.4	-2.8	2.3	2.8
Fiscal deficit as a % GDP	0.9	4.7	4.4	10.3	7.0	7.7	5.2	7.3	10.2	8.0
Inflation rate annual %	6.7	18.1	1.9	21.0	10.0	13.4	-6.4	0.6	6.2	-8.6
Black mart rate ann. aver	2.3	4.1	3.0	6.7	7.5	7.3	7.2	7.7	8.31	8.86
Exchange rate premium	0.23	0.67	0.44	1.92	3.61	0.22	0.21	0.02	0.02	0.01
Real interest rate ann. aver	11.7	-13.0	-1.2	-12.4	8.7	6.0	4.6	5.1	-0.2	-5.8
Money as % GDP	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.5
GDP growth rate	4.1	1.7	15.0	-4.2	12.0	6.2	5.2	10.6	7.1	-1.7
Narrow money growth	-5.9	-13.6	12.2	2.7	-0.4	18.3	2.4	-1.3	5.3	10.5
Broad money growth	0.0	0.2	10.5	-0.9	-0.6	24.2	2.7	-0.2	10.5	11.4

Source: CSA, MEDaC and NBE

Sluggish Performance of the economy is reflected in the macroeconomic indicators presented in table 1 above. Despite a commendable growth in GDP, per capita income showed declines in most of the years as indicated in the table. The main contributing factors for this are recurrence in drought and high population pressure. There was a declining trend in the level of fiscal deficit after the reform but due to the Ethio-Eritrea conflict, fiscal deficit to GDP ratio picked up to 10.2 percent in 2000. Historically, Ethiopia is a low inflation country; except for drought years, inflation was contained at single digit levels. The average figure for the last three decades is computed to be 7.15 percent (Yohannes: 2001). Recurrent droughts, adoption of inappropriate policies and weak institutional framework have harnessed growth of the economy and resulted in

macroeconomic imbalance, which was aggravated towards the end of the totalitarian Derg regime. Consequently, the inflation rate escalated to 21 per cent in 1990, which was the highest rate in the history of the country.

Figure 1: Trends in GDP and Money Supply
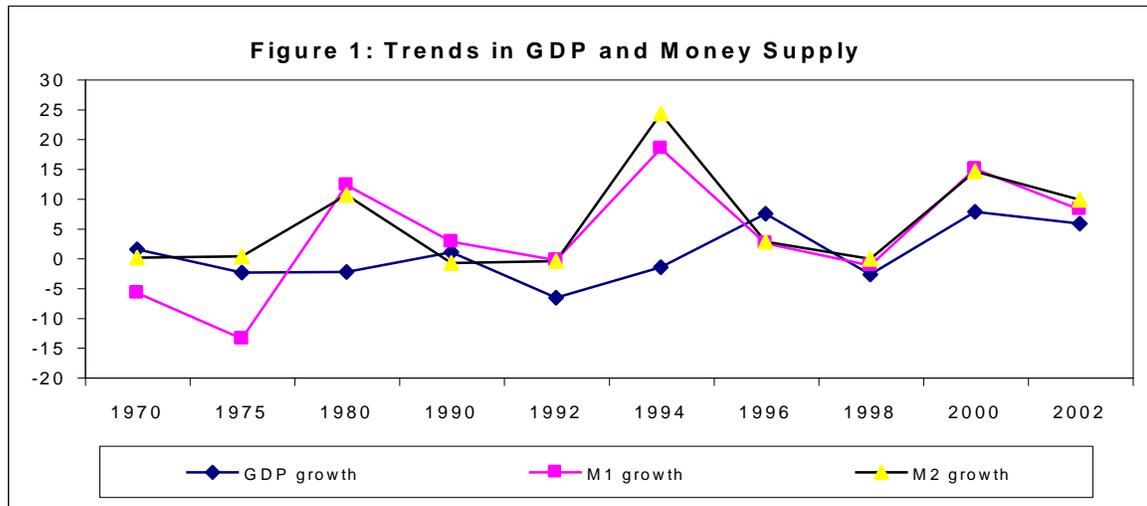
3.2 Fiscal and Monetary Policies

Monetization of budget deficit is one of the links between fiscal and monetary policies. Prior to the economic reform of 1992, the government's fiscal deficit was as high as 12 percent of GDP. During the last years of the Dergue regime, there existed rising public expenditure against low revenue collection. This phenomenon could be ascribed by the high tax rate structure that led to tax evasion and narrower tax base on the one hand and ever-increasing military and other expenditure on the other. Consequently, this has resulted in expansionary monetary policy enticed by financing the fiscal deficits (monetaization of the deficit). This was reflected by a higher growth rate of money supply in comparison to the GDP growth rate in the Derg period and beginning of the reform (See figure 1). The fact that the government was financing its deficits mainly through printing of money and there was lack of external financing resulted in an accelerated money supply growth. Despite this, however, in the overall and compared to similar LDCs (for example Latin American economies) fiscal deficit was not a major problem as historically inflation was not a serious problem in Ethiopia.

In the post reform period, however, increased government saving and reduced budget deficit was achieved (Berhanu and Seid: 1999). This was a result of the fiscal reform and use of different non-inflationary sources to finance budgetary deficits. The introduction of treasury bills auction in early 1995, inflow of external resources in support of the reform program and cut on military expenditure are the major factors that contributed to the squeeze in fiscal deficit.

The monetary policy in the reform period was money targeting that is mainly geared to credit controls, stabilization of price and, enhancing sustainable economic growth. To this effect, the reform starts with an upward revision of interest rate polices which have been administratively controlled for quite a long time and biased in-favor of the government sector which was the outcome of excessive financial repression. The policy concentrates on price stability and maintaining positive real interest rate so as to induce financial savings and investment. Price stability is considered to be one of the most important objectives of monetary policy in developing countries like Ethiopia. Stringent credit policy towards lending to the government and ensuring credit availability to the private sector were also the objectives of the monetary policy in the post reform period.

Thus, money supply growth rate was monitored to keep pace with that of growth in nominal GDP, which is reflected in very low inflation rate (see table 1). Therefore, demand management measures or tight fiscal and monetary polices are adopted.

3.3 Exchange rate policy

Ethiopia's export sector is led by a single major commodity export-coffee. On average over 90% of exports are agricultural primary products that are vulnerable to deterioration in the terms of trade, natural and man made problems as well as adoption of inappropriate policies and weak institutional framework. Some of these policy constraints include adoption of a fixed exchange rate regime for a long time, (that led to wider misalignment of the official and parallel exchange rates which in turn made exports unnecessarily expensive and imports cheaper), levying of very high tax incidence on exporters, and prohibition of private sector participation beyond a pre-determined low capital ceiling in

the sector. Overvaluation of the domestic currency that hinders the country's external competitiveness and expansion in boarder contraband trade are ensued from these policies.

In post-reform period, a series of reform measures have been taken. In October 1992, the domestic currency was devalued significantly (142% in Birr terms) followed by an introduction of retail Dutch foreign exchange auction system as of May 1993. Subsequently, Forex bureaus were opened within commercial banks to buy and sell foreign currencies. Current account liberalization measures and transfers of exchange control operations from National Bank of Ethiopia to commercial banks were effected. Since August 1998 the retail foreign exchange auction was replaced by a wholesale auction in which investors and commercial banks are allowed to buy foreign currency not less than US$500,000. Concomitantly, an inter-bank foreign exchange market was also established to pave the way for a market determined exchange rate regime. Since October 2001 the wholesale foreign exchange auction was terminated and replaced by the inter-bank foreign exchange market. Currently, the nominal exchange rate is determined by the daily transactions of the inter-bank foreign exchange market. Thus, a managed floating type (dirty floating) of exchange rate regime is in place now. Efforts are being exerted to move to a more market determined exchange rate regime. As a result the misalignment in the parallel market premium has wiped out significantly. Currently the premium is less than one percent.

3.4 Financial sector development

The financial system in Ethiopia, like in many other developing countries is characterized by a financial dualism. It comprises of the formal and informal financial institutions. The formal (organized) institutions consists of the central bank, eight commercial banks, one specialized development bank, nine insurance companies, twenty three micro-financing institutions and over seven hundred formal saving and credit unions or cooperatives. The informal (unorganized) financial institutions on the other hand, include the traditional informal money markets like i*quib*, *idir,* m*ahiber, usury and the parallel foreign exchange market*.

The financial sector in Ethiopia is rudimentary and underdeveloped. Bank branch population ratio with a branch serving over 200,000 people[1], indicates that Ethiopia is one of the most under banked economies even by SSA countries standards. Money and capital markets are not developed that there is only a thin primary market for treasury bills and weak inter-bank money market while except government issued bonds, all types of capital markets including stock exchange and equity markets are non-existing.

Although periodic revisions have been made to maintain positive real interest rate, interest rates are not fully market determined. The floor interest rate for saving deposits is still controlled by the National Bank of Ethiopia (NBE), meanwhile; the lending interest rate is freed to be determined by market forces since January 1998.

The banking sector is concentrated in major cities and towns. For example, at the close of June 2002 there were 93 (30 % of total) commercial bank braches in Addis Ababa only. Moreover, with regard to ownership structure and concentration, one government owned commercial bank dominates the banking sector. At end June 2002, for instance, this Bank accounted for 82.2 percent of total banking sector assets, 80.3 percent of total deposits, and 71.9 percent of outstanding loans and advances (NBE:2002).

Assets of the banking sector increased from Birr6.2 billion at the close of 1990 to Birr42.1 billion at the end of June 2001 (about 80 percent of GDP). This is a result of the comprehensive reform program in general. The reform in the financial sector includes: enacting of a new Monetary and Banking Proclamation No. 83 of 1994 and subsequent financial sector liberalization measures. The banking legislation allows private investment in the sector for Ethiopians. The NBE is vested the power and responsibilities to license, supervise and regulate financial institutions by proclamation No. 84 of 1994. As a result, six private commercial banks, eight insurance companies and twenty-three micro financing institutions are established and are in operation. The market share of these private banks and insurance companies is steadily increasing. Despite these positive

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[1] As of December 2002, there are 327 bank branches all over the country and given a mid-year population estimate of 67 million (CSA 2002), the bank branch to population ratio is about 1:210,000

developments, however, the financial sector soundness and competitiveness is still crawling. Commercial banks are facing structural liquidity and institutional problems.

4. MODEL SPECIFICATIION, DATA AND METHODOLOGY

4.1 Formulation of the Money Demand Function

Conventional money demand theory suggests that the behavior of the money demand function is determined by scale and opportunity cost variables. The scale variables are variables related to measures of economic activities like income, expenditure, or wealth, while the opportunity cost variables include variables such as both domestic and foreign interest rates, expected inflation (hedging), expected exchange rate (currency substitution) and the price level. The functional relationship of the money demand function therefore can generally be represented as equation (1) below.

$$M/P = f(SV, OCV) \text{ ---[1]}$$

Where M/P is the desired real money balance, SV represents scale variable and OCV represents vector of opportunity cost variables.

In a typical LDC economy like Ethiopia, the financial sector is rudimentary characterized by inadequate financial infrastructure, absence and/or underdevelopment of money and capital markets, limited availability of financial services and low financial innovations. Due to such weak and low level of financial sector development, the narrowly defined monetary aggregate (M_1), or transactions money which is currency outside banks and demand deposits at commercial banks be chosen as a more stable measure (Siram 1999). Empirical studies of the money demand function indicate that narrowly defined monetary aggregate is a better aggregate for policy formulation in developing countries. On the other hand, there is also equally important argument on the appropriateness of broader definition of money for developing countries. Thus, both real narrow and broad definitions of money are estimated as appropriate variables to be investigated. The consumer price index is used to deflate monetary aggregates.

With regard to the scale variable, real income or real gross domestic product (GDP) is used. It is chosen because other scale variables such as wealth or industrial production index, etc. are not available. Moreover, in many empirical studies of money demand function in developing countries real GDP is considered as a more relevant scale variable.

Theory argues that interest rate is a very important opportunity cost variable to be considered in money demand function. Interest rate in Ethiopia was administratively fixed for a long time (especially during the Dergue regime). Furthermore, even under the current economic paradigm, interest rate is not fully freed to market forces and hence we cannot confidently argue that the prevailing interest rate is market determined. Therefore, we take the real instead of the nominal interest rate[2].

In recent empirical studies of money demand function in developing countries, currency substitution or expected depreciation of the domestic currency is proxied by the premium exchange rate or the official expected exchange rate and significant coefficients are obtained (see Ergete 1998). It is argued here that due to the authorities' intervention, the official nominal exchange rate may be lower than the market exchange rate. Similarly, the parallel market rate could be higher due to information asymmetry and the risks involved in it. Hence, we argue that the trade weighted real effective exchange rate (REER) would better reflect the market rate and it is included in the model.

Foreign monetary aggregates such as foreign interest rate and foreign aid are believed to influence the money demand function. The effect of foreign interest rate may be limited as Ethiopia is not integrated in the global capital market. But the influence of foreign aid is argued to be important. The data for foreign aid however is not available. Official transfers balance, which includes both cash and in kind transfers, is used as a proxy for foreign aid.

Given the theories of demand for money and assuming there is not money illusion; the money demand function for Ethiopia can be specified as follows:

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[2] Real interest rate is computed as the difference of nominal interest rate and inflation rate.

$$m_{t-}cpi_t = ß_0 + ß_1 y_t + ß_2 r_t + ß_3 reer_t + ß_4 fa_t + e_t \text{ ------ (2)}$$

Where m represents both real narrow and broad monetary aggregates, *y* is real GDP, *r* is nominal interest rate, *cpi* is the Addis Ababa consumer price index, *reer* is real effective exchange rate, *fa* is foreign aid and *e* is the stochastic disturbance term. Following conventional money demand equation estimation all the variables are transformed into logarithm.

In terms of the expected signs of coefficients, theory tells that the scale variable (y) should be positively related to real money demand while the real money balance is expected to be negatively related to the opportunity cost variables. In short, theory suggests that $ß_1$, $ß_3$ and $ß_4$ are positive and $ß_2$ is negative.

4.2 Sources of Data

Data series for the variables specified in equation 2 above are obtained from different sources. Data for interest rate, Addis Ababa consumer price index, narrow and broad monetary aggregates and foreign aid are collected from various issues of Quarterly Bulletins of National Bank of Ethiopia. The real effective exchange rate is computed by defining the nominal effective exchange rate by the ratio of relative prices of tradables to non-tradables. In choosing the relevant price index we take the wholesale price index of major Ethiopia's trading partners where available as a proxy for price of tradable and in the absence of the wholesale price index the consumer price index is considered. The quarterly disaggregated real GDP series is taken from previous studies of Equar, Haile and Tura (2001)

4.2 Methodology

There is a universal or general agreement among scholars that time series data on most economic variables are not stationary. A regression of non-stationary variables give spurious or inconsistent regression, which gives very high R^2 due to time trend that may lead to invalid statistical inferences. As is usually done in recent econometric time series analysis, testing for unit root or stationarity of the variables is the first stage. The results

depicted that all the included variables are found to be I (1). Thus, this calls for the use of co-integration analysis. In this study the Engle-Granger (1987) two-stage procedure is employed. Hence, the equations in (2) are first estimated and the error terms of the estimated equations were tested for unit root. The Augmented Dickey Fuller (ADF) test results depict that the error terms are found to be stationary in levels or I(0). Then the first lags of the error terms along with the first differences of the variables in the equations are used to estimate the short-run dynamics Error Correction Models of each equation. Finally, the general to specific approach is employed to arrive at the parsimonious final short run error correction model.

5. ESTIMATION RESULTS AND STABILITY TESTS

5.1 Estimation of the model

Estimation of the long-run static model (equation 2) for narrow and broad definitions of money using OLS gives us the following results.

Narrow money

$$m1_t = -5.10 + 0.61y - 0.02reer - 0.32r + 0.25fa \ldots\ldots\ldots\ldots (3)$$
$$\quad\quad (-1.79) \quad (2.0) \quad\quad (-0.20) \ (-3.85) \quad (5.37)$$
$$R^2\text{-adjusted} = 0.96 \quad\quad\quad \sigma = 0.10 \ DW = 1.00$$

Broad money

$$m2_t = -6.36 + 0.90y - 0.20reer - 0.37r + 0.21fa \ldots\ldots\ldots\ldots (4)$$
$$\quad\quad (-2.42) \quad\ (3.21) \quad (-1.96) \quad (-4.79) \quad (4.81)$$
$$R^2\text{-adjusted} = 0.97 \quad \sigma = 0.09 \quad DW = 0.78$$

Where: All the variables are as defined earlier and the figures in parenthesis are t-values.

As theoretically argued, the static equation result depicted above income and foreign aid are directly related to both narrow and broader definitions of real money balances. Real effective exchange rate defined as the price of foreign currency in terms of the local currency and hence the negative coefficient implies that the real effective exchange rate is positively related to both transactions money and broad money. Theoretically it is argued

to be an empirical issue, since it is long run, however, depreciation of the exchange rate is expected to improve balance of payments and restrain monetary expansion Interest rate is found to explain inversely real money balances as theoretically expected. Given the time series properties of the data series, the standard t and F tests may not tell us the significance of their coefficients.

In time series econometrics the variables may not have causational relationship that their relationship as estimated in equation (3) and (4) above may be due to time trend. Hence we have to check if all the relevant variables have long-run relationship by running co-integration tests.

5.2 Co-integration tests

Most time series macro-economic variables are non-stationary in which case the variables may have consistent trend relationship and the regression result we obtained would be inconsistent. Upon checking the unit root test for our variables using Dickey Fuller and Augmented Dickey Fuller tests, we found that they are not stationary in levels. Non-stationary of data series indicates that co-integration technique can be applied. In order to know whether our variables of interest are co-integrated we apply Engle- Granger (1987) two-stage procedure. The first stage is to determine their orders by differencing each variable.

The unit root test result unravel that the variables are found to be stationary in their first differencing. Hence they are stationary of order one or I(1). Stationarity means that the effect of a random shock dampens out overtime and return to steady state. The second stage is to test if the residual series of the static model is stationary in level or an I(o) process. Since we found this result, we can arguably assume that the variables are co-integrated that their linear combination is related in the long run. Thus, we can be confident that the long run money demand function involving these variables exists, (Thomas, 1993).

5.3 Short rum dynamics Error correlation model

A short run demand for money equation can be estimated by Engle-Granger two-stage procedure. In the preceding section we obtained a result that suggests the variables are co-integrated implying the long run relationship exists. Thus, the short run money demand functions can be given as error correction representation involving dis-equilibrium errors, (Thomas, 1993). The residuals from the static model are used as estimates of the dis-equilibrium error.

The short rum dynamics error correction model that comprises both the short run dynamics and long-run adjustment coefficient are estimated. The results are reported as follows.

Narrow money

$$\Delta m1_t = -5.10 + 0.28m1_{-3} - 0.13\Delta r - 0.20\Delta reer_{-1} - 0.37ecm_{t-1} \dots\dots\dots (5)$$

$$\qquad (1.89) \quad (1.67) \qquad (-1.51) \qquad (-1.83) \qquad (-3.24)$$

R^2 -adjusted = 0.31, σ = 0.08   , DW = 1.75, RSS = 0.16

Normality test: Jarque-Bera = 0.679[0.718]
Autocorrelation test: F-statistic   = 0.619[0.848]
Heteroskedasticity   = 1.744(0.149)
ARCH Test: F-statistic   = 1.472[0.235]
Ramsey RESET test: F-statistic   = 0.831[0.371]

Broad Money

$$\Delta m2_t = 0.43m2_{-3} + 0.68\Delta y - 0.20\Delta r - 0.22\Delta reer - 0.34ecm2_{t-1} \dots\dots\dots (6)$$

$$\qquad (3.82) \qquad (3.79) \qquad (-3.45) \quad (-3.28) \qquad (-4.09)$$

R^2 -adjusted = 0.57 , σ = 0.05   , DW = 1.46   RSS=0.07
Normality test: Jarque-Bera = 3.109[0.211]
Autocorrelation test: F-statistic   = 3.090[0.066]
Heteroskedasticity   = 1.206[0.349)
ARCH Test: F-statistic   = 0.865[0.361
Ramsey RESET test: F-statistic   = 0.677[0.419]

The narrow and broad definitions of money short run dynamics error correction regression results are presented in equation 5 and 6. In the case of narrow of narrow money interest rate and real effective exchange rate explain transactions money last not significantly as indicated by their insignificant t-ratios. Income and foreign aid, however, are dropped from the model due to unexpected sign in their coefficient and not explaining the dependent variable. The long run adjustment coefficient is statistically significant implying that the variables included in the model explain significantly narrow money in the long run.

Income, real effective exchange rate and interest rate are significant in explaining broad money while foreign aid is dropped due to insignificant coefficient. The adjustment coefficient is also significant but coefficient of long-run adjustment is more significant in the case of narrow money relative to broad money. The error adjusts by 37 percent in one year in narrow money while it adjusts by 34% in broad money.

Diagnostic tests in both narrow and broad money short run equations suggest that there are no evidence of autocorrelation, heteroscedasticity, normality and misspecification problems. Thus the standard F and t tests can be considered as valid. The result can therefore be taken as Gaussian.

5.4 Stability tests

As pointed out in the outset, some of the reasons that interest researchers and scholars to estimate the money demand function are stability of the function and its responsiveness or elastic ties with respect to its determinants. Stability in this case, refers to constancy of regression parameters and constant or smaller change in the variance of the error term over the specified sample period, which measures unchanged economic relationships. Two characteristics of the stable money demand function are therefore yielding the same estimation result over time for different sample estimates and the accuracy of out of sample forecasts (Rother, 1998)

Testing the structural stability of money demand function parameters is becoming a common feature in the vast literature of money demand function. This is because the fact that the stability or constancy of parameter has an important implication to monetary policy. The existence of stable money demand function (unchanged economic relationship) is essential for the effectiveness of monetary policy. Because unstable relationship of money demand to its determinants makes the effects of changes in money supply unpredictable (Judd and Scadding, 1982). One possible consequence of parameter instability in the money demand equation is that predictability of monetary policy measures would be more hazardous.

The most well known tests of stability of regression parameter are probably the chow tests. These tests, as applied below, are the sum of squared residual proportionate change and predictive failure tests. We also employ recursive least square graphic test to supplement the Chow test results. These tests for our money demand function are applied as follows:

5.4.1   Chow's Breakpoint Test

Chow's break point test-to-test stability of regression parameters is to divide arbitrarily the sample data into two groups and estimate them 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. According to this test we partitioned our sample data into two-sub periods. The first (pre-reform) period includes 1971(1) to 1991(4) and the second (post-reform) period covers from 1992(1) to 2001(4).

The equations are estimate and based on the results we apply Chow's break point test for structural stability of both narrow and broad definitions of money[3]. The test result

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[3] The break point test is an F distribution. F-statistic is based on the comparison of the restricted and unrestricted sum of squared residuals and in the simplest case involving a single breakpoint, is computed as

$$F = \frac{(\sum e_T^2 - \sum e_1^2 - \sum e_2^2)/K}{(\sum e_1^2 + \sum e_2^2)/(T-2K)}$$ Where $\sum e_i^2$ is residual sum of square, 1 and 2 represents sample

period one and two, T stands for the total sample size, K is the number of coefficients.

suggests that we tend to reject the null hypothesis of parameter stability or the hypothesis that the money demand functions in the two periods are the same. The result seems to suggest that there is structural change in the relationship.

5.4.2   *Chow's Forecast Test (predictive failure)*

This method also suggests that dividing the sample data into two periods in such a way that the second sub-period sample size is less than the number of regressors. Since in this case we cannot run OLS regression for the second sub-period, we compute the sum of squared residuals for the first sub-period only to be compared with that of the entire sample.

We divided the sample into two sub-periods. The first period covers from 1971(1) to 2000 (4) and the second comprising 2001(1) to 2001(4). In this method the estimated model for the first period is used to predict the values of the dependent variable in the remaining sample period.

Large differences between these predicted values of the dependent variable and its actual value might cast doubt on the stability of the relationship over the entire sample period[4]. The Eviews test result of chow's forecast test is reported in table 5.1 below

Table 5.1

Chow Forecast Test from 1992(1) – 2000(4)

	F. Stat	Probability	LR	Prob.
Narrow Money	0.74	0.83	34.83	0.52
Broad Money	0.75	0.83	34.96	0.51

---

[4] Chow's forecast test is an F statistics given by $\dfrac{(\sum e_T^2 - \sum e_1^2)/n_1}{\sum e_1^2/(n_1 - K)}$; where n_1 is number of

observations in the first period and the other symbols are as defined above in footnote 2… The F and likelihood function test results are presented in table 5.1 below which suggest rejecting the null hypothesis of parameter stability.
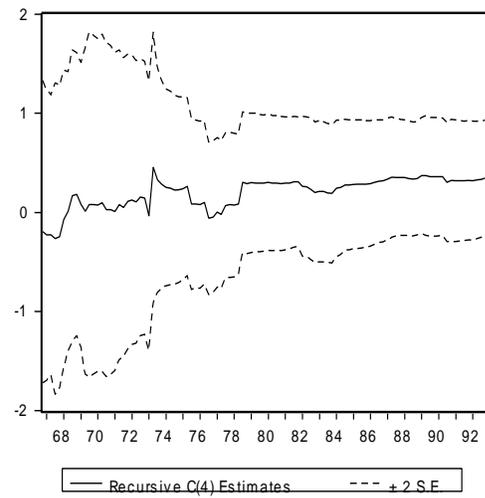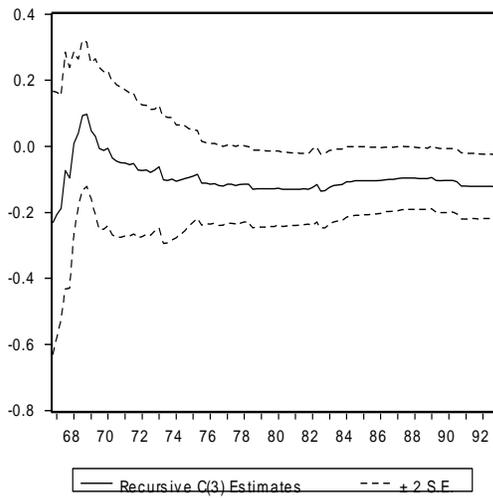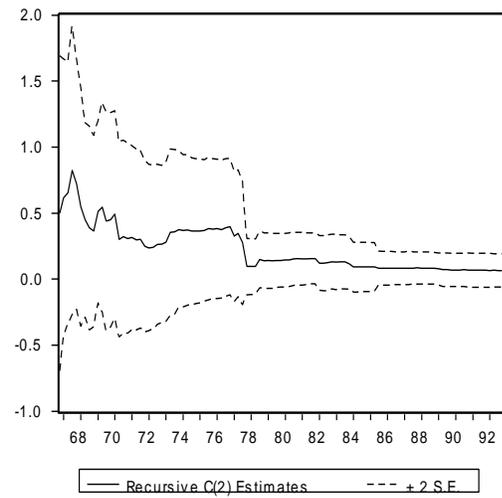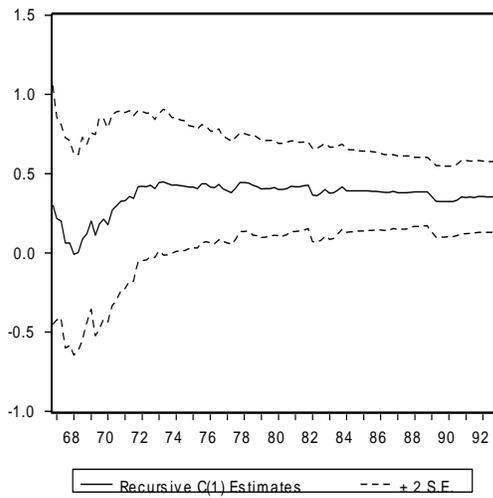
Given the forecast result in table 5.1 above, one may reject the null hypothesis of no structural change in both narrow and broader definitions of money for Ethiopia before and after the reform.

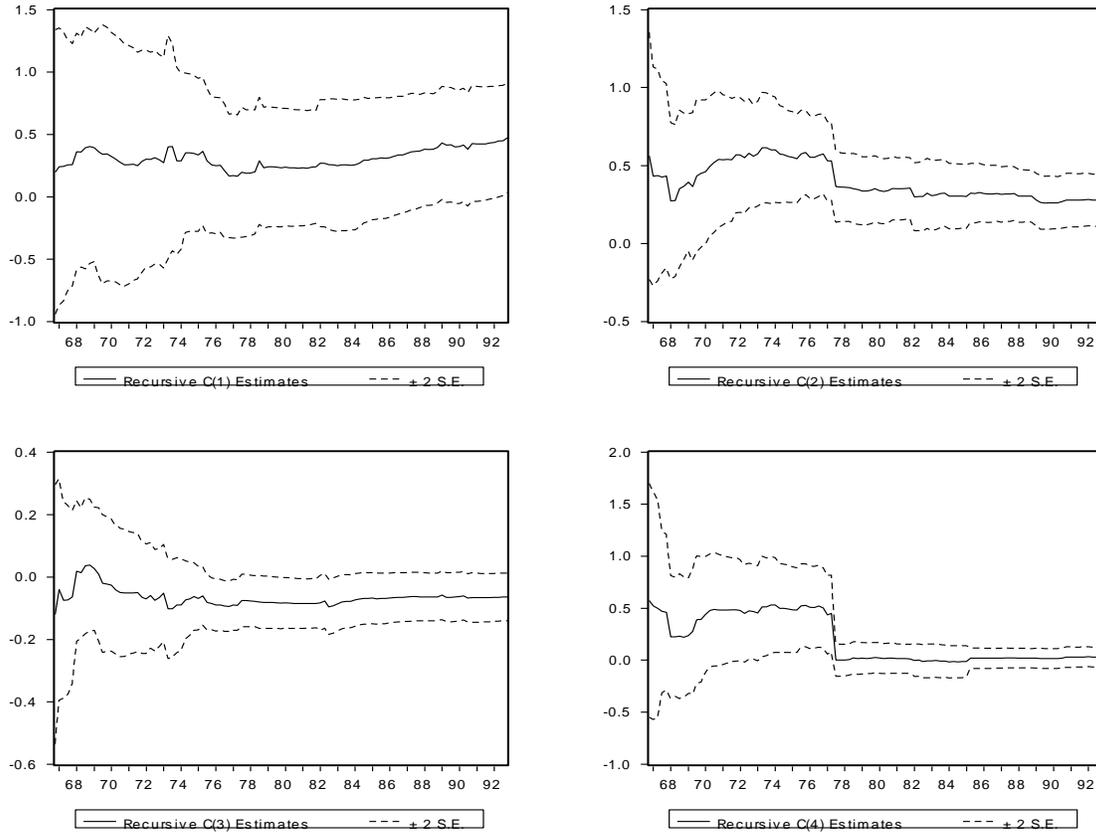### *5.4.3   Recursive least square method*

Chow's break point test of testing parameter constancy using proportionate increase in the sum of residual squares and forecast or predictive failure tests fail to indicate whether the instability is in the intercept or in which variable coefficient that occurred. Moreover, we cannot trace when the shock or the natural break is occurred in the sample data in these methods. Hence, researchers are intended to test stability of parameters without natural break in the data and without dividing the sample data into sub-periods using a technique called recursive least square method.

In recursive least squares each variable coefficient is estimated for a small sub-sample of time series observations where the sample is greater than the number of parameters, (Thomas, 1993). By increasing the sub-sample size estimation of parameters continued until the total sample data is completed. In recursive method we observe the evolution of estimates for any coefficient as more and more observations are added in the model. A record of parameter estimates is kept and the paths of these estimates overtime are plotted. The estimates obtained in this method are known as recursive least square estimates. Recursive estimates of the error correction model are presented in the following graphs, which can be used to investigate the stability of parameter and variance in the residuals. In the recursive plots, there are two standard error bands around the selected estimated coefficient. In figures 5.1 and 5.2 below the recursive estimated coefficients of both narrow and broad money are plotted in between the critical bands indicated by the dashed line.

Figure 5.1 Recursive least square graphs of equation 5

Recursive C(1) Estimates   ----- + 2 S.E.

Recursive C(2) Estimates   ----- + 2 S.E.

Recursive C(3) Estimates   ----- + 2 S.E.

Recursive C(4) Estimates   ----- + 2 S.E.

**Figure 5.2 Recursive least square graphs of equation 6**

Significant variations are observed in some estimated coefficients while narrowing disparities are displayed in other estimated coefficients. If the recursive graphs reveal significant variations as the number of the sample size increases, then one may argue that the coefficient is not stable over the sample period. On the other hand, if the variation is diminishing, as more and more observations are included, then we may say that the coefficient is stable over the entire sample period. The test result as displayed in figure 5.1 and 5.2 is mixed that seems to cast doubt on the stability of both narrow and broader monetary aggregates.

Figure5.3 Recursive graphs of residuals of equation 5
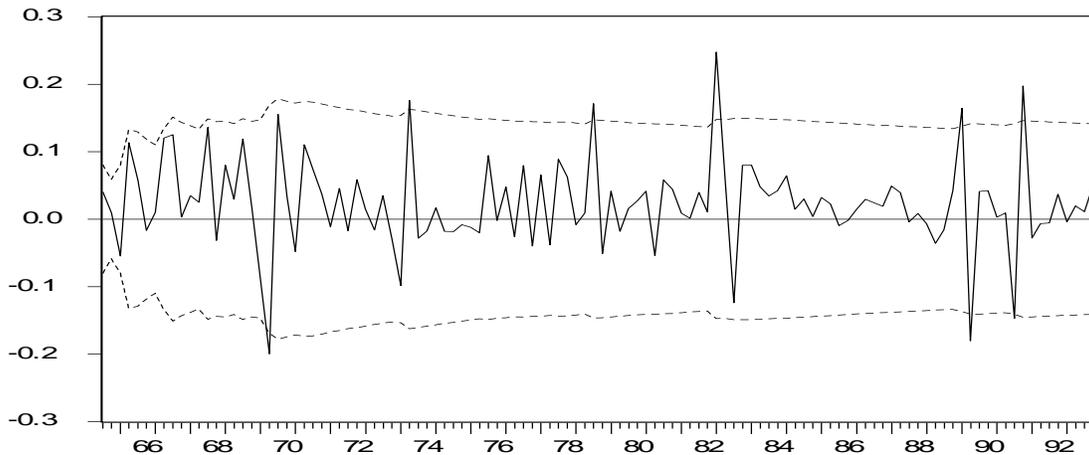
Figure 5.4   Recursive Residuals   - - - - - ± 2 S.E.   **Recursive**

Figure 5.4 Recursive graphs of residuals of equation 6

Recursive Residuals   - - - - - ± 2 S.E.
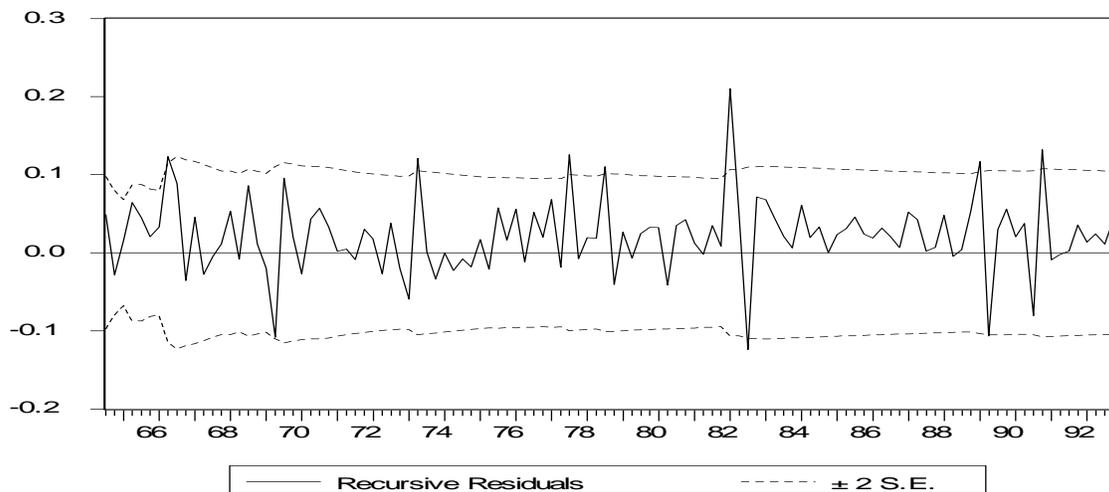
The recursive residual graphs and the error bands are depicted in the graphs in figures 5-3 and 5.4 above. The result seems to suggest that the residuals graphs are not within the critical bands in many instances. The Graphs indicate that the variances of the estimated models do not have similar or unchanged variances. This seems to suggest that the instability in the money demand function is due to hetroskedasticity.

In all the three methods of testing stability we employ above, Ethiopia's money demand function appears to be unstable over the study period. Test results also seem to indicate that changing variance of the residual term or violation of the homoskedasticity

27

assumptions causes the instability. Thus, we may argue that policy changes subject structural break

6. CONCLUSION AND POLICY IMPLICATIONS

6.1 Conclusions

As vividly indicated in the outset, one of the purposes of this paper is to identify the determinants of money demand function in the case of Ethiopia. Knowing these determinants is very crucial for policy formulation and its effectiveness. Changes in macroeconomic policies such as monetary, fiscal and exchange rate policies, may cause a structural break or instability in the money demand function. The other purpose of the paper is to test if changes in these policies (the economic reform program) have caused instability in the money demand function. Thus, the second objective is studying the long-run behavior of the money demand equation. Based on the findings from the first and second objectives, the study also envisaged giving some policy implications.

Formulation of the model is based on conventional definitions of money and the variables are selected based on economic theories and fundamentals of the Ethiopian economy. Annual data for 30 years, collected from different sources is used for the empirical analysis. The Engle-Granger two stage procedure of error correction procedure is applied in estimating both narrow and broad definitions of money.

The long-run static model empirical result suggests that income, real effective exchange rate, interest rate and foreign aid are found to explain the narrow money equation as predicted in theory. Similarly these variables explain the broadly defined money as expected. Sign of interest rate and real effective exchange rate coefficients are found to be negative in both cases implying that try are opportunity cost variable.

The short-run dynamics error correction estimation results indicated that real effective exchange rte, and interest rate are explaining narrow money while income real effective exchange rate and foreign and are significantly in explaining broad money.

The adjustment to long run equilibrium is 37 percent for narrow money and 34 percent for broad money in one year. That is, full adjustment to a shock may take about three years in both cases,

In spite of the comprehensive reform program and changes in macroeconomic policies, the empirical result of stability tests show that the money demand function in Ethiopia seems to be unstable over the period (1971-2001). The three techniques employed to test stability; Chow's break point, predictive failure and recursive tests revealed that the money demand equation is not stable.

6.2 Policy Implications

The policy implication of this result is that in conducting monetary policy not only income and price but also the behavior of the exchange rate should be considered. The significance of real effective exchange rate shows that the Ethiopian economy is significantly dependent on foreign goods. Emphasis should be made on policies that encourage the manufacturing sector.

Instability of the money demand equation seems to suggest that indirect monetary policy instruments may not be effective and monetary policy actions are not predictable. Thus, the following policy implications are suggested.

The government has to pursue policies that improve structural bottlenecks in the real sector. For example, relaxing the land lease policy, encouraging investment through provision of additional incentive schemes, improving the bureaucratic inefficiencies and deepening the implementation of the civil service reform program, changes in the attitudes of the people, etc and improving financial infrastructure, which includes:
- ✓ Strengthening supervision and regulation of financial institutions;
- ✓ Creating the opportunities for banks to allocate their resources on economic principles in view of sterilizing the structural liquidity problems;

- ✓ Maintain credibility, transparency and public confidence in the financial system by creating a sound and competitive financial market; and
- ✓ Deepening the financial sector liberalization to enhance competition in the banking sector.

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