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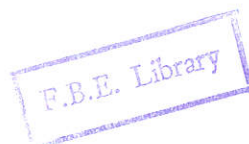
# **THE INCOME VELOCITY OF MONEY THE ETHIOPIAN CASE (1960-1998)**

By

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*Submitted to the School of Graduate Studies,  
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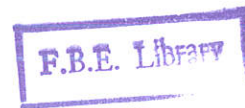
**ADDIS ABABA UNIVERSITY**  
**School of Graduate Studies**

*The Income Velocity of Money: The Ethiopian Case (1960-1998)*



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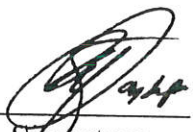
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# **TABLE OF CONTENTS**

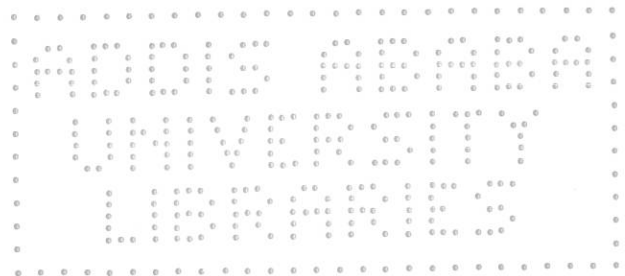
## **LIST OF TABLES AND FIGURES ABSTRACT**

|                                                                                            |             |
|--------------------------------------------------------------------------------------------|-------------|
| <b>CHAPTER ONE - INTRODUCTION</b>                                                          | <b>Page</b> |
| 1.1 General Background .....                                                               | 1           |
| 1.2 Statement of the Problem .....                                                         | 3           |
| 1.3 Objectives of the Study .....                                                          | 5           |
| 1.4 Significance of the Study .....                                                        | 6           |
| 1.5 Organization of the Study .....                                                        | 7           |
| <b>CHAPTER TWO: LITERATURE SURVEY</b> .....                                                | <b>8</b>    |
| 2.1 Theoretical Framework on Income Velocity .....                                         | 8           |
| 2.2 Empirical Studies .....                                                                | 17          |
| <b>CHAPTER THREE: FINANCIAL SECTOR STRUCTURE AND MONETARY<br/>POLICY IN ETHIOPIA</b> ..... | <b>27</b>   |
| 3.1 Financial Sector Structure .....                                                       | 27          |
| 3.1.1 Money and Banking in Ethiopia .....                                                  | 28          |
| 3.1.2 Financial Markets and Interest Rate Structure .....                                  | 33          |
| 3.2 Monetary Policy .....                                                                  | 36          |
| 3.2.1 Experience of Developing Countries in a Move to<br>Indirect Policy Instruments ..... | 40          |
| 3.2.2 Monetary Policy in Ethiopia .....                                                    | 43          |
| 3.3 The Behavior of Income Velocity of Money in Ethiopia .....                             | 47          |
| <b>CHAPTER FOUR: METHODOLOGY AND THE DATA</b> .....                                        | <b>52</b>   |
| 4.1 Methodology .....                                                                      | 52          |
| 4.1.1 The Johansen Maximum Likelihood Procedure .....                                      | 53          |
| 4.1.2 Testing for Unit Roots .....                                                         | 55          |
| 4.1.3 Model Specification .....                                                            | 57          |
| 4.1.4 The Data .....                                                                       | 62          |





|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>CHAPTER FIVE: ANALYSIS OF RESULTS .....</b>               | <b>64</b> |
| 5.1 Time Series Characteristics of the Data .....            | 64        |
| 5.2 Testing for Cointegration and Long Run Velocity .....    | 66        |
| 5.2.1 Interpretation of Long run Solutions .....             | 70        |
| 5.2.2 Weak Exogeneity .....                                  | 72        |
| 5.3 Dynamic Specification of Income Velocity Model .....     | 72        |
| 5.3.1 The Stability of Velocity .....                        | 77        |
| <b>CHAPTER SIX: CONCLUSIONS AND POLICY IMPLICATIONS.....</b> | <b>81</b> |
| <b>BIBLIOGRAPHY</b>                                          |           |
| <b>APPENDIX</b>                                              |           |



## LIST OF TABLES AND FIGURES

### **Tables:**

1. Ratio of Currency to Money and Ratio of Domestic Credit to Gross National Product
2. Comparison of Out Standing Credit Ceiling to Actual total Credit of Commercial Banks
3. Comparison of Growth Rates of Actual Domestic Credit to its Target
4. ADF Statistics for Testing for a Unit Root
5. Cointegration Analysis of Income Velocity of Money ( $V_2$ )
6. Cointegration Analysis of Income Velocity of Money ( $V_1$ )
7. Error Correction Model ( $V_2$ )
8. Error Correction Model ( $V_1$ )

### **FIGURES:**

1. Behavior of the Velocity of Currency in Circulation
2. Behavior of the Velocity of Narrow Money
3. Behavior of the Velocity of Broad Money
4. One Step Residuals and Break Point Chow Statistics for Equation 1
5. One Step Residuals and Break Point Chow Statistics for Equation 2

## **Abstract**

*This study has attempted to evaluate the determinants of income velocity of money defined as the ratio of nominal income to money supply in Ethiopia. Two alternative measures of velocity are used namely velocity of narrow money and broad money when estimating the velocity functions. Velocity is assumed to depend on real income per capita; inflation rate; currency money ratio; investment income ratio and the price level.*

*In estimating the long run velocity equations, we have used the Johansen and Juselius (1990) approach. First the time series characteristics of the data is established using the ADF test and found that all of the variables are integrated of order one except the inflation variable which is excluded from the tests for cointegration. The cointegration tests show that velocity (based on broad and narrow definitions of money) is cointegrated with real income per capita, currency money ratio, investment income ratio and the price level. The tests for weak exogeneity reveal that except the currency money ratio all of the variables are found to be weakly exogenous. Based on the tests for cointegration and weak exogeneity, we developed the dynamic model treating currency money ratio as an endogenous variable. The estimated error correction models show that real income per capita and the inflation variable have significant effects on velocity based on both definitions of money, while currency money ratio and investment income ratio are not important determinants. The evidence on the stability of the estimated models shows that the income velocity function based on narrow and broad money definitions has remained stable over the period of study.*



# **Chapter One**

## **Introduction**

### **1.1 General Background**

Ethiopia is one of the least developed countries in the world. Its poor performance is reflected in low level of per capita income which stood at \$100 in 1996(IFS, 1997). Agriculture is still the mainstay of the Ethiopian economy. About half of the country's GDP comes from agriculture, it employs 85 percent of the population and 90 percent of export earnings are either agricultural commodities or agro-processed.

The country's economic difficulties lie in exogenous as well as uncontrollable events. Some of the problems, which have contributed to the sluggish economic development of the country, are drought, rapid deterioration in the quality of land and unfavorable terms of trade and military conflicts. Significantly, distorted economic policy and management together with the above factors worsened the economic situation in the country.

Specifically during the Derg regime, like many of the former socialist economies, it has experienced a strong and persistent fall in output. This has occurred because political events have overtaken economic reforms in the country.

The financial system in the country operated far below its potential unable to make resources available for a more efficient use in the economy. The financial system was characterized by extensive and imprudent regulations, which primarily serve to finance

the government or state enterprises or to direct credits for use of priority sectors. These repressive policies usually required regulations that restricted entry into financial system and resulted in public ownership of major financial institutions in the country. Furthermore, development of financial systems in the country like other sub-Saharan African countries, tended to focus on the banking system, i.e. on development finance institutions. Consequently, non-bank financial market kept receiving lower priority.

In view of these considerations, the greater ease of entry and exit of financial institutions is indispensable for the enhancement of competition in the financial system and paves the way for the use of monetary policy instruments (Popiel, 1985). Hence, the government has issued a proclamation about the licensing of financial institutions, which permitted private investors to participate in the banking as well as insurance businesses.

Related to the financial system, another important development is the introduction of treasury bills auction in January 1995 (National Bank of Ethiopia, 1997). Treasury bills are one of money market instruments, which are expected to help monetary authorities to influence the level of interest rate and bank reserves. However, given the limited time that it has been introduced it will not be appropriate to judge whether it has achieved its objectives.



## 1.2 Statement of the Problem

The poor performance of the Ethiopian economy has been largely attributed to distorted economic policies among the various causes. To this end, the country has launched a reform program to foster economic development. Monetary policy is one of the policy instruments employed to achieve rapid economic growth and stabilization.

There are two divergent views regarding the efficacy of monetary policy- the views by monetarists and non-monetarists. Both support the portfolio adjustment process as a framework to describe the real economy. They differ with regard to the range of assets and interest rate that should be considered (Havrilesky and Boorman, 1976). Hence the question of the effectiveness of monetary policy is essentially an empirical issue, not a theoretical one.

In this regard, the effectiveness of monetary policy in light of specific economies should be considered. Despite the fact that the financial structure in developing countries is too rudimentary to permit the full use of monetary techniques and the unavailability of accurate statistical information, monetary policy has remained to serve as one of the major policy instruments in these countries (Furness, 1975). In fact Khatkhate(1972), Park(1973) and Coats and Khatkhate(1980) have indicated that monetary policy can be employed to achieve economic growth and development in developing countries.



One indicator of the efficacy of monetary policy is the behavior of income velocity<sup>1</sup> of money. As Short (1973) indicated; “How great a command over resources the government and banking system are able to obtain without causing inflation by issuing newly created money depends on the behavior of money during economic growth. If velocity falls as per capita income increases, the money issuing authorities can issue more money and obtain a greater leverage on resources than if velocity were constant or rising”

Therefore the important issue is whether the income velocity of money is constant or variable. If it is not constant, this means that there are factors affecting velocity other than income which has essential implications for monetary planning (Kashala, 1975). A number of empirical studies have found that velocity declines overtime in many developing countries which implies that resources can be transferred for investment purposes through non-inflationary monetary expansion (Driscoll and Lahiri, 1982).

Hence for the quantity of money to serve as an instrument of economic policy the link between nominal GNP and the stock of money must be stable and predictable. As Reynolds (1989) stated: “...predictability of impact is not as high as may appear at first glance. What the government can control precisely is the size of bank reserves. But there is uncertainty. Because of the variability in money multiplier, a given change in reserves may translate into a larger or smaller change in money stock. Because of the variability of velocity, a given change in money stock may mean a larger or smaller change in spending or nominal GNP”

---

<sup>1</sup> Velocity is defined as the ratio of nominal income to money stock.



For instance Brau (1971) has shown that when formulating credit policy which is one of the instruments of controlling money supply in developing countries, knowledge about the predictability of velocity function is indispensable.

In view of these considerations, it would be worthwhile to investigate how velocity has behaved in Ethiopia. Few studies have been made on income velocity in developing countries [ Ndanshau (1996), Driscoll and Lahiri (1982) and Melitz and Correa (1970)]. In the studies, income velocity of money is found to depend on expected inflation, share of agricultural income, per capita real income, number of bank branches, etc.

Income velocity of money in advanced economies varies with changes in financial factors. But some studies indicated that the way income velocity of money should be treated in developing economies must be different from the developed economies, because financial structure and systems in these economies are not well developed. Therefore, it is indispensable to account for institutional and structural differences when analyzing the behavior of income velocity of money in developing countries.

### **1.3 Objectives of the Study**

Traditional theories of income velocity of money assume that velocity depends on few variables such as the opportunity cost of holding money, usually measured by interest rate or expected inflation and income. However, Siklos (1993), based on the institutionalist hypothesis, has shown the possibility that structural shifts namely changes in fiscal and

monetary policies as ways of explaining movements in velocity other than the conventional determinants.

Therefore, the objective of the study is to estimate and analyze income velocity of money function in Ethiopia accounting for structural changes that have occurred during the period under study (i.e.1960-98). In the study income velocity is assumed to depend on expected inflation, real per capita income, currency-broad money ratio, and investment-income ratio and the price level.

Monetary policy effectiveness requires that the income velocity of money function must be stable and predictable. This has remained a major issue for both developing and developed economies. Thus the other objective of the study is to test for the stability of velocity function over the period of study.

#### **1.4 Significance of the Study**

Ethiopia, like many developing countries, has experienced macroeconomic imbalances, both internal and external ones. To counter these imbalances various policy measures have been implemented. The measures are contained in the Structural Adjustment Programs introduced in 1992. On the monetary front, one of the main specific policies is reducing the growth rate of money supply.

The financial programs supported by the International Monetary Fund included control over domestic credit by means of aggregate credit ceilings and reserve requirements to

restrain monetary expansion. Control over credit expansion is an important means of bringing balance in the economy as stated by Brau (1971); “control over credit expansion by domestic banks is used to influence expenditure decisions, since the availability of credit has a strong impact on expenditures on domestic and foreign goods and services and possibly on net capital flows and therefore on the balance of payments.”

In this regard, the attainment of the targets of the credit programs by the monetary authority requires knowledge about the determinants and predictability of income velocity of money (Ndanshau, 1996). Therefore this study attempts to analyze the behavior of income velocity of money, as systematic study on it is limited in Ethiopia.

## **1.5 Organization of the Study**

The rest of the paper is structured as follows. The second chapter contains a survey of both theoretical literature and empirical studies on income velocity of money and money demand. Chapter three presents discussion on financial market and monetary policy. And chapter four deals with the econometric model of income velocity of money and on the methodology to be employed and data sources. Then analysis of data will be presented in chapter five. Finally conclusions and policy implications will be presented.

## **Chapter Two**

### **Literature Survey**

#### **2.1 Theoretical Framework on Income Velocity**

In the literature, there are two main theories, which try to explain the behavior of the income velocity of money, namely the quantity theory of velocity and the Keynesian theory.

The earliest theory of velocity is based on the quantity theory of money. The central implication of the theory is that changes in the quantity of money induce an equal change in prices. When money supply increases, the price level must rise until the real money supply is reduced to its original level. Since an economy tends towards full employment in the long run, all the adjustment will occur by movements in the general price level. Thus, according to the classical economists velocity is stable in the long run (Kaufman, 1977).

The quantity equation has taken different forms. The most famous version of the quantity equation is the transactions version given by Irving Fisher. The equation states that:

$$MV=PT \text{ or } \quad (1)$$

$$V=PT/M$$

where M stands for total money stock, V is velocity of transactions, P is the general price level and T is transactions of goods and services.

The right hand side of the equation corresponds to the transfer of goods, services and securities and the left-hand side to the matching transfer of money (Friedman, 1970). Fisher pointed out that in the long run, and on the average, in a large community velocity remains stable because it is rooted in the customs and payment habits of society which do not change in the short run. On the other hand, the volume of output would not be affected by monetary factors in the long run because it depends ultimately on real factors such as physical capacity and the state of technology (Furness, 1975).

As Friedman (1970) indicated, the ambiguities of the concepts of transactions and the general price level, specifically those arising from the mixture of current and capital transactions, were never resolved.

Hence the quantity equation has been expressed in terms of income rather than transaction as:

$$MV=Py \text{ or } (2)$$

$$V=Py/M$$

Where  $y$  is national income in constant prices,  $V$  is the income velocity of money and  $P$  is price index implicit in estimating national income at constant prices.

According to the transaction approach, money is entirely viewed as a medium of exchange. Therefore, velocity is determined by payments practices, financial and economic arrangements and the speed of communication and transportation (Patinkin,



1965). On the other hand, the cash balance approach makes it appropriate to include also the use of money as a store of value, that is it makes it possible to incorporate opportunity cost measures as determinants of velocity (Friedman, 1970).

After a group of economists at Cambridge University attacked the quantity theory, the focus of monetary analysis shifted from money supply to money demand. Money was viewed, by the Cambridge school in a wider context as a financial asset, while the quantity theory of money emphasizes solely the medium of exchange function of money. According to the classical view, because money has no inherent utility, the only motive for holding money is the need to facilitate transactions. But Cambridge cash balance approach emphasized the role of money as a temporary abode of purchasing power. They hypothesized that how much cash balances the public need to hold for this purpose is some proportion  $k$ , to its real income which can be written as:

$$M = Pky \quad (3)$$

Where,  $0 < k < 1$  and  $V = 1/k$

Even though the Cambridge school stressed the demand for money and changes in the demand, it did not develop a theory of how shifts in demand were related to economic factors. In addition,  $k$  was not related to money stock. Failure to do so has made it impossible to predict the effects of money on income (Kaufman, 1977).

The quantity theory of velocity has been tested widely with quantitative data more extensively than any other set of propositions (Duck, 1993). The empirical studies

revealed that not only that both real income and velocity were not constant but also both were affected by changes in money supply.

The Keynesian revolution replaced a new theory for the velocity approach in monetary analysis. According to Keynes, expanding on the contribution of the Cambridge school, economic agents desire to hold money balances for three distinct motives namely transactions, precaution and speculation.

Keynes argued that velocity is not constant. He postulated that the speculative demand is very interest elastic and that increases in the quantity of money, beyond the amounts economic agents demanded for transactions and precautionary purposes, will lower interest rates and raise income less proportionately. Consequently, velocity will decline (Kaufman, 1977). Similarly, when real income increases, the volume of cash needed for transactions also increases. Provided that money supply has unchanged to meet the increased needs, funds have to be drawn from idle balances by raising interest rates to induce owners. As a result, there will be an increase in velocity (Ritter, 1959).

After the publication of the General Theory by Keynes, a number of economists attacked the quantity theory of money. Among the criticisms of traditional monetary theory include the rejection of the Cambridge behavioral income velocity analysis in favor of mechanicalistic, 'weighted average' interpretation of velocity.(Tavlas, 1981).For instance as indicated by Tavlas(1981), some authors viewed velocity as a passive concept. They segregated the demand for money into active and idle components.

**Robinson argued:**

*“A rise in PT is determined roughly speaking by the level of trade activity. If the banking system fails to increase the money supply to meet the induced increase in the demand for money in the active circulation, the rate of interest rises and inactive deposits fall as much as the active deposits have increased.”<sup>2</sup>*

Therefore, the average velocity of circulation increases as a result of the increase in PT. In this case, velocity becomes a passive concept, changing so as to leave the identity equation intact.

A model of money demand called Inventory Approach model was developed by Baumol (1953) and Tobin (1956) which was an extension of keyne's Liquidity Preference model. Unlike the liquidity Preference model, the approach assumes that people hold money for transaction purposes only (Jain and Tomic, 1995). The model is called an Inventory Approach because “ a stock of cash is like an inventory of a commodity that is given up at the appropriate time in return for profit.” (Jain and Tomic, 1995). Based on the theory, the real demand for transactions balances is given as: (Laidler, 1985).

$$M_d = \alpha b^{0.5} T^{0.5} r^{-0.5} P$$

Where  $\alpha = \frac{1}{2} \sqrt{2}$ ,  $b$  = brokerage fee (the real cost of turning bonds into cash),

$T$  = the real value of the agent's income,  $r$  = the rate of interest per period,  $P$ =Price level

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<sup>2</sup> Quoted by Tavlas (1981)

Economists at the University of Chicago led by Friedman (1970) attacked parts of Keynesian velocity formulation. The reformulation of the velocity function reflects both the inclusions of the earlier quantity theory direct stock approach and Keynesian portfolio adjustment analysis. Both Keynes and Friedman agree in the variability of velocity. Nonetheless, contrasting views were reached regarding the importance of money and monetary policy. The differences were attributed to disagreements regarding the stability of the velocity function and differing assumptions about the relevant variables entering the function. Friedman did not accept that the velocity function is unstable. He claimed that in the long run variations in income velocity occur in a predictable and systematic way except during hyperinflation. However, the short run velocity function may not be stable owing to time lag in the transmission of money supply to the resulting change in money income (Furness, 1975).

In this connection, the monetarists indicate that it is essential to make a distinction between measured velocity and permanent velocity. The latter, that is measured as the ratio of permanent income<sup>3</sup> to money stock, is stable compared to the former which is defined in terms of current income. Measured velocity depends not only on the determinants of the demand for money but also on the relationship between measured income and permanent income (O'Bannon Bond and Shearer, 1975).

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<sup>3</sup> Friedman (1982) indicated that "income as measured by statisticians may be a defective index of wealth because it is subject to erratic year to year fluctuation, and a longer term concept permanent income developed." Mankiw and Summers (1986). It is simply defined as the income level the household has come to expect as its normal income (O'Bannon Bond and Shearer, 1975).

Regarding the determinants, he argued that velocity is more related to wealth or some long run average of income than to annual income that is subject to year to year fluctuations. Since wealth is not easily observable, consumption is an ideal proxy for permanent income (Mankiw and Summers, 1986). In addition monetarists assigned an important role to price expectations as an explanatory variable in the velocity function. As explained by Tavlas (1981), “the variability of velocity was largely adduced to the existence of abundant near money substitutes and to the influence of price expectations.”

The velocity function specified by Friedman can be expressed as:

$$Y/M_2 = V_y = F(r_b, r_e, p^e, Y/p, W, U)$$

where  $Y$  is nominal income,  $M_2$  is money supply broadly defined,  $V_y$  is income velocity,  $r_b$  is the bond rate,  $r_e$  is the expected return on equities,  $P^e$  is the expected rate of change in the price level,  $Y/p$  is real income and  $W$  is wealth and  $U$  tastes.

Even though the monetarists and Keynesians agreed on the variability of velocity, no consensus has been reached regarding the secular behavior of velocity. Ezekiel and Adekunle (1969) have noted that there have emerged four hypotheses about the secular behavior of velocity. These include the hypothesis by Fisher (1926) which states that there is a rising secular movement in income velocity, in contrast, Friedman assumes that velocity declines as income increases. While Gurly and Shaw (1960) indicated that at earlier stages of growth velocity tends to decline and then become constant at a higher stage.

Finally, it is essential to consider the applicability and usefulness of the different theories of velocity in developing countries. Kashala (1975), Park (1973) and Porter (1961) argue that since the generalizations of the theory are based on developed countries which have entirely a different economic set up, the theory is irrelevant to the monetary problems of developing economies.

For instance the Keynesian and Neo – Classical economists argue that interest rates on financial assets as important variables in a demand for money function. They consider real money balances and physical capital as two competitive assets. But in developing countries the substitution effect does not hold because financial markets are not well developed and there are no uniform opportunity cost of holding money and rate of return on physical capital. Instead, Mckinnon (1973) argue the complementarity between real money balances and physical capital. According to Mckinnon (1973), in a financial repressed regime, private enterprises are limited to self-finance. Thus prior to undertaking actual investment, the potential investors must accumulate money balances (Ghatak, 1995). Therefore, an increase in the real return on holding of money will increase the stock of money and the greater will be the inducement to invest. The complementarity can be seen in Mckinnon's demand for money function : ( Ghatak, 1995).

$$(M/P)^d = f(I/Y, Y/P, r)$$

where  $M/p$  = the real money stock ,  $I/Y$  = the ratio of investment to output,  $r$  = the real deposit rate of interest and  $P$  = the price level.



The major reason why it is not appropriate to directly apply the theories in developing countries is the differences in the institutional and structural characteristics of the two types of economies. For instance, in less developed countries the financial market has not developed. As a result, “ treasury bills, government bonds and marketable shares which form the transition between money and real assets in countries with fully developed financial systems play a minor role in the asset structure of less developed countries” (Park, 1973).

Accordingly, income velocity of money is likely to be insensitive to interest rates since money is demanded mainly for transactions purposes. However, Park (1973), Campbell (1970) and Kashala (1975) argue that income velocity in less developed countries depends on opportunity cost of holding money proxied by expected rate of inflation. Studies by Ndele (1991), Campbell (1970) and Deaver (1970) have indicated that expected inflation significantly affect income velocity suggesting that real assets and money are substitutes.

Therefore, though theories are useful in analyzing monetary changes in a developing economy context, direct application may result in misleading policy conclusions. Hence there is a need to account for structural and institutional differences between the two types of economies.



## 2.2 Empirical Studies

The number of empirical studies on money demand or its inverse<sup>4</sup> -the income velocity of money - has grown recently in developing countries. The main issues in these studies include the appropriate definition of money, the variables that enter the income velocity function and the stability of the income velocity (Park, 1973).

In this section some empirical studies on income velocity of money and money demand for developed and developing countries will be reviewed. The results of the studies differ with respect to the determinants included and the methodologies employed.

A study conducted by Driscoll and Lahiri (1982) reveals the existence of sectoral differences in income velocity behavior and thus formulated a model which incorporates the sectoral income composition factor as an important determinant to analyze the behavior of velocity function for twelve<sup>5</sup> agricultural developing countries and found that in more than half of these countries the share of agricultural output has significant impact on income velocity. They estimated a time series income velocity model using OLS taking expected inflation and real per capita income, apart from the share of agricultural income, as explanatory variables. They found that expected inflation affects velocity positively and significantly in all the countries under study except Honduras and

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<sup>4</sup> Assuming the conventional money demand function, we can write:  $M_t^d = Y_t^\alpha R_t^\beta P_t^\lambda$ ; where  $Y$  = nominal income;  $R$  = interest rate,  $P$  = price level. Assuming that  $M_t^d = M_t^s$  and dividing the equation by  $Y_t$  we obtain;

$M_t^d / Y_t = Y_t^{\alpha-1} R_t^\beta P_t^\lambda$  and this in income velocity form can be written as:  $Y_t / M_t = Y_t^{\alpha-1} R_t^\beta P_t^{-\lambda}$

<sup>5</sup> The countries are Colombia, El Salvador, Honduras, Paraguay, Egypt, Nigeria, India, Korea, Philippines, Serilanka, Thailand and Turkey.

Paraguay. While, percapita real income is negatively related to velocity but is not significant.

Park (1970) also made an international comparison of income velocity of money using data over the period 1953-1968 in 30 countries, which included both developed, and developing countries. The result showed that velocity is subject to greater year to year fluctuations in less developed countries than in the industrial countries. According to the writer, the variations in velocity in developing countries may reflect first the instability in economic structure, social and political system which influences decisions and preferences with respect to holding of money. Second, some fluctuations are attributed to errors in data. Third the study uses gross national income in defining income velocity. However, the relevant portion of income should have been that which requires the use of money, namely monetized income. The non-monetized sector that accounts for a significant part of income depends on agriculture which is subject to erratic fluctuations hence for the variability of velocity.

In contrast to the above study, Melitz and Correa (1970) undertook a cross section study of velocity in which Goldsmith's (1966) classification of countries is used as a proxy for the rate of monetization. The study indicated that other proxies for monetization such as urbanization ratio, the ratio of taxes to GNP and the size of nonagricultural output proved unsuccessful because the proxies were either poor or insignificant or both. In addition to the rate of monetization, they found two statistically significant variables with the theoretically appropriate sign, namely the rate of interest and currency money ratio.

Bhattacharya (1974) also included the degree of monetization when formulating money demand function for India. He estimated money supply and demand equations based on Hansen Modigliani model using OLS. Monetized disposable income and short term interest rate of the organized market are taken as explanatory variables in the demand equation. The results show that the use of national income data instead of monetized income leads to an underestimation of the income elasticity of money demand. In addition, he indicated that money demand and interest rate are inversely related. Furthermore, money should be considered as an endogenous variable.

According to Short (1973) knowledge about the secular behavior of income velocity during economic growth is important because it determines how great a command over resources the central banks are able to exercise without causing inflation. He indicated that many economists have found velocity to be negatively related to per capita income. According to the writer the negative relationship is due to the fact that saving income ratio rises during economic development; that causes velocity to decline. Another reason is that of Friedman's luxury "good" hypothesis which states that income elasticity of demand for money exceeded one which implies that velocity declines as per capita income increases. In the study he conducted on Malaysia and Singapore for the period 1951-66, it is found that velocity moves inversely to per capita real income and thus income elasticity of money demand is greater than unity implying that velocity is declining and the banking system may be able to obtain greater leverage on resources by issuing money without causing inflation.

Ezekiel and Adekunle (1969) examines the secular behavior of velocity by looking at the relation between income velocity levels and levels of economic development proxied by per capita income using a cross section analysis for 37 countries. The results showed that there is significant inverse relationship between the levels of income and velocity for totals of narrow and broad money. However, the levels of income velocity of currency and levels of income are not significantly related.

In Tanzania, Ndanshau (1996) estimated income velocity function, which includes real per capita income, expected rate of inflation, the rate of monetization proxied by the number of branches of commercial banks, and lagged real money balances as variables. The velocity function was estimated using OLS for different definitions of money and the results show that except money defined as currency in circulation, per capita real income and velocity are inversely related as anticipated. While the coefficient of expected inflation has the unexpected negative sign. The coefficients of the number of bank branches and lagged real money balances have the expected signs but are not significant.

A study conducted by Porter (1961) in Pakistan concluded that resort to velocity analysis to avoid inflation is unnecessary, uncertain and misleading. This is attributed to the fact that the use for prediction of a historically estimated function requires the assumption that the structure of the economy is unchanging or changing in consistent fashion. However, Porter has shown that this was not the case in Pakistan.

Traditional models of income velocity of money do not consider institutional changes. However, according to the institutional hypothesis technological changes in payments system, improved communications and the development of broader based banking system are important in explaining the behavior of income velocity of money. A study by Siklos (1993) explored the nature of long run relationship among traditional and institutional determinants of velocity using data from five industrialized countries. He used Johansen (1988) maximum likelihood method to estimate the velocity function and concluded that a long run relationship exists between variables proxying institutional change and velocity for all countries considered.

Monetary policy effectiveness requires that the demand for money function or its inverse income velocity of money must be stable and predictable. This has remained a major issue for both developing and developed countries. For instance a number of studies during the 1970s have shown that a stable demand for money exist for the US economy. Even though the studies conducted during those periods were based on different theories of money demand i.e. transactions and asset theories , differences between these two sets of theories were taken to resolve themselves in to four empirical issues which involved the appropriate definition of money, the arguments that enter the money demand function, measure for opportunity cost of money and whether lagged values of money should be included. After examining these issues Goldfeld examined the demand for money function of the US and found that post 1973, the demand for money had become unstable. This was owed to failure to incorporate institutional change, financial innovation and

regulatory change. Judd and Scadding (1982) have indicated that the most likely cause of the instability in the demand for money in 1973 is financial innovation.<sup>6</sup>

Mehra (1993) also tested the stability of  $M_2$  demand function in the US using an error correction model. The model included real GNP, short term market rate of interest and the own rate of return on  $M_2$  as explanatory variables. The chow test is implemented using slope dummies on the variables. The F values reported are generally small and thus in line with the hypothesis that the money demand function is stable for the sample period from 1953 to 1991.

The validity of Goldfeld's suggestion is also confirmed by a number of empirical studies in the case of Asea where there is instability in the interaction of money growth, economic activity and inflation due to financial market reforms. For instance Dekle and Pradhan (1997) have assessed whether money demand equations are relatively stable and predictable in Indonesia, Malaysia, Singapore and Thailand. They estimated long run real money demand relationships using the Johansen(1988) full information maximum likelihood procedure taking interest rates and real income as determinants of the equation for the period 1978-95. The results show that there are no stable relationships between real narrow money and the variables in all countries except Malaysia. According to the

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<sup>6</sup> According to the author, during the time there were two classes of innovations which were the security repurchase agreement or RP and innovations in cash management techniques such as concentration of accounts [for detailed explanation see Judd and Scadding(1982)]. The reason for the shift down in demand for money in 1974 may be attributed to the lower costs of converting RPs into money which allows money holders to keep smaller balances and therefore to reduce the amount of demand deposits needed to keep on hand.

authors, the instability of narrow money demand is probably related to financial innovations (the increased use of cards, electronic transfers and the introduction of mutual funds) which enables agents to economize on narrow money holdings. However, in the case of Malaysia where financial reforms were not extensive, financial markets are less developed and thus obtained a stable narrow money demand function. The stability tests based on real broad money was also the same.

Contrary to the above findings, Ericsson and Sharma (1996) have shown that using the conventional money demand determinants i.e. interest rates and real income –the estimated ECM model in Greece is constant despite the introduction of new financial instruments and liberalization of the financial system. This is attributed to the fact that with restrictions on external capital flows removed and financial deregulation higher returns on assets inside broad money may increase the demand for money while greater availability of alternative assets may lower demand.

Rother (1998) also looked at the stability of real narrow money and quasi-money demand in the Western African Economic and Monetary Union. He indicated that financial liberalization and use of indirect monetary instruments makes the money demand relation unstable and therefore it becomes difficult to predict monetary aggregates. The empirical estimates reveal that the demand for real narrow money depends positively on real income, the interest rate, exchange rate and the inflation rate in CoteD'Ivoire. The



positive relation between opportunity cost measures and money demand is against what economic theory postulates. He reasoned that the positive own interest rate elasticity might result from a combination of low degree of financial development and extensive use of agricultural credit. While a decrease in uncertainty regarding the macroeconomic environment may explain the positive relationship between inflation and real money. Regarding the stability of the money demand function, the parameters are stable when narrow definition of money is used and also forecast performance is superior for the same definition of money.

A study conducted by Broeck , Krajnyak and Lorie (1997) looked at the behavior of income velocity of money in the transition economies of the former Soviet Union. Velocity has a general tendency to increase early on the implementation of stabilization programs and starts to decline gradually following stabilization. According to the authors, the initial increase in velocity is associated with reduction in inflation to a great extent. They developed a money demand model, which takes real output, nominal foreign currency, interest rate and expected rate of depreciation of the domestic currency as explanatory variables. And a reduced form price equation that reflects the interaction between demand and supply on the goods market is also estimated. Combining the two equations, the analysis shows that velocity tends to increase at the onset of monetary tightening.

Adam (1993) considers domestic rate of interest, the expected depreciation of the parallel market rate of exchange (as a measure of the rate of return on holdings of illegal foreign

currency) and the rate of inflation as determinants of money demand in Kenya. He estimated the model using different definitions of money. The long run demand has an income elasticity equal to unity in the case of cash balances but as the aggregate widens the income elasticity of demand falls to 0.8. This fall is owed to the relative shift from transactions to portfolio considerations in holdings of money balances. Expected depreciation of the parallel market rate of exchange affects the money demand negatively and significantly in all the definitions of money.

Ndele (1991) also estimated short run and long run demand for money function for Kenya taking real income, rate of interest and inflation as determinants. To investigate the effect of non-bank financial intermediaries on the conduct of monetary policy, he adjusted both narrow and broad definitions of money by adding non-bank financial intermediary's liabilities. The results show that using the adjusted narrow definition of money, all of the explanatory variables are found to have significant effect on money demand. On the other hand when the broad definition including non-bank financial intermediaries is used except real income, all the other variables are insignificant.

A study conducted by Treichel (1997) takes real GDP, inflation rate and interest rates as explanatory variables. He estimated broad money demand model for Tunisia using Johansen's (1988) maximum likelihood procedure and error correction models. He finds an income elasticity of 0.8 that is generally lower than developed countries, which might reflect as he explained; increasing substitution towards treasury bills in the estimation period. Money demand and treasury bill rates are found to be negatively related but the variables were statistically insignificant. He also indicated that even though there seems

to exist a stable long run relationship between real money and real GDP, there has been parametric instability over the past five years. If this instability continuous, then the monetary authorities can not use the money demand in determining appropriate target of monetary policy.

In Ethiopia, studies on money demand or its inverse income velocity of money is limited. A study by Gemech (1993) takes gross domestic product as a scale variable index of coffee production to capture the effect of monetization, and expected exchange depreciation as explanatory variables. He employed Johansen (1988) procedure in estimating the demand for money function and found that money demand is a positive function of real income, the price level and the rate of monetization and a negative function of expected depreciation of the exchange rate. He obtained a high income elasticity of 1.8 as he explained owes to limitations of asset substitution and instability due to periodic economic disorder in addition to the the luxury good hypothesis and the shorter economic horizon.

Another study by Assefa (1998) also used Johansen (1988) procedure in estimating money demand in Ethiopia taking real income, price level, expected inflation, parallel market exchange rate premium, the interest rate on time deposits and parallel market exchange rate as explanatory variables. Both studies [Gemech(1993) and Assefa(1998)] have included exchange rate to capture currency substitution. However, Adam (1993) has noted that currency substitution is limited in a country where foreign currency holdings do not constitute a significant proportion of private sector wealth because the parallel market in foreign exchange was illegal.

## **Chapter Three**

### **Financial Sector Structure and Monetary Policy in Ethiopia**

#### **3.1 Financial sector structure**

Like other less developed countries, the Ethiopian economy is also characterized by economic dualism i.e. the coexistence of the modern sector and the traditional sector. The traditional or agricultural sector is associated with the non-monetized sector while the modern or non-agricultural sector is identified with the monetized sector.

The monetized sector is composed of the informal and formal financial markets. The size of the informal financial market is difficult to measure in the country. But it provides a considerable amount of credit. The formal financial market consists of the central bank, commercial banks, insurance companies, pension fund and other credit and saving institutions. In the following section emphasis will be given to development of banking in the country and an attempt will also be made to measure the relative importance of the formal financial market.

### **3.1.1 Money and Banking in Ethiopia**

The first bank of Ethiopia, the Bank of Abyssinia was established in 1905 in partnership with the National Bank of Egypt. When the Franco-Ethiopian railway reached Addis Ababa (which opened easier outlet of the country's foreign trade), the bank expanded its operation by opening branches in Gore, Dessie, DireDewa and Gambella. At that time, the bank undertook both commercial and central banking activities, because there was no distinction between the two. Hence the bank as a central bank issues bank notes and acts as economic advisor to the government (Degueffe, 1973).

In 1931, the Ethiopian government bought the bank and renamed it as the Bank of Ethiopia. There was still no functional separation of central and commercial banking and hence the bank was also responsible for issuing bank notes which were covered by deposits in gold and silver.<sup>7</sup> But the bank was liquidated after it operated for five years.

Italians established a number of banks after their occupation. Prior to the setting up of the State Bank of Ethiopia in 1942 the British organized banking services of Addis Ababa. The State Bank was initially created to carry out commercial bank activities but later the bank was entrusted with duties of a central bank namely controlling the issue of currency,

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<sup>7</sup> " The currency principle states that a sound system of note issue is that which commands the greatest confidence of the public in the country which is made possible when paper currency is fully convertible into gold i.e. the note issue is backed by 100 percent gold reserves. Under this system the amount of notes issued would be accompanied by identical changes in gold reserves backing by the monetary authorities ." (Vaish, 1989).

holding the foreign reserves of the country and acting as a fiscal agent of the government (Degueffe, 1973).

The bank has been given the authority to issue currency in May 1945 and in July 23 of the same year the Ethiopian dollar was created with an official rate of Eth. \$2.48 per US dollar and became the legal tender. Before the issuance of the note, the Marie Thersa Thaler , the East African Shilling and the Italian Lire were used. In September 1976, the name of the Ethiopian currency was called Birr and minimum reserve of 25 percent in gold and foreign exchange are required against total bank notes issued (World Currency Year Book, 1986/87).

As the economy develops it was thought that establishing specialized banks can efficiently meet the growing demand of banking services in the country. Hence in 1964 the State Bank was restructured separating commercial and central banking operations by establishing the Commercial Bank of Ethiopia and National Bank of Ethiopia. Commercial Bank of Ethiopia was authorized to undertake all types of commercial banking, which also includes attracting public deposits of all kinds including savings and promoting banking habit. The National Bank of Ethiopia was given the authority to control the setting up of banks and insurance companies, opening of branches and operations of banks, and also to control the supply of money and liquidity of the economy (Negarit Gazeta, 1963).

As the commercial bank business expanded in the country it was thought that banking services could be carried out efficiently by enabling financial institutions to specialize in different banking activities.<sup>8</sup> Consequently, the Development Bank of Ethiopia and Mortgage Bank of Ethiopia were established in 1951 and 1965 respectively. The former was to provide medium and long term loans to industrial and agricultural enterprises whereas the later was to provide financial and credit facilities for the construction of commercial, industrial and residential buildings.

During that time as the country did not restrict private and foreign participation in the banking business, there was one private domestic bank (Addis Ababa Bank) and three private foreign banks owned by Italians. However, in 1976 after the country become under the rule of command and control system, all private banks and other financial institutions [except saving and credit cooperatives (SACCS) with services limited to members and whose assets not exceeding 1 % of the total, (Gebrehiwot, 1999)] were nationalized.

The financial system in the country operated inefficiently during the socialist system as a result of extensive and imprudent regulations, which primarily serve to finance the government or state enterprises or to direct, credits for the use of priority sectors.

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<sup>8</sup> Mixed banking system, as opposed to specialized system, refers to that banking system under which the commercial banks make long term loans to industry and agriculture in addition to its main activity of supplying short term credit requirements of trade and commerce (Vaish, 1989).

For instance, the National Bank had to finance government deficits through bonds and direct advances. The deficit financed each year was increasing significantly that by the end of 1991/92 the accumulated credit has reached Birr 5.4 billion (NBE, Quarterly Bulletin, 1996/97). The Commercial Bank of Ethiopia monopolized commercial banking activities like financing for trade and related operations, as it was the only commercial bank in the country. Moreover, Agricultural and Industrial Development Bank and Housing and Saving Bank provided long term and medium term loans at very low interest rates for priority sectors. All of the banks were specialized in a particular banking operation and private participation was not allowed resulting in public monopoly in the financial sector.

As part of structural adjustment programs, financial liberalization is in the process of being implemented to overcome the problems associated with financial repression. The liberalization process among other policy recommendations include restructuring of state owned banks and licensing of domestic private investors to participate in the banking business. The Agricultural and Industrial Development Bank of Ethiopia and Housing and Savings Bank have been restructured initially allowing them to perform universal banking activities vis-à-vis their former objectives. The number of commercial banks has now increased from 1 to 6 and one other bank in the process of starting operation whereas the number of branches increased from 220 to 257 (National Bank of Ethiopia 1999).



To measure the growth of financial system the ratios of currency to supply of money and of domestic bank credit to GNP can be used [Park (1970)]. These measures are given in the table below.

**Table-1- Ratio of Currency to Money (Defined Narrowly and Broadly) and Ratio of Domestic Credit to Gross National Product.**

| <i>Year</i> | <i>Currency/Narrow<br/>Money</i> | <i>Currency/Broad<br/>Money</i> | <i>Domestic credit<br/>to the<br/>gov't/GNP</i> | <i>Domestic Credit/Gross<br/>National Product</i> |
|-------------|----------------------------------|---------------------------------|-------------------------------------------------|---------------------------------------------------|
| 1970        | 0.71                             | 0.5                             | 0.024                                           | 0.12                                              |
| 1975        | 0.73                             | 0.55                            | .011                                            | 0.15                                              |
| 1980        | 0.66                             | 0.46                            | .0135                                           | 0.40                                              |
| 1985        | 0.52                             | 0.35                            | 0.198                                           | 0.35                                              |
| 1990        | 0.58                             | 0.43                            | 0.312                                           | 0.50                                              |
| 1995        | 0.62                             | 0.39                            | 0.249                                           | 0.44                                              |

Source: International Monetary Fund, IFS (1996).

The ratio of currency to narrow money shows a declining trend except in the year 1995. As the country moved to command and control system where the financial policy was repressive, the ratio declined significantly. The same trend is also observed in the case of currency to broad money ratio. Where as in the case of the ratio of domestic credit to gross national product the ratio increased overtime. This may be attributed to the fact that a significant proportion of domestic credit is credit provided by the National Bank of Ethiopia in the form of bonds and direct advances to finance government deficit, which

was increasing considerably during the time. For instance the ratio of domestic credit to the government to GNP reached 31 percent in 1990 from 1 percent in 1975.

### **3.1.2 Financial Markets and Interest rate Structure**

In developed countries the financial market consists of money market, capital market, primary market, spot market, future market or forward market and option market. These markets are not developed in Ethiopia. Securities market with short-term maturities, which are usually dealt with commercial banks and other financial institutions, are limited. For instance, treasury bills which are the major money market instruments are only introduced in January 1995. The National Bank of Ethiopia acts as a fiscal agent for the government in the issuance of three kinds of treasury bills that are 28 day bill, 91 day bill and 6 month bill. The major objectives of treasury bills are to use interest rates determined in treasury bills market as a benchmark in the determination of interest rates in the country and also to finance government deficits (National Bank of Ethiopia, 1997). The absolute numbers of buyers are very small which are mainly commercial banks, insurance companies, provident funds and other government organizations. Interest rates in the treasury bill market are very small usually in the range of 3 percent to 5 percent per annum (National Bank of Ethiopia, Quarterly Bulletin 1996/97). This may indicate that it is too early to use the rate as a benchmark.

With regard to capital market, it also displays all characteristics of a narrow market. The non-securities segment of capital market is relatively more developed which includes saving and loan institutions, housing finance institutions and commercial banks. On the

other hand, the securities market, which is important in financing long-term investment, are completely non-existent in the country.

During the socialist period interest rates had been administratively fixed and there had been selective credit control and concessionary finance. For instance the lending rate during the socialist period was discriminatory against the private sector in favor of state owned enterprises and cooperatives (NBE Quarterly Bulletin, 1996/97).

In the past interest rates have been established based on the following: the desire of the government to have interest structures similar to other countries, policies to encourage or discourage certain sectors, to promote economic development through the encouragement of investment, considerations of demand and supply and more recently inflation has also started to be considered in establishing the rates (National Bank of Ethiopia, 1997).

During the socialist period the National Bank of Ethiopia fixed specific lending rates. There are sectoral differences as well as variations with regard to the type of ownership. For example cooperatives which were the most favored obtain credit with the rates in the range of 4.5 to 6 percent, state enterprises with the lending rate of 4.5 to 8 percent whereas the private sector in range of 7 to 10 percent. Time and saving deposit rates were also differed by ownership and maturity and on the average it was 6 percent. In addition individuals saving and credit cooperatives and self help organizations who were allowed to maintain saving deposits earned only 2 percent interest for deposits exceeding Birr

100,000 while others are not allowed to deposit in saving accounts (National Bank of Ethiopia Quarterly Bulletin, 1996/97).

With the launching of the new reform program both the lending and deposit rates were revised. The major reforms are as follows. The first reform involves the removal of preferential lending rates with respect to state enterprises and the private sector in October 1992 and also the upward adjustment to 14 percent. In September 1994 sectoral differences with respect to lending rates were completely eliminated. As of January 1995 the maximum rate was adjusted slightly upwards to 15 percent and then downwards to 10.5 percent in September 1996. In the case of deposit rate, the major reform was in October 1992 which raised the minimum rate to 11.5 percent and up to September 1996 it varied from 10 to 11.5 percent. And in September 1996 the minimum rate was fixed at 7 percent. Effective January 1, 1998 NBE has completely liberalized the lending interest rate i.e. removed limits on maximum bank lending rates where as the minimum deposit rate has been fixed at 6 percent (National Bank of Ethiopia, Quarterly Bulletin, 1996/97).

Floors on deposit rates should be continued because a premature attempt to liberalize interest rates is problematic. This as stated by Caprio and Levine (1994): “ The principal risk from premature attempts to liberalize interest rates is that without ceilings on the rates banks with little capital would bid up deposit rates to attract deposits as a way to fund continued loans to risky borrowers at the expense of worthier, safer ventures. Such practices would lead eventually to bankruptcies and a collapse of the banking system.”

According to Caprio and Levine (1994) full liberalization of interest rates should be carried out if macroeconomic conditions are reasonably stable, the financial condition of banks and their borrowers is sound and financial markets are competitive and well developed. Nevertheless most of these are not met. Hence the country can at least rationalize the interest rate structure i.e. achieve positive real rates.

### **3.2 Monetary Policy**

Both developed and developing countries implement monetary policy with the aim of achieving stable prices, high employment and rapid economic growth. In most countries the central bank is responsible for conducting and formulating monetary policy in addition to its other functions such as the promotion in the development of money market and supervision and regulation of banks.

In adopting monetary policy, a central bank can use either direct or indirect monetary instruments. Direct instruments fix prices such as interest rate or quantities such as domestic credit through regulations and usually they deal with balance sheets of commercial banks. Direct instruments include interest rate controls, bank by bank credit ceiling and directed lending by central banks (Coats and Khatkhate, 1980).

On the other hand indirect instruments are market based i.e. they operate through the influence of demand and supply. The major types of indirect instruments include, open market operations, rediscount windows and central bank lending. Open market operations involve the purchase or sale of financial instruments in a primary or a secondary market.

Treasury bills, central bank bills and prime commercial papers are the common instruments in open market operations (Alexander et al, 1995). Indirect monetary policy instruments are widely used in developed countries and also with the adoption of IMF supported structural adjustment programs these instruments are also in the process of being adopted in developing countries.

Indirect instruments are preferred to direct instruments because of the high cost of utilizing the latter. For example credit ceilings which are often derived based on a bank's historical penetration in the credit market and independent of a bank's competitiveness limits the incentives for banks whose ceilings are binding to finance profitable projects. In addition, the use of direct instruments may lead to an overhang of liquidity, financial repression and disintermediation. Moreover, the direct instruments of monetary control, for example bank by bank credit, deter competition by protecting inefficient banks from competition limiting the growth of efficient banks. On the other hand, indirect instruments are more effective because first they do not encourage disintermediation and the development of informal financial sector (their development leads to the reduction of financial assets, which the monetary authorities can control). Second indirect instruments permit greater flexibility in policy implementation because small and frequent changes in instrument setting can be made in the case of indirect instruments. Third it is also argued that indirect instruments can help deepen financial markets which tend to price capital according to its scarcity leading to efficiency of investment (Alexander et al, 1995).

However, in developing countries the structure of financial markets makes the adoption of indirect instruments difficult. For example in the absence of well developed market for securities, open market operations cannot be effective in influencing either the cost or amount of credit (Montiel, 1991). Thus prior to implementation of indirect instruments there is a need to design the right financial market. This is because the effectiveness of the policies depends on financial market development.

In this regard central banks in developing countries should work towards building a sound financial structure for the development of financial markets. The banking sector is the most important sector in the financial system of a country since monetary policy works through them. Apart from its payment and credit functions, the sector provides a medium to policy makers for regulating the economy (Jain and Tomic, 1995). Thus restructuring of the banking system is crucial.

The IMF supported structural adjustment programs and the World Bank held the view that state ownership and monopolization of banking activities may reduce competition among existing banks and leads to inefficiency (Willig, 1993). Hence the state owned banks should be privatized to enhance competition. But prior to the commencement of privatization process, the centralized banking systems must be broken down to avoid monopolies so that financial reform can be speeded up (Caprio and Levine, 1994). The rationales for privatization as indicated by Willig (1993) are “ inefficiency, poor quality of out put in operations of state run enterprises as contrasted with cost effective, high quality and creative productivity in operations of private enterprises.” The efficiency

gains from privatization emerged from the fact that “state owned enterprises are subject to politicized directives while private enterprises enjoy a degree of insulation.” (Willig, 1993). However, Stiglitz (1994) has pointed out that as long as interventions by the government is well designed, there is a role for the government in financial markets. He gave the East Asia as an example where the government has been successful in creating efficient financial institutions. Thus in the case of developing countries there is no simple solution as to which financial policy to follow.

In addition to privatization, the IMF supported adjustment programs also contain reforms (related to the banking system) regarding elimination of bank specialization and improvement of supervision and regulations of banks. Bank specialization could be eliminated for example saving banks could be allowed to enter commercial loan market while commercial banks could be allowed to take household deposits, provide mortgages and make other household loans. Supervision and regulation of banks should be improved. For example bad loans are usually associated with state owned banks, failure of the monetary authority to regulate such banks results in impeding improvements in bank efficiency, distorting allocation of credit and complicating and delaying privatization. Deposit equity swap (transforms a large fraction of deposits into equity claims on the bank), debt equity swap and debt bond swap are some of the solutions suggested for converting bad debts (Caprio and Levine, 1994).



### **3.2.1 Experience of Developing Countries in a Move to Indirect Monetary Instruments**

Ethiopia started IMF supported structural adjustment programs in October 1992. The policy reforms, which are being implemented by many developing countries, are almost similar in each economy. Thus it is worthwhile to look at the experience of some of the countries which adopted these programs. In these countries financial market is under developed. The banking sector at large is owned by the government, which undermines the effectiveness of monetary policy as it depends on the competitiveness of the financial system. Furthermore, at the start of SAPS implementations, the countries are characterized by high government deficits, high inflation and negative real interest rates.

The countries under review are Ghana, Indonesia, Egypt and Chile. These countries implemented IMF supported monetary and financial sector reform during the 1980s and 1990s. In all of these countries the reform aimed at improving the structure and efficiency of the financial sector through banking supervision, restructuring the banking system and adopting market based monetary instruments.

Prior to the reform, the economies were characterized by high budget deficits, sluggish growth, high rates of growth of domestic credit, high inflation, low nominal interest rates and therefore negative interest rates in real terms. Indonesia is exceptional in that the macroeconomic situation was favorable at the time of the reform. Monetary policy in these economies were not market based which included credit ceilings, interest rate ceilings and the governments also intervened in credit allocation. For example in Ghana,

credit ceilings were imposed on all banks depending on credit market shares regardless of their competitiveness and efficiency. Reserve requirements were very high for instance it was 75 percent on sight deposits and 47 percent on time deposits in Chile and 25 percent of time deposits in Egypt (Alexander et al, 1995).

The measures taken on the monetary front were privatization of the banking sector, removal of the interest rate ceilings and credit controls and reduction of preferential credit allocation. In Chile the government implemented tight monetary policy by reducing fiscal deficits to reduce inflation but this did not work and hence turned to exchange rate in abating it: inflation declined from 220 % in 1976 to 20% in 1981 (Alexander et al, 1995).

In a move to market based monetary instruments, treasury bills were introduced. Treasury bills are meant to provide benchmark interest rate. In Indonesia there were no government debt instruments because the prohibitions of government borrowing and hence open market type operations took the form of central bank certificates. Auctions are open to banks and non-bank financial institutions but the public is allowed to buy in a secondary market. In Ghana the auction is also open to banks and non-banks. But there are limits on bank financing of the government as a result banks holding of government securities have been insignificant (Alexander et al, 1995).

The other important measures included the restructuring of the banking system. In Ghana non-performing loans were high and they were replaced by Bank of Ghana bonds or offset against the banks or government bonds. The restructuring also includes

privatization of banks and the lifting of barriers to entry in the participation of both foreign and domestic banks. In Chile the government dominated the banking sector and hence privatization was an important measure taken to improve the efficiency of banks. However, during the process of privatization most banks were purchased by conglomerates, which resulted in high concentration of ownership. Other measures include the strengthening of banking supervision and regulation and also starting deposit insurance.

In general the move to market based monetary instruments was not without problems. In the case of Chile slow developments in the financial system were observed which is attributed to insufficient supervision and regulation. Besides, though indirect monetary instruments have enabled the central bank to cope with large capital inflows through sales of promissory notes, this has led to large operating losses. While in the case of Egypt the problem has been too much emphasis being put upon treasury bills as the major indirect monetary policy instrument. This would result in high cost to the government if it failed to issue other securities or design other ways of absorbing banks excess liquidity. In Ghana the transition to indirect instruments had been relatively successful. However, initially since the Bank of Ghana has taken on the risk of loans by state enterprises, it suffered heavy losses limiting the efficient use of monetary policy instruments. But later the losses were converted into interest bearing long- term bonds allowing the Bank of Ghana to use monetary policy instruments. In Indonesia the move to market based instrument has resulted in improved resource allocation and increased the competitiveness of banking system. However slow developments in the financial system have been

observed due to delays in the removal of targeting interest rates and liquidity credits (Alexander et al, 1995).

### **3.2.2 Monetary Policy in Ethiopia**

In this section an attempt will be made to look at monetary policy that existed during the Derg and some of the reforms made with regard to monetary policy in the country. Prior to 1992, the Ethiopian economy was characterized by large deficits, high growth rates of domestic credit and imbalances in the balance of payments. The annual average rate of inflation from 1974 to 1991 was 9.7 (computed based on Addis Ababa Consumer Price Index) which resulted in maintaining positive to moderately negative real rates of interest on financial assets with limited effect on the demand for real cash balances (Mohamed, 1996). Moreover, the formal financial system composed of merely commercial banks, two other specialized banks, pension fund, saving and credit institutions and an insurance company. Financial and monetary policies were repressive. For instance there has been restrictions on the entry of private businesses in the financial sector and therefore the financial system was not meant to be competitive.

Monetary policy was expansionary. For example credit expansion was based on sectoral allocation and the condition for credit was not the availability and quality of collateral, as it is now, which has resulted in high non-performing loans of banks. Between 1973/74 and 1991/92 money supply ( $M_1$ ) grew at an average annual rate of 14 percent which was attributed to expansion in domestic credit (National Bank of Ethiopia, 1997). It is argued that selective credit allocation and below market interest rates are costly to the economy

because without a market allocation system, saving and credit will be misallocated (Besley, 1994). As a result the country has adopted financial liberalization policies.

In 1992 the country implemented structural adjustment programs which focused on reduction of budget deficits, price and exchange rate liberalization, restructuring of the financial sector and privatization of state enterprises. Since then a number of measures have been taken.

As the programs aimed at implementing market based monetary instruments, a major reform is that of making the financial sector competitive and efficient through restructuring and improving of regulatory framework of the banking system. In this regard, supervisory and regulatory power of financial institutions has been given to the National Bank of Ethiopia by proclamation no. 84/1994 and no.86/1994(National Bank of Ethiopia, 1999). Supervision of banks include licensing, controlling the stability, liquidity, solvency, soundness and efficiency of banks. Private domestic banks can be established and the capital adequacy is a minimum of 8 percent of risk weighted asset or Birr 10 million, which ever is lower ( Gebrehiwot 1999).

Open market type operations or treasury bills had been introduced in January 1995. Initially only three- month treasury bill started with the auctions being carried out monthly. The purpose of treasury bills is to finance government deficits, to serve as a major monetary policy instrument and to provide a benchmark interest rate. Then later, auctions of one month bills and six month bill were started in December 1996 with the

auction being carried out every 15 days. Initially to make the market competitive, the biggest bank i.e. the Commercial Bank of Ethiopia was restricted in that it was not allowed to purchase exceeding 50 percent of the total amount issued. Moreover, Social Security Authority and Commercial Bank of Ethiopia did not participate in the auction but used to get non competitive bids and also there was a cut-off rate which is a ceiling on the rate that the participants can offer. But as of August 26, 1998 auctions are open to all participants alike; the 50 percent ceiling on Commercial Bank of Ethiopia and also the ceiling in the rate that the treasury bills participants can offer have been eliminated. Furthermore, the minimum denomination was lowered from Birr 100,000 to Birr 50,000 then further to Birr 5000 (National Bank of Ethiopia ,1999).

Reserve and liquidity requirements were imposed on all commercial banks. Initially the reserve requirement imposed was 5 percent of deposits on all banks except Commercial Bank of Ethiopia, which was required to reserve 8 percent of its deposits. But currently all commercial banks are required to reserve 5 percent of deposits and 15 percent of their net current deposit as the liquidity requirement which was 20 percent during the pre-adjustment -era. Interest rate floor policy still continued on deposit rate at which the minimum is fixed at 6 percent whereas the lending rate was liberalized as of January 1, 1998.

Credit ceilings are not considered as market oriented but with the objective of restricting money supply growth, the National Bank of Ethiopia determines bank by bank credits

ceiling, which applies to all banks. Comparison of actual credit to aggregate ceiling for commercial banks as determined by NBE is given below.

Table-2- Comparison of outstanding credit ceiling to actual total credit of commercial banks (in mill Birr , end of June)

| <i>Year</i>     | <i>Ceiling</i> | <i>Actual</i> |
|-----------------|----------------|---------------|
| <i>1994/95*</i> | <i>3333.8</i>  | <i>3277.4</i> |
| <i>1995/96</i>  | <i>4829.3</i>  | <i>5604.7</i> |
| <i>1996/97</i>  | <i>7057.4</i>  | <i>4074.1</i> |
| <i>1997/98</i>  | <i>8036.8</i>  | <i>9783.4</i> |

Source: National Bank of Ethiopia

\* End of December

In all the periods commercial banks have exceeded the credit ceiling set by the NBE except in 1994/95 and 1996/97.

On the other hand, comparison of aggregate domestic credit to its target from the year 1992/93-1997/98 shows that the targets are achieved by the NBE (except in the years 1992/93 and 1996/97 in which the actual is slightly greater) due to the decline in government debt financing by the bank.

Table-3-Comparison of Growth Rates of Actual Domestic Credit to its Target.

| <i>Year</i>    | <i>Target</i> | <i>Actual</i> |
|----------------|---------------|---------------|
| <i>1992/93</i> | <i>18.3</i>   | <i>19</i>     |
| <i>1993/94</i> | <i>9.7</i>    | <i>7.3</i>    |
| <i>1994/95</i> | <i>10</i>     | <i>8.9</i>    |
| <i>1995/96</i> | <i>8</i>      | <i>7.4</i>    |
| <i>1996/97</i> | <i>5</i>      | <i>6.7</i>    |
| <i>1997/98</i> | <i>9.1</i>    | <i>9</i>      |

Source: National Bank of Ethiopia

Financial market is under developed for instance the number of commercial banks are still limited, there are no well developed capital and money markets, there is only one security being issued in a primary market which is not competitive. To make the financial market more competitive the IMF suggest that the government should privatize the government owned banks and permit foreign participation in the financial system although the benefits and costs of doing so is not researched in the current Ethiopian context.

**3.3     The Behavior of Income Velocity of Money in Ethiopia**

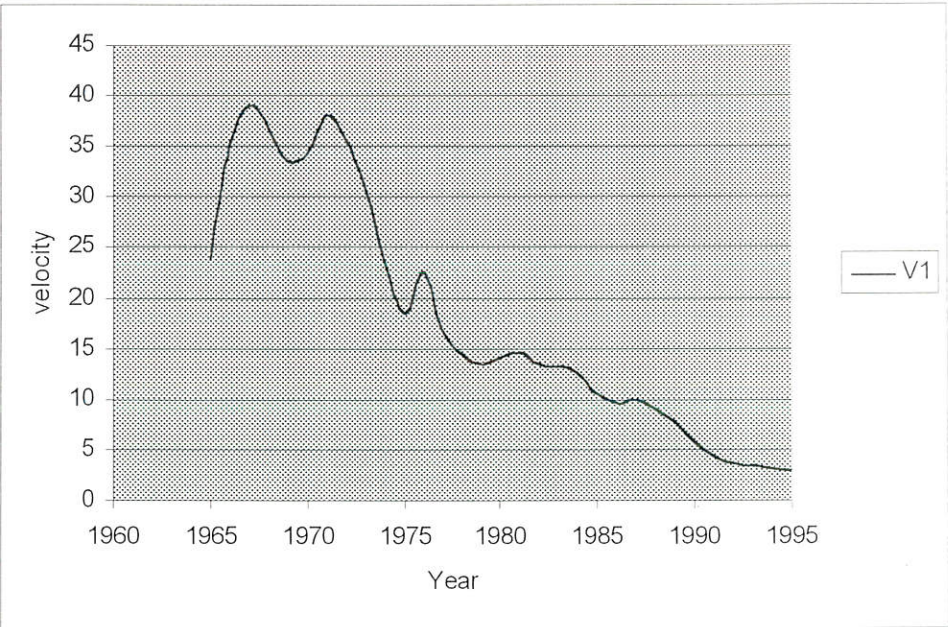
This section briefly describes the behavior of velocity during the period 1965-1995 in Ethiopia. In measuring the variability of income velocity an adjusted coefficient of variation defined as the standard error as the percentage of the mean of the variable is used.



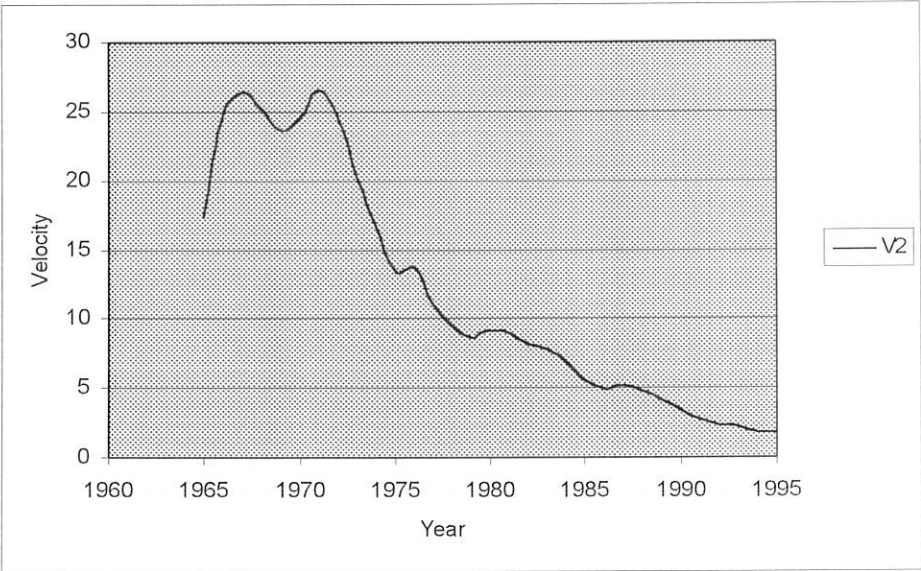
Depending on how money is defined in the denominator, three measures of velocity are considered. These are GDP divided by currency in circulation denoted by  $V_1$ , GDP divided by narrow money ( $V_2$ ) and GDP by broad money ( $V_3$ ).

The behavior of income velocity of money for the three alternative measures is depicted in the figures below. In all the three measures the income velocity of money show similar behavior i.e. initially the measures show-increasing trend then it declines and rises slightly, which then continuously declines. In the period 1965 to 1967, the income velocity measures  $V_1$ ,  $V_2$  and  $V_3$  averaged 13.3, 9 and 7.5 respectively. In the following periods both  $V_1$  and  $V_2$  decline slightly up to 12.7 and 8.9 whereas  $V_3$  continuously declines. From 1971 onwards  $V_1$  and  $V_3$  also depict decreasing trends.

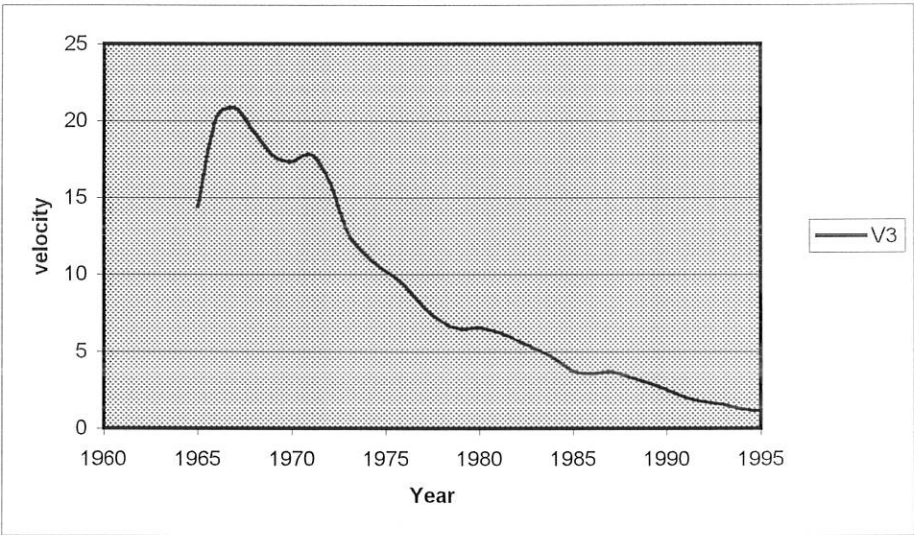
*Figure 1 Behavior of The velocity of Currency in Circulation*



*Figure 2 Behavior of the Velocity of Narrow Money*



*Figure 3 Behavior the Velocity of Broad Money*



As Park (1970) indicated, the variability of income velocity measures  $V_1$ ,  $V_2$  and  $V_3$  can be computed using the adjusted coefficient of variation<sup>9</sup> which shows the relative degree of dispersion of the observation of each velocity around its mean. The higher the coefficient of variation the higher the variability in velocity. The computed adjusted coefficient of variation in the period 1965-95 for  $V_1$ ,  $V_2$  and  $V_3$  are 32.5, 39.2 and 41.5 respectively revealing that the variability in velocity increases as the definition of money is broadened. Relative to the coefficients computed for both developing and developed countries by Park (1970) and for developing countries by Kashala (1975), the variability in velocity tends to be higher in less developed countries than in developed countries which can be attributed to the following factors: instability in economic structure and social and political system, wide fluctuations in non-monetary income, errors in data and lagged adjustment and transmission mechanism.

In the case of Ethiopia, all the factors could contribute to the variability in velocity. During the period, 1965 to 1995 three political regimes existed. Specifically during the Derg the economic, social and political system were the unstable with drought, famine and war being the order of the day. The instability could affect decisions and preferences to hold money thereby affecting velocity.

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<sup>9</sup> Adjusted coefficient of variation is defined as " the standard error of estimate as percentage of the mean of the dependent variable [Park (1970)]. Formally given as:  $cv \equiv [\sqrt{\sum (v_i - \bar{v})^2 / (n - 1)} / \bar{v}] * 100$  (Kashala, 1975).

Moreover, the country's main source of income is agriculture, which is subject to year to year fluctuations because it depends on natural conditions that are not under full control. Furthermore, due to underdeveloped financial systems as in other developing countries changes in the quantity of money will not affect other money substitutes but will be transmitted directly to markets for real assets which has impact on the variability of velocity as Park (1970) has pointed out. However, if the supply of real assets is rationed, money could be a forced asset demand. This could develop into a parallel market for goods (Ghatak, 1995).

## **Chapter Four**

### **Methodology and the Data**

#### **4.1 Methodology**

Prior to estimation of long run models, the time series properties of the variables concerned should be established i.e. we must distinguish between stationary and non-stationary variables. The application of ordinary least squares to non-stationary series results in spurious (nonsensical) regression i.e. the variables which are known to be unrelated indicates that the series are correlated ( Adam, 1992).

Given non-stationary variables it is possible to infer causal long run relationships when the variables are cointegrated. As Engle and Granger (1987) explained, if two or more series are linked to form an equilibrium relationship spanning the long run, then even though the series themselves may contain stochastic trends they will nevertheless move closely together overtime and the difference between them will be stable or stationary( Harris, 1995).

There are two alternative tests for cointegration, namely the Engle Granger (1987) two step procedure and the Johansen (1988) procedure. The former is considered inferior because it does have a number of drawbacks, which includes the absence of systematic procedure for separate estimation of multiple cointegrating vectors. Also the procedure assumes that as the sample size grows infinitely large, the test for cointegration will be

the same whichever variable is used on the left hand side when estimating the long run equilibrium. However, this assumption may not hold because of limited sample sizes ( Enders,1995).This study employs Johansen(1988) and Johansen and Juselius(1990) maximum likelihood method which overcomes the drawbacks mentioned above.

### 4.1.1 The Johansen Maximum Likelihood Procedure

The Johansen procedure is a multivariate generalization of the Dickey Fuller test. It starts with the following vector autoregressive (VAR) model.

$$Z_t = A_1Z_{t-1} + A_2Z_{t-2} + \dots + A_kZ_{t-k} + \mu + \delta D_t + U_t \dots\dots\dots (1)$$

Where  $Z_t$  is vector of  $n \times 1$  variables

- $A_i$  is  $n \times n$  matrix of parameters
- $\mu$  is a vector of constants
- $D_t$  is a vector of dummies
- $U_t$  is a vector of error terms

The VAR model provides a way to estimate dynamic relationship among endogeneous variables without imposing a priori restrictions about the exogeneity of the variables ( Harris, 1995).

After performing some mathematical manupilations, equation (1) can be represented in its equivalent vector error correction (VECM) form:

$$\Delta Z_t = \sum_{i=1}^{k-1} \Gamma_{t-i} \Delta Z_{t-k} + \Pi Z_{t-k} + \mu + \delta D_t + U_t \dots \dots \dots (2)$$

Where  $\Gamma_i = -(I - A_1 + \dots + A_i) \quad i=1 \dots \dots \dots K-1$

$\Pi = -(I - A_1 + \dots + A_k)$

$\Delta$  = difference operator

$I$  =Identity matrix

The system contains information on both short and long run adjustments to changes in  $Z_t$  through estimates of  $\Pi$  and  $\Gamma_i$ . Johansen defines two matrices  $\alpha$  and  $\beta$  where  $\Pi = \alpha\beta'$ . The  $\alpha$  represents the speed of adjustment to disequilibrium, whereas  $\beta$  is a matrix of long run coefficients (Harris, 1995). The Engle Granger methodology determines whether the residual obtained from longrun equilibrium is stationary or not in order to test for cointegration. While the Johansen approach seeks to determine the rank of  $\Pi$  which gives the number of independent cointegrating vectors. Since, there are  $n$  variables which constitute the vector  $Z_t$  the rank can be at most equal to  $n$ . If the rank is equal to zero, then there are no cointegrating vectors. If the rank is  $n$  then the process is stationary. Otherwise we have multiple cointegrating vectors ( Enders,1995).

The number of cointegrating vectors can be obtained by testing the significance of each eigen value of  $\Pi$  because the rank of the matrix is the number of non-zero eigen values. Johansen (1988) provides two test statistics to determine the number of eigen values that are insignificantly different from unity. These are the lambda trace and lambda max statistics. The null hypothesis under lambda trace is that the number of distinct

cointegrating vector is less than or equal  $r$  ( $r$  being the number of cointegrating vectors) against the general alternative. While lambda max tests the null hypothesis that there are  $r$  cointegrating vectors against the alternative  $r+1$  (Enders, 1995).

#### 4.1.2 Testing for Unit Roots

Prior to the estimation of a vector error correction model (VECM), it is important to test for the presence of unit roots to determine the orders of integration. A series is said to be integrated of order  $d$  if it becomes stationary after differencing  $d$  times which is denoted as  $I(d)$ .<sup>10</sup>

As Enders (1995) indicated although cointegration tests can be carried out for differing orders of integration it is not appropriate to mix variables with different orders of integration. Hence, the time series characteristics of the variables should be established. For this the most popular tests for the presence of unit roots are the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests which will be described briefly below.

The Dickey-Fuller approach tests the null hypothesis that the series is non-stationary against the alternative of stationarity. Dickey and Fuller (1979) consider three different regression equations that can be used to test for the presence of unit roots (Enders 1995).<sup>11</sup>

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<sup>10</sup> "A stochastic process is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed" (Gujarati, 1995).

<sup>11</sup>  $y_t = \rho y_t + \xi_t$  can be written in the form  $\Delta y_t = \alpha y_{t-1} + \xi_t$  by subtracting  $y_{t-1}$  from both sides of the equation where  $\alpha = \rho - 1$



$$\Delta y_t = \alpha y_{t-1} + \xi_t \dots \dots \dots (1)$$

$$\Delta y_t = a_0 + \alpha y_{t-1} + \xi_t \dots \dots \dots (2)$$

$$\Delta y_t = a_0 + \alpha y_{t-1} + a_2 t + \xi_t \dots \dots \dots (3)$$

Testing for unit roots using equation (1) assumes that the data generating process of  $y_t$  is a simple first order autoregressive process with zero mean and no trend component. Since the data generating process is not known a priori as to whether or not it has a trend, equation (2) with an intercept, and equation (3) with both an intercept term and trend, should also be estimated. In the above equations if  $\alpha = 0$ , the  $y_t$  sequence contains a unit root. After estimating the equations using OLS, we compare the resulting t- statistics with the critical values given in Dickey Fuller tables. If the t-statistic computed is less than the critical value then we conclude that the series is non-stationary (Enders, 1995).

Due to the problems<sup>12</sup> associated with Dickey Fuller test. Instead of equations 1-3 the following pth order autoregressive equation should be estimated.

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<sup>12</sup> " The Dickey-Fuller test assume that the errors are independent and have constant variance. The problem is that since we don't know the data generating process, we need to know how to conduct the test if the order of moving average terms is unknown. The other problem is that we can not properly estimate  $\alpha$  and its standard error unless all the autoregressive terms are included in the estimating equation. The Dickey-Fuller test considers a unit root however a pth order autoregression has p characteristic roots." ( Enders, 1995).

$$\Delta y_t = \alpha y_{t-1} + \sum_{i=2}^p \beta_i \Delta y_{t-i+1} + \xi_t \dots \dots \dots (4)$$

$$\Delta y_t = a_0 + \alpha y_{t-1} + \sum_{i=2}^p \beta_i \Delta y_{t-i+1} + \xi_t \dots \dots \dots (5)$$

$$\Delta y_t = a_0 + \alpha y_{t-1} + \sum_{i=2}^p \beta_i \Delta y_{t-i+1} + a_1 t + \xi_t \dots \dots \dots (6)$$

The test in this case is called Augmented Dickey Fuller (ADF) .If  $\alpha = 0$  against the alternative  $\alpha < 0$ , then  $y_t$  contains a unit root. To test the null hypothesis we compute the t-statistics and compare it with the critical values given in ADF table.

### 4.1.3 Model Specification

Conventional income velocity models consider the velocity function to depend on the opportunity cost of holding money and wealth or permanent income (Laidler, 1985). The opportunity cost of holding money, as Friedman (1970) indicates, is the income to be earned from holding other financial assets such as bonds and equity. In advanced economies the financial market is well developed and hence the substitution between money and financial assets is considerably high. Therefore the returns on those assets i.e. the rate of interest, can be taken as an opportunity cost measure (Park, 1973).

However, financial sector in Ethiopia is underdeveloped, specifically money and capital markets are not well developed. Financial assets such as treasury bills, government bonds and securities constitute an insignificant proportion of private wealth. Hence there is limited substitution between broad money and financial assets. Consequently, the desired holdings of money are likely to be insensitive to interest rates on these financial assets. However, Laidler (1985) has indicated that few studies have included the own rate of return on money in money demand equations, despite the fact that its exclusion is empirically inaccurate. However, in Ethiopia interest rates on saving and time deposits have been administratively fixed in the past. Thus its effect is likely to be insignificant. Assefa (1998) has tried to include nominal interest rates on time deposits when he estimates money demand in Ethiopia and find that its inclusion does not result in sensible cointegration relationship and hence excluded from the model.

In Ethiopia, like other developing countries where non-deposit financial assets are lacking, real assets can be considered as good substitutes for money (Park, 1973). Studies by Driscoll and Lahiri(1982),Campbell(1970) and Assefa (1998) taking expected rate of inflation as an opportunity cost measure have shown that it has significant impact on money demand or its inverse income velocity of money. Expected inflation rate is anticipated to be positively related to income velocity. When inflation increases it will result in lower returns on all assets fixed in nominal terms or even if it is not fixed, the real value will be eroded as a result of inflation increasing at a higher rate. Therefore the desire to hold real money balances will decline thereby raising income velocity.

As Adam (1993) and Domowitz and Elbadawi (1987) pointed out, in countries where there are strong parallel markets in foreign exchange, demand functions should involve currency substitution considerations. If it is ignored, it may result in overstating the substitution from money to domestic real assets. However, the degree of substitution between domestic currency and foreign currency depends on the nature of legal control regime. In Ethiopia foreign currency can not be considered as an important alternative asset to domestic currency. This is because during the Derg period, the foreign exchange policy with respect to domestic residents was very strict. Parallel market activities were illegal and the legal risk involved is very high. Besides, domestic residents are not allowed to keep accounts denominated in foreign currencies and thus foreign currency is likely to constitute an insignificant proportion in private wealth portfolio.

The other variable in the conventional income velocity function is real per capita income. Ezekiel and Adekunle (1969) noted that different views exist regarding the secular behavior of income velocity of money. One of the earliest views held by Fisher states that the income elasticity of demand for money is lower than unity i.e. a rising secular movement in income velocity. In contrast to this view, Friedman's luxury hypothesis asserts that the amount of money demanded rises more proportionately than the rise in real income per capita (Jain and Tomic, 1995). In other words, income velocity of money would tend to fall as income increases. On the other hand Gurly and Shaw (1960) held the view that since at earlier stages of economic growth individuals tend to hold a fixed proportion of their financial assets during out put growth, velocity would fall at first. But as the economy grows he indicated that velocity would become constant. Empirical

evidence for developing countries reveals mixed results ( Kashala,1975). Thus the need to investigate in the case of Ethiopia. Following Ezekiel and Adekule (1969), Miltz and Correa (1970) and Siklos (1993) real income per capita is used as proxy for the level of economic development.

Based on the usual treatment that money is exogeneously determined, the standard long run money demand equation without imposing the restriction that the price level elasticity of demand for money is equal to unity, is given by:<sup>13</sup>

$$M^d / Pn = \beta_0^{-1} P^{\beta_1-1} (Y / Pn)^{\beta_2} \pi^{-\beta_3} \dots\dots\dots(1)$$

Where M is money stock,  $\Pi$  is expected inflation rate, n is population, and p is consumer price index. Y/pn is real per capita income and  $\beta_0, \beta_1-1, \beta_2$  and  $\beta_3$  are parameters to be estimated.

In income velocity form, equation (1) can be written as:

$$Y / M = \beta_0 P^{1-\beta_1} (Y / Pn)^{1-\beta_2} \pi^{\beta_3} \dots\dots\dots(2)$$

Taking the logarithm of equation (2) we obtain:

$$V = \alpha_0 + \alpha_1 P + \alpha_2 Y / Pn + \alpha_3 \pi \dots\dots\dots(3)$$

Where V is natural logarithm of income velocity of money, Y/pn natural logarithm of real per capita income, P is natural logarithm of CPI,  $\Pi$  is first difference of natural logarithm of CPI and  $\alpha$ s are parameters to be estimated.

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<sup>13</sup> See Melitz and Correa (1970), "International Differences in Income Velocity." Review of Economics and Statistics vol.xlii (February).

The ratio of currency to money, broadly defined to include time, saving and demand deposits, is also another important determinant of income velocity of money. Studies by Melitz and Correa (1970), Kashala(1975) and Siklos(1993) have shown that income velocity is significantly affected by this ratio. Melitz and Correa (1970) included this ratio reasoning that currency holdings involve higher risks than bank deposits because it is subject to accidental loss and robbery. Thus currency would tend to circulate faster than demand deposits. Whereas Siklos (1993) and Kashala (1975) used it as a proxy for financial institution development. At first, as banking spreads, velocity declines because of greater reliance on currency to settle transactions. But later as financial institutions and arrangements improve new methods of making payments other than currency become available. Consequently, money broadly defined expands and currency/money ratio and velocity decline.

Including currency/money ratio, the income velocity function in logarithmic form is given as follows:

$$V = \alpha_0 + \alpha_1 P + \alpha_2 Y / Pn + \alpha_3 \pi + \alpha_4 C / M_2 \dots\dots\dots(4)$$

Where C is currency in circulation and M<sub>2</sub> is money broadly defined which includes currency in circulation, demand, time and saving deposits.

The Keynesian and Neo-Classical economists argue that interest rates on financial assets as important determinants of income velocity of money. They consider real money balances and physical capital as two competitive asset. This is true in the context of developed countries where financial markets are developed and there are uniform

opportunity costs of holding money and physical capital. Individuals in developed countries compare the returns on capital and money and holds the one which yields the highest return (Jain and Tomic,1995). But in developing countries the substitution effect does not hold. Instead, Mckinnon (1973) argue the complementarity between real money balances and physical capital. Coats and Khatkhate (1980) points out that " though the model suggested by Mckinnon (1973) is applicable to least developed countries, it suffers from a highly stylized set of assumptions". Nevertheless, they indicate that none of the assumptions is required for establishing complemetarity between real money balances and physical capital. The higher the accumulation of liabilities by financial intermediaries which occurs when real interest rates on deposits is higher, the greater the amount of investment. Thus velocity and investment income ratio are expected to be negatively related.

Accordingly, instead of equation (4) we can stipulate that:

$$V = \alpha_0 + \alpha_1P + \alpha_2Y / Pn + \alpha_3\pi + \alpha_4C / M_2 + \alpha_5I / Y .....(5)$$

Where I/Y is the ratio of gross fixed investment to gross national income.

#### 4.1.4 The Data

The data to be used in the study are as follows. In defining income velocity, there exist different measures depending on the various definitions of income in the numerator and money in the denominator. In this study, velocity is defined as the ratio of annual domestic product at current market prices to money. Money is measured as end-period

broad money stock i.e. currency in the hands of the public, demand deposits and quasi-money (i.e. time and saving deposits) and narrow money (i.e. currency in the hands of the public and demand deposits). However, such definition of income velocity is not without limitations. As the Ethiopian economy is composed of both monetized and non-monetized sectors, the relevant portion of income should have been that part of income originating from the former (Ghatak , 1995). But no data is available on their break down.

The other variable in the model is expected inflation. The inflation rate is computed from the consumer price index and current rate of inflation is used as an indicator of expected inflation. The shortcoming of using the available consumer price index is that it is based on price movements in Addis Ababa and thus does not represent overall price movements in the country.

With regard to the other variables namely per capita real income which is obtained dividing GDP at constant factor cost by population; currency-money ratio is computed dividing currency in circulation by money broadly defined and investment income ratio is obtained by dividing gross fixed investment to gross national income.

The sample period is 1960 through 1998. The data sources are National Bank of Ethiopia, Ministry of Economic Development and Cooperation, and International Monetary Fund's International Financial Statistics.



# **Chapter Five**

## **Analysis of Results**

### **5.1 Time Series Characteristics of the Data**

Prior to conducting cointegration tests among the variables concerned, it is important to establish the time series characteristics of the data. This is because the order of integration of the variables in the models has important implications when all the variables are not integrated of order one (Harris, 1995).<sup>14</sup>

There are different ways of testing the presence of unit roots but this study employs the most popular method, which is the augmented Dickey Fuller (ADF) (1981) statistics. The null hypothesis under this statistics is that a series contains a unit root i.e. it is non-stationary against the alternative of stationarity. If the null hypothesis is not rejected, it is important to check for higher order of integration. Dickey and Pentula (1987) suggest a procedure for testing if more than one unit root is suspected (Enders, 1995). The procedure requires differencing the series a given number of times, however empirical evidence shows that economic series do not need to be differenced more than two times (Enders, 1995). Testing for order of integration after first differencing the series in levels also involves testing the null hypothesis of unit root against the alternative of stationary root. If the null hypothesis is rejected, then the series is stationary in first difference and

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<sup>14</sup> Harris (1995) pointed out the possibility of cointegration relationships among a mix of  $I(0)$ ,  $I(1)$  and  $I(2)$  variables in the model. But in the case of  $I(0)$  variables in a multivariate model, for every stationary variable included, the number of cointegration equations will increase correspondingly. The case of  $I(2)$  variables is more complicated because the standard Johansen approach is developed to handle  $I(0)$  and  $I(1)$  variables and thus will not provide the necessary stationary vectors.



therefore it is I(1). Table 4 lists the augmented Dickey Fuller statistics calculated for the variables in the analysis

**Table 4 ADF Statistics for Testing a Unit Root**

| Variable<br>(Annual<br>Data) | With a Constant<br>and Trend |       | With a<br>Constant only |       |
|------------------------------|------------------------------|-------|-------------------------|-------|
|                              | Null Order                   |       | Null Order              |       |
|                              | I(2)                         | (1)   | I(2)                    | (1)   |
| V <sub>2</sub>               | -3.61*                       | -0.69 | -3.38*                  | -1.48 |
| V <sub>1</sub>               | -6.15**                      | -1.88 | -3.24*                  | -1.13 |
| I/Y                          | -3.64*                       | -2.48 | -3.33*                  | -1.78 |
| y/n                          | -3.74*                       | -3.20 | -3.79**                 | -1.95 |
| P                            | -4.56**                      | -1.31 | -2.97*                  | 1.04  |
| C/M <sub>2</sub>             | -5.09**                      | -3.25 | -3.50*                  | -2.84 |

Notes: The superscripts \* and \*\* denote the rejection of the null hypothesis at 5 % and 1 % significance level. The lag length is three.

: All series are in natural logs V<sub>2</sub> = Velocity based on broad money supply; V<sub>1</sub>=Velocity based on narrow money supply; y/n= Real per capita income; P= Consumer price index, C/M<sub>2</sub>= Currency money ratio; I/Y= Investment income ratio.

: The sample period is from 1960 to 1998 for level, and 1961 to 1998 for first differences.

Since the actual data generating process is not known a priori, the test of determining the orders of integration of the variables is conducted first including both a constant and

trend, and then a constant only. As can be observed from table 4, the inclusion of a trend does not affect the results. The ADF test statistics show that the hypothesis of a unit root can not be rejected in all the variables. Under the null I (2), we are able to reject the null hypothesis of a unit root for V2, I/Y, y/n at 5% significance level and V<sub>1</sub>, P, and C/M<sub>2</sub> at 1% significance level when both a constant and a trend is included. However, when the trend term is excluded, with the exception of y/n (in which the null is rejected at 1% significance level), in all the series the null is rejected at 5% level. Hence we can conclude that all of the variables are integrated of order one.

## 5.2 Testing for Cointegration and Long run Velocity

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 cointegrated<sup>15</sup>. If each variable in a model is integrated of order one, there can be a linear combination between them, which is stationary. However, if the series are not cointegrated then the relationship between the dependent and independent variables is one between a set of random walks (Harris, 1995). This section presents tests for cointegration among the variables in the model using the Johansen and Juselius (1990) procedure.

Tests for cointegration in the velocity function will be done based on different components of money supply. We use two definitions of money namely broad (which

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<sup>15</sup> "The Engle and Granger definition of cointegration states that if two (or more) series are linked to form an equilibrium relationship spanning the long run, then even though the series themselves may contain stochastic trends (i.e be non-stationary) they will nevertheless move closely together overtime and the difference between them will be stationary." In short it is the existence of a long-run equilibrium to which an economic system converges overtime. [ Harris (1995)]

includes currency in circulation, demand deposits and quasi-money) and narrow (which includes currency in circulation and demand deposits). The reason for using the two different measures is to check which components should be chosen as policy instruments (Ghatak, 1995). As noted in section 5.1, the order of integration of all the series are  $I(1)$  except  $\Delta P$ , which is  $I(0)$  and therefore omitted from the test for cointegration because it is important for the series to be the same order of integration. Hence, cointegration tests are conducted among the following variables:  $V_2$  or  $V_1$ ,  $P$ ,  $y/n$ ,  $I/Y$  and  $C/M_2$ .

Tables 5 and 6 report the estimates and the test statistics for cointegration among the variables. A second order vector autoregression for each definition of velocity, with a constant and a dummy for government change, is estimated. The data is annual and covers the period 1960 to 1998.

**Table 5**  
**Cointegration Analysis of Income Velocity ( $V_2$ )**

|                                    |                                 |            |            |            |                  |
|------------------------------------|---------------------------------|------------|------------|------------|------------------|
| Eigen values                       | 0.696                           | 0.444      | 0.389      | 0.217      | 0.0548           |
| Hypotheses                         | $r = 0$                         | $r \leq 1$ | $r \leq 2$ | $r \leq 3$ | $r \leq 4$       |
| Lambda max                         | 40.44*                          | 19.99      | 16.75      | 8.34       | 1.92             |
| 95% critical value                 | 36.4                            | 30.3       | 23.8       | 16.9       | 3.7              |
| Lambda trace                       | 87.44**                         | 47.00      | 27.00      | 10.25      | 1.92             |
| 95% critical value                 | 77.7                            | 54.6       | 34.6       | 18.2       | 3.7              |
| <u>Variable</u>                    | $V_2$                           | I/Y        | y/n        | P          | C/M <sub>2</sub> |
| Standardized $\beta'$ Eigen vector | 1                               | 0.069      | 0.2049     | 1.939      | -1.519           |
| Standardized $\alpha$ coefficients | -0.1814                         | -0.1696    | -0.0815    | -0.04843   | 0.1139           |
|                                    | Weak exogeneity test statistics |            |            |            |                  |
|                                    | $V_2$                           | I/Y        | y/n        | P          | C/M <sub>2</sub> |
| Chi-sq (1)                         | 12.04**                         | 2.02       | 3.58       | 1.47       | 4.72*            |

Notes: The statistics Lambda max and Lambda trace are Johansen's maximal eigen value and trace eigen value statistics for testing cointegration.

: All series are expressed in logs.

\* and \*\* denote significance at the 5% and 1% levels respectively

**Table 6**  
**Cointegration Analysis of Income Velocity ( $V_1$ )**

|                                    |         |                                 |            |            |                  |
|------------------------------------|---------|---------------------------------|------------|------------|------------------|
| Eigen values                       | 0.699   | 0.452                           | 0.282      | 0.217      | 0.0525           |
| Hypotheses                         | $r = 0$ | $r \leq 1$                      | $r \leq 2$ | $r \leq 3$ | $r \leq 4$       |
| Lambda max                         | 39.57*  | 19.87                           | 10.92      | 8.09       | 1.78             |
| 95% critical value                 | 36.4    | 30.3                            | 23.8       | 16.9       | 3.7              |
| Lambda trace                       | 80.24*  | 40.67                           | 20.79      | 9.87       | 1.78             |
| 95% critical value                 | 77.7    | 54.6                            | 34.6       | 18.2       | 3.7              |
| <u>Variable</u>                    | $V_2$   | I/Y                             | y/n        | P          | C/M <sub>2</sub> |
| Standardized $\beta'$ Eigen vector | 1       | 0.093                           | 1.301      | 3.422      | -3.550           |
| Standardized $\alpha$ coefficients | -0.121  | -0.070                          | -0.034     | -0.023     | 0.053            |
|                                    | $V_2$   | Weak exogeneity test statistics |            |            | C/M <sub>2</sub> |
|                                    |         | I/Y                             | y/n        | P          |                  |
| Chi-sq.(1)                         | 18.9**  | 1.81                            | 3.54       | 1.37       | 4.61*            |

Notes: The statistics Lambda max and Lambda trace are Johansen's maximal eigen value and trace eigen value statistics for testing cointegration.

: All series are expressed in logs.

: \* and \*\* denote significance at the 5% and 1% levels respectively

To determine the number of cointegrating vectors<sup>16</sup> two test statistics called lambda max and lambda trace statistics are computed. In the first test the null hypothesis is that the number of cointegrating vectors is  $r$  against the alternative of  $r+1$  cointegrating vectors. The second test which is based on the trace statistic, tests the null hypothesis that the number of distinct cointegrating vectors is less than or equal to  $r$  against the alternative hypothesis that there are  $r$  or more cointegrating vectors (Enders, 1995). The critical values for the two test statistics are from Johansen and Juselius (1990).

Tables 5 and 6 reveal that the null hypothesis of zero cointegrating vectors is rejected for both definitions of income velocity of money based on the maximum and trace eigen values. While the null hypothesis of at most one cointegrating vector cannot be rejected. Table 5 shows that the null hypothesis of no cointegration is rejected at 1% significance level under the lambda trace statistics and 5% level for the lambda max. Table 6 also shows that the null hypothesis of no cointegration is rejected at 5% significance level under both test statistics. Thus we can conclude that there is only one cointegrating vector linking velocity to its determinants.

### **5.2.1 Interpretation of Long run Solutions**

Tables 5 and 6 also report the  $\alpha$  coefficients that measure the rate of feedback effects of the disequilibrium in cointegrating relation to the variables in the vector autoregression.

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<sup>16</sup> If the number of cointegrating vectors is  $r$  then this means that there are  $r$  linear combinations of the variables that are stationary. If there is no linear combination of the non-stationary variables which is stationary then this indicates the non-existence of long run equilibrium relationship among the variables (Enders, 1995).

Specifically the first coefficient indicates the speed at which the dependent variable adjusts towards the long run cointegration relationship. If it is negative and large in magnitude then this means that disequilibrium relation will fade away in the long run. The  $\alpha$  coefficients can be interpreted as the percentage feed back per period (since the series are in logs). As indicated in the tables a feed back of 18.1 percent (-0.181) per year for  $V_2$  and 12.1 (-0.121) percent for  $V_1$  is obtained.

The standardized  $\beta'$  (reported in tables 5 and 6) is the estimated cointegrating vectors which define the long run income velocity of money functions. From tables 5 and 6 the respective long run functions are given as follows:

$$V_2 = -0.07 I/Y - 0.20 y/n - 1.94 P + 1.51 C/M_2$$

$$V_1 = -0.09 I/Y - 1.3 y/n - 3.42 P + 3.55 C/M_2$$

In both equations per capita real income elasticity of velocity of money has negative signs in accordance with Friedman's luxury "good" hypothesis. The estimates indicate that a 1 percent increase in per capita real income leads to a decline of 0.2 percent in  $V_2$  and 1.3% in  $V_1$ . The price elasticity of velocity is also correctly signed with a higher coefficient in the case of  $V_1$ . The proxy for financial institution development affects both  $V_1$  and  $V_2$  positively as expected. As banks and financial institutions expand, the population will be encouraged to hold more bank deposits and also new methods of making payment other than currency such as checks become available. Thus as monetary and financial institutions develop, money supply broadly defined expands and causes currency money



ratio to decline thereby affecting income velocity positively. We also note that investment income ratio and income velocity in both equations are negatively related in accordance with Mckinnon's complementarity hypothesis between physical capital and money.

### **5.2.2 Weak Exogeneity**

The final rows of tables 5 and 6 report the values of the statistics for testing weak exogeneity of a given variable for the cointegrating vector. The test involves the null hypothesis that the speed of adjustment coefficients ( $\alpha_i$ ) contains zeros. If the null is not rejected then the variable can be considered as weakly exogenous (Harris, 1995). The tests reveal that in both equations investment income ratio, real income per capita and price are weakly exogenous except the currency broad money ratio for which the null is rejected at 5 percent significance level. The importance of testing for weak exogeneity is that if all the variables in the cointegration vector are not weakly exogenous, then it is not valid to move to a single equation approach when estimating the short run model. Siklos (1993) has indicated that though the institutional factor is important to maintain long run relationship, it is criticized as it fails to pass the test for weak exogeneity.

## **5.3 Dynamic Specification of Income Velocity Model**

In this section we estimate the dynamic error correction model for each income velocity function. As Harris (1995) indicated it is important to consider the short run evolution of the variables since long run equilibrium may rarely be observed as a result of the inability of economic agents to adjust to changes instantaneously. The error correction model relates the short run change in the dependent variable [by first differencing the I(1) series

which becomes  $I(0)$ ] to the short run change in the explanatory variables but captures the long run effect through the error correction term (Adam,1992).First differencing and regressing using OLS will throw away potential valuable information about the long run relationships which economic theories may postulate (Maddala,1992). Therefore to integrate short run dynamics with long run equilibrium and to obtain information on equilibrium relationship with in a stationary, and thus statistically consistent, model error correction method is employed.

Based on the results on cointegration and weak exogeneity test, we have developed a multiple equation model for the income velocity functions. As explained in the previous section, since all the explanatory variables are not weakly exogenous, there will be a loss of information by estimating a single equation system. Hence currency money ratio is treated as an endogenous variable when the error correction model is estimated.

The error correction terms in the error correction model are obtained from the long run equilibrium models estimated when testing for cointegration using Johansen procedure. A two period autoregressive distributed lag model is initially imposed on all the variables except the error correction term in each short run income velocity equation. A general to specific procedure is employed which involves simplifying the model into a more interpretable and parsimonious characterization of the data by reducing sequentially insignificant variables based on t- test statistics. At each stage of reduction an F test for model reduction and diagnostic test are carried out to check that the reduction is reasonable.

The following tables (6 & 7) report the restricted parsimonious error correction models estimated using 2 stages least squares for income velocity of money based on broad ( $V_2$ ) and narrow ( $V_1$ ) definitions of money respectively.<sup>17</sup>

**Table 7 : Equation (1) Modeling  $\Delta LV_2$  by 2SLS: Sample is 1960 - 1998.**

| <i>Variable</i>     | <i>Coefficient</i> | <i>Standard Error</i> | <i>t-Value</i> | <i>t-probe</i> |
|---------------------|--------------------|-----------------------|----------------|----------------|
| $\Delta LI/Y$       | -0.5567            | 0.3389                | -1.643         | 0.1121         |
| $\Delta Ly/n$       | -0.7911            | 0.2750                | -2.877         | 0.0078         |
| $\Delta LC/M_{2-1}$ | -0.2198            | 0.1307                | -1.681         | 0.1042         |
| $\Delta LP-1$       | 0.7729             | 0.2442                | 3.165          | 0.0038         |
| $ECM-1$             | -0.1771            | 0.0406                | -4.359         | 0.0002         |
| <i>Constant</i>     | -0.6453            | 0.1343                | -4.805         | 0.0001         |

Diagnostic Tests:

F –tests on retained regressors, F(3,25)

|               |                    |                     |                    |
|---------------|--------------------|---------------------|--------------------|
| $\Delta Ly/n$ | 3.08393 [0.0456]*  | $\Delta LI/Y$       | 1.01263 [0.4131]   |
| $\Delta LP-1$ | 4.88308 [0.0083]** | $\Delta LC/M_{2-1}$ | 1.01629 [0.4021]   |
| $ECM-1$       | 10.2934 [0.001]**  | <i>Constant</i>     | 11.2622 [0.0001]** |

$\delta=0.0607$   $R^2$  (LR) = 0.730

AR 1-2F(2,25) = 1.3343 [0.2814]

Normality: Chi-sq(2)=2.0031 [.3673]

ARCH:F(1,25)=0.19731 [0.6607]

Chi-sq F(10,16)=0.17828 [0.6973]

Notes: Values in square brackets are probability values.

$\Delta$ - difference operator; \*-denotes significance at 5 % level; \*\*-denotes significance at 1 % level ;ECM- error correction term.

<sup>17</sup> Although simultaneous equations are estimated, we reported the income velocity functions as we are not interested in the other equation which takes the currency money ratio as an endogenous variable.

**Table 8 : Equation (2) Modeling  $\Delta LV_1$  by 2SLS: Sample is 1960 - 1998.**

| <i>Variable</i>   | <i>Coefficient</i> | <i>Standard Error</i> | <i>t-Value</i> | <i>t-prob</i> |
|-------------------|--------------------|-----------------------|----------------|---------------|
| $\Delta Ly/n$     | -0.9273            | 0.2941                | -3.153         | 0.0038        |
| $\Delta LC/M_2-2$ | 0.1772             | 0.1267                | 1.398          | 0.1731        |
| $\Delta LP$       | 0.6598             | 0.2568                | 2.569          | 0.0158        |
| $\Delta LP-2$     | 0.73894            | 0.2281                | 3.239          | 0.0031        |
| $ECM-1$           | -0.1121            | 0.0546                | 2.053          | 0.0499        |
| <i>Constant</i>   | -0.1004            | 0.0180                | -5.568         | 0.0001        |

Diagnostic Tests:

F –tests on retained regressors, F(2,27)

|               |                   |                   |                   |
|---------------|-------------------|-------------------|-------------------|
| $\Delta Ly/n$ | 5.38129 [0.0108]* | $\Delta LC/M_2-2$ | 1.17484 [0.3242]  |
| $\Delta LP$   | 5.2402 [0.0119]*  | Constant          | 17.9119 [0.000]** |
| $\Delta LP-2$ | 5.3213 [0.0113]*  |                   |                   |
| $ECM-1$       | 4.0046 [0.0300]*  |                   |                   |

$\delta = 0.0651$   $R^2 (LR) = 0.747$

AR 1-2F(2,26) = 0.89368 [0.4213]

Normality: Chi-sq(2)=4.3473[0.1138]

ARCH:F(1,26)=0.33472 [0.5679]

Chi-sq F(12,15)=0.39006 [0.9464]

Notes: Values in square brackets are probability values.

$\Delta$ - difference operator; \*-denotes significance at 5 % level; \*\*-denotes significance at 1 % level ;ECM- error correction term

Tables 7 and 8 include diagnostic statistics to assess the quality of the error correction models. The tests indicate that the models are consistent with the data. Unless all

regressors are strongly exogenous and the error process is strictly AR(1), the standard Durbin Watson statistic is not a sufficient test for autocorrelation ( Adam, 1992). The LM test for autocorrelated residuals is valid for systems with lagged dependent variable. In both equations (1&2), the null of no autocorrelation is not rejected. In addition, the Jarque Bera normality test which tests the distribution of the error terms ( as the efficiency and consistency of OLS is based on the normal distribution of the error terms) is not rejected in both equations. Furthermore, the ARCH test in both cases show the absence of autoregressive conditional heteroscedastic errors.

The results reveal that in both equations the error correction terms, which measure the speed of adjustment to equilibrium, are negative and significant. The F tests indicate that the error correction terms are significant in both equations. The F statistics, which involves the null hypothesis that the coefficient is zero is rejected at 1 percent significance level in equation 1, and 5 percent level in equation 2. The significance of the error correction terms supports the previous conclusion that velocity is cointegrated with its determinants. The estimated coefficients of the error correction terms are  $-0.177$  and  $-0.112$  for income velocity based on money broadly defined ( $V_2$ ) and income velocity based on money narrowly defined ( $V_1$ ) respectively. This implies that 17.7 percent for  $V_2$  and 11.2 percent for  $V_1$  of the discrepancy between actual income velocity of money in the previous year to long run equilibrium is corrected each year.

The t values of per capita real income are significant for both measures of income velocity. Judging from the F tests, the estimates of coefficients in both equations are

significantly different from zero at 5 percent level. It is noted that per capita real income has a negative sign in accordance with Friedman's luxury "good" hypothesis. The inflation variable is also found to be positively related to velocity as expected. In the case of equation (1), the F test shows that the estimated lagged inflation coefficient is significantly different from zero at 1 percent level. In equation (2), both current and lagged inflation are found to have strong effect on velocity as the F tests indicate that the coefficients are significantly different from zero at 5 percent level.

The results also show that currency to broad money ratio does not significantly affect the behavior of income velocity judging from the t values as well as F tests in both equations which are insignificant. In equation (1), the coefficient of currency to broad money ratio is negative as opposed to the sign obtained in the long run model. Finally, the investment income ratio is correctly signed but with insignificant effect of the variable on velocity with money broadly defined. Since the effect of the variable on velocity with money narrowly defined is found to be very insignificant it has been dropped from the model.

### **5.3.1 The Stability of Velocity**

It is important to consider the stability of the velocity functions overtime, because if the relationship between velocity and factors incorporated into it change unpredictably, then we will be unable to tell the consequences of changes in the quantity of money (Laidler,1985). Thus for the quantity of money to be essential tool of economic policy, the velocity function must be stable and predictable.

In this section an attempt is made to test the stability of the error correction models. The most widely used test for structural stability of the velocity functions is to check for structural breaks in the model using Chow test. Hence the error correction models of equations 1 and 2 are re-estimated using the recursive Fiml over successive time periods by increasing the sample period by one additional observation for each estimation. Figures 4 and 5 plot the test statistics for recursive Chow tests and the critical values for rejecting the hypothesis of stability at 5 percent level for equations, 1 and 2 respectively. As can be observed from the figures for both velocity equations all the Chow test statistics are within the critical value indicating that the equations are stable and there are no statistically significant structural breaks as the Chow “break point ” F tests do not reject the null hypothesis of parameter constancy over the sample period.

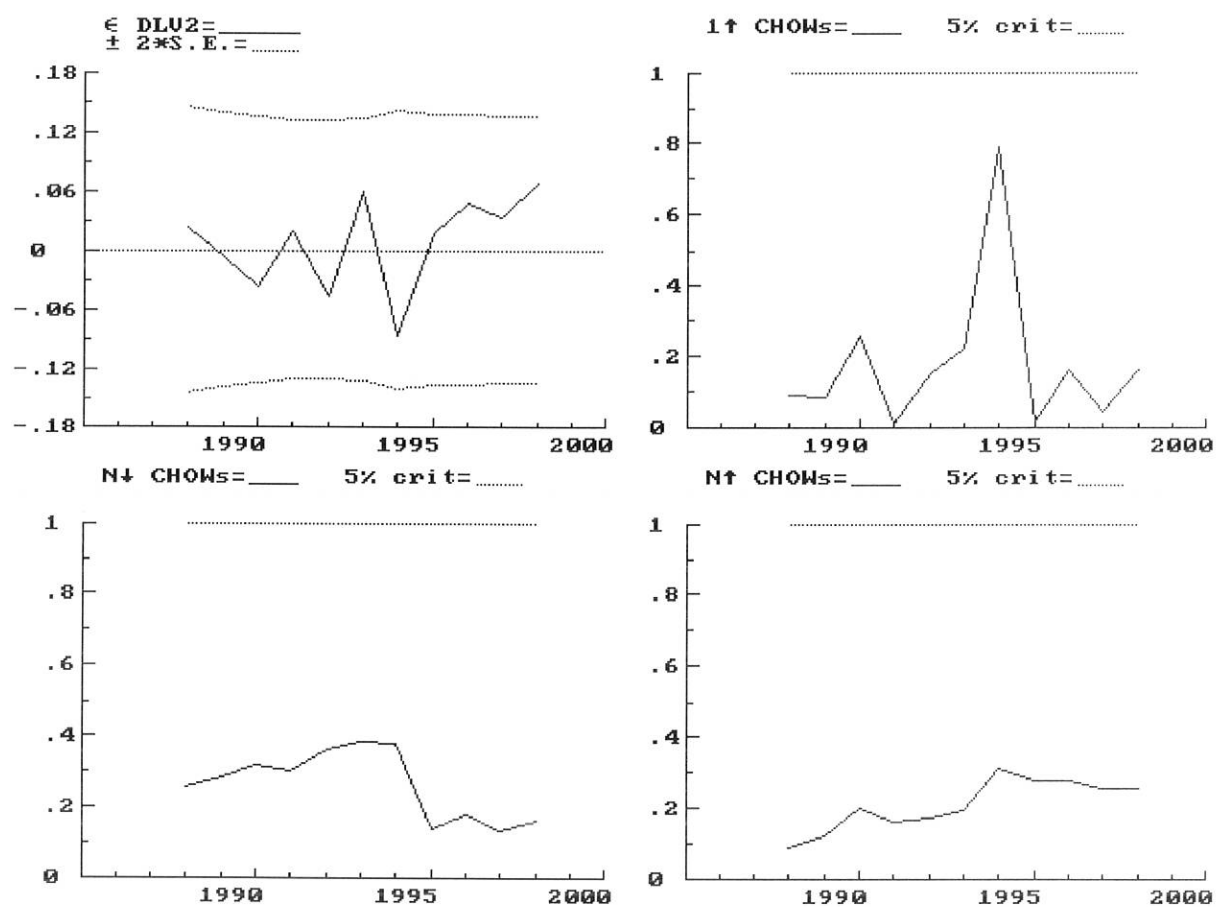


Figure 4: One Step Residuals and Break Point Chow Statistics for Equation (1)



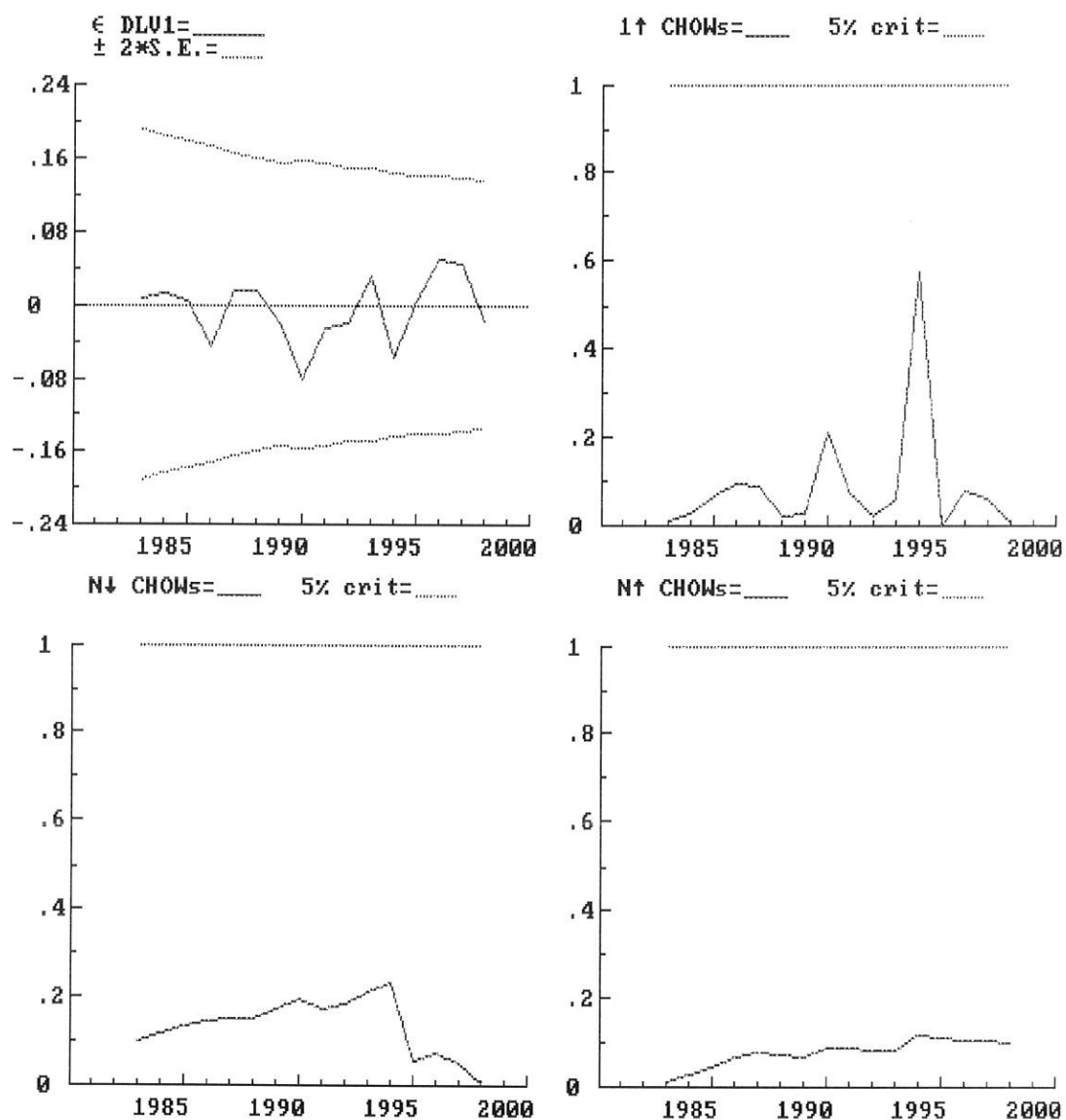


Figure 5: One Step Residuals and Break Point Chow Statistics for Equation (2)

## **Chapter 6**

### **CONCLUSIONS AND POLICY IMPLICATIONS**

This paper has attempted to study the factors that determine fluctuations in income velocity of money in Ethiopia. It is important to analyze the behavior of velocity and its stability because understanding changes overtime in the variables is considered as one way in which the problem of formulating monetary policy can be addressed. If the velocity function and the factors included into it are not stable then predictions about the effects of changes in monetary policy would be incorrect resulting in undesirable consequences in the economy.

In the empirical analysis we have used annual data and income velocity models are estimated for two definitions of velocity that is based on broad money ( $V_2$ ) and narrow money ( $V_1$ ). Conventional velocity functions have been estimated using time series data either in levels or first differences. However, recent econometric analysis has developed a technique, which combines the two specifications using theories of error correction and cointegration. Hence this study employed the Johansen and Juselius(1990) approach to determine the long run relationship and the dynamic structure of the velocity function. In formulating the velocity function, we have attempted to include factors that affect both the demand and supply of money as institutional and structural changes have important impacts in the monetary and financial system of the country.

Velocity is assumed to depend on per capita real income, which measures the country's level of economic development; the opportunity cost measure proxied by the inflation rate, currency money ratio which measures financial institution development, investment income ratio that reflects the complementarity between money and physical capital, and the price level. First the time series characteristics of the above variables have been established using the Augmented Dickey-Fuller (ADF) test and found that all the variables are integrated of order one except the inflation rate. Then cointegration tests using the Johansen approach have been carried out and the evidence shows that velocity (based on both monetary aggregates) is cointegrated with per capita real income, the price level, currency money ratio and investment income ratio.

The regression results show that per capita real income and velocity (based on both monetary aggregates) are found to be negatively related as hypothesized on the secular behavior of velocity in a developing country. Based on the estimated error correction model, the variables affect income velocity significantly. As Short (1973) points out the negative relationship between real per capita income and velocity has important implications for monetary planning stated in his own words, "How great a command over resources the government and banking system are able to obtain without causing inflation by issuing newly created money depends on the behavior of velocity of money during economic growth. If velocity falls as per capita real income increases, the money issuing authorities can issue more money and obtain a greater leverage on resources than if velocity were constant or rising."

On the issue of the relationship between income velocity of money and inflation, the evidence from the estimated error correction model show that inflation has a positive and significant impact on income velocity of money. The result supports the view that inflation is an important opportunity cost measure in a developing country like Ethiopia where other alternative financial assets are lacking.

As shown in the study, although the currency money ratio has significant impact on long run income velocity, it is found that it has insignificant impact in the short run. The investment income ratio is found to be negatively related to income velocity of money as expected but with weak explanatory power. The negative relationship reflects the complementarity between money and physical capital in contrast to the Keynesian hypothesis of the substitution effect between them.

A test of stability of income velocity functions based on broad and narrow definitions of money shows that the function has remained stable over the period of study. This implies that the velocity function may be used for policy purposes.

Finally it is important to mention some of the limitations of the study, First to obtain reliable and accurate results from any econometric analysis, the variables must be measured accurately and in line with theoretical definitions. But most variables in the study are proxies and subject to error limiting the reliability of the results obtained. For instance as explained earlier, the Ethiopian economy is characterized by economic dualism i.e. the coexistence of the monetised and non-monetised sector thus the gross

national income includes income from both sectors of the economy. However, the relevant portion in monetary analysis is the monetised component of income. Since data on this component is not available we are obliged to use the available income measure. The inflation variable is not also without problems since the price data available in the country can not be assumed to represent overall price movements because they generally represent price movements in the urban areas only. Moreover, based on the theoretical definition from Mckinnon's hypothesis, private investment, instead of gross fixed investment, should have been used. Again since data on private investment is not available we have used gross fixed investment. Furthermore, the proxy used for financial institution development, i.e. the currency money ratio, is also problematic since it is dependent on the money stock used to derive velocity, thus resulting in a feedback effect between the two variables. The other econometric problem is that of multicollinearity in data which must be considered when inferences on the estimators is made. A further study, which solves some of the problems mentioned above, would improve and extend knowledge about income velocity in the country.

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## **Appendix: Data Definitions and Sources**

This appendix provides the data used in the study and their sources. All the data in the analysis are annual and the sample period is from 1960-1998.

### **Monetary Aggregates**

The narrow definition of money includes currency in circulation and demand deposits.

The broad definition of money includes narrow money plus quasi- money (saving and time deposits).

Source: National Bank of Ethiopia, Annual Bulletin Various Issues.

### **Price Level**

The Addis Ababa Retail price index is used with base year 1963. The first difference of the logarithm of the price level is used to get the rate of inflation.

Source: National Bank of Ethiopia

### **Real Income per Capita**

The Gross Domestic Product divided by population measured at 1980/81 prices is used to proxy economic development.

Source: Ministry of Economic Development and Cooperation.

### **Investment Income Ratio**

Gross fixed investment divided by gross domestic product at current market prices is used to test the complementarity hypothesis between physical capital and money.

Source: Ministry of Economic Development and Cooperation.

### **Currency Money Ratio**

Currency in circulation divided by money broadly defined is used as a proxy for financial institution development.

Source: National Bank of Ethiopia, Annual Report, Various Issues

### **Velocity Measures**

Velocity of currency in circulation is obtained dividing gross domestic product at current market prices to currency in circulation.

Velocity of narrow money is obtained by dividing gross domestic product at current market prices to narrow money.

Velocity of broad money is obtained by dividing gross domestic product at current market prices to broad money.

Source: National Bank of Ethiopia and Ministry of Economic Development and Cooperation.

### **Dummy Variable**

Government change dummy, equal to unity in 1974 and 1992 and 0 otherwise.

## **DECLARATION**

The thesis is my own original work, has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

**Declared by:**

*Martha Kibur*

  
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