JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DETERMINANTS OF INCOME VELOCITY IN ETHIOPIA: 1970/71-2010/11

BY:

TIBEBU ALEMU

JUNE, 2014

JIMMA, ETHIOPIA
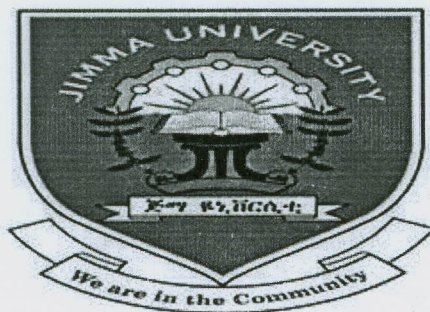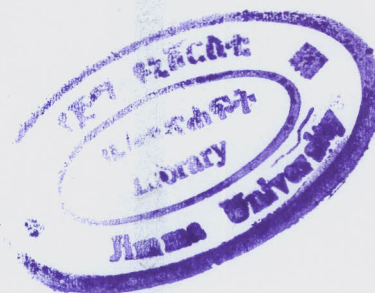
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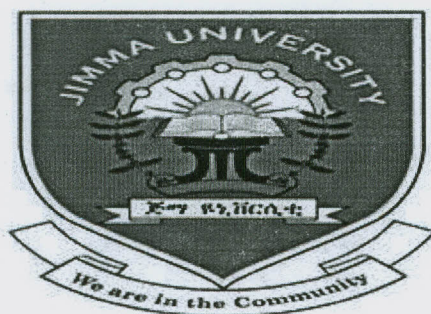MAIN ADVISOR: WENDWESEN SIYUM (ASS. PROFESSOR)

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A Thesis Submitted to the School of Graduate Studies of Jimma University In partial Fulfillment of the Requirements for the Degree of Master of Science in Economics (Economic Policy Analysis)

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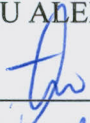
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I, the undersigned, declare that this MSc thesis is my original work and has not been presented for a degree in any university and that all sources of materials used for the thesis have been duly acknowledged.

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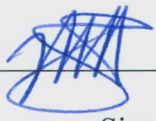
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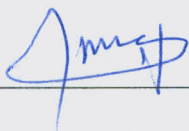
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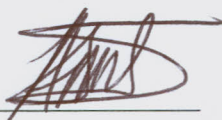
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My deepest and warmest thank goes to the Almighty God, who help me in all aspect of my life including the achievement of this program.

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ACRONYMS

ADF - Augmented Dicky Fuller

AIC - Akiake Information Criterion

ARDL- Auto regressive distributed lag model

ECM - Error Correction Mechanism

EG - Engle and Granger procedure

GGDP – growth rate of gross domestic product

FDE - Financial Development

GM1 – growth rate of narrow money definitions

GM2 – growth rate of broad money definitions

GNP -Gross National Product

GVM1 – growth rate of income velocity of narrow money definition

GVM2 – growth rate of income velocity of broad money definition

IMF - International Monetary Fund

INF – inflation

LCPI- logarithm of consumer price index

LFDE – logarithm of financial development

LM – Lagrange-multiplier test

LREER – logarithm of real effective exchange rate

LVM1 – logarithm of income velocity of narrow money definition

LVM2 – logarithm of income velocity of broad money definition

M1 – narrow money definition

M2 – broad money definition

Mo FED - Ministry of Finance and Economic Development

NBE - National Bank of Ethiopia

OLS - Ordinary Least Square

REER - Real Effective Interest Rate

SBIC - Schwarz Bayesian Information Criterion

VAR - Vector Auto Regressive

VECM -Vector Error Correction Model

VM1 - Income Velocity of Narrow Money Definition

VM2 - Income Velocity of Broad Money Definition

ABSTRACT

One of the most closely watched variables in order to design effective monetary policy is income velocity. Income velocity relates monetary aggregates to economic activity. In line with this, the present study has examined the determinants of income velocity of both narrow and broad money definition in Ethiopia between the period 1970/71 up to 2010/11 using multivariate co-integration analysis.

To achieve the objective of the study: unit root test, co-integration test and stability test are carried out. The result of unit root test shows that the series are stationary at first difference. The study suggest the existence of a unique and statistically significant relationship between the variables under consideration and income velocity of both money definitions. The stability test shows that the relationship is stable for both definitions of income velocity.

The result of Johansen co-integration test indicates economic growth and inflation has significant positive effect on income velocity of both money definition. The result implies that money issuing authorities cannot obtain additional power by issuing more money without generating high pressure on inflation. The result also shown that proxy of financial development has negative effect on both models which supports the hypothesis that the country economy might be operating at earlier stage of financial development. Finally, real effective exchange rate found to have positive effect on velocity of broad money definition. So, it is better to take in to account the stage of financial development and level of exchange rate in forecasting income velocity in Ethiopia.

Key-words: *income velocity, financial development Johansen co-integration test, monetary policy*

PART ONE

INTRODUCTION

1.1. BACKGROUND OF THE STUDY

The velocity of money or income velocity traditionally also called velocity of circulation and much earlier currency is the average frequency at which one unit of national currency is spent on new goods and services produced domestically with a given time period.

The velocity of money circulation is a central issue in monetary theory which has attracted attention for hundreds of years. Even though, inquire to velocity can be traced back to the earlier works in 1660s, most of the current studies of velocity is commonly attributed to the influential exchange equation presented by Irving fisher, in his influential book ''the purchasing power of money'', published in 1911. He developed the transaction based theory of money demand in which the demand for real balances is proportional to interest changes. In this theory the most import feature is that it suggests interest rate have no effect on the demand for money. Further, fisher considered velocity of money as fairly constant in the short run and nominal income is determined solely by the movements in the quantity of money. The main idea of fisher's theory is that velocity is constant (Wang and Qiu, 2005).

While fisher was developing his quantity theory approach to the demand for money, a group of classical economists in Cambridge, England which include Alfred Marshall and A. C. Pigou were studying the same topic. The Cambridge economists come up with the same equation with that of the fisher's equation of exchange. The same to fisher, Cambridge economists often treat velocity of money as a constant and agreed with fisher that nominal income is determined by the quantity of money. Both of them developed a classical approach to the demand for money in which the demand for money is proportional to income. However, the two approaches differ in that fisher give value for technological factors and ruled out any possible effect of interest on the demand for money in short run, whereas the Cambridge approach emphasized on individual choice and did not ignore the effects of interest rates (Mishkin, 2004).

John Maynard Keynes, in his famous 1936 book The General Theory of Employment, Interest, and Money, extended the Cambridge approach suggesting three motives for holding money i.e.,

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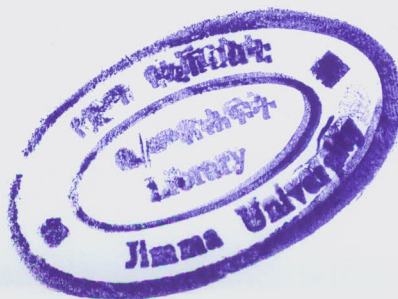
the transaction, precautionary and speculative motive for holding money. Keynes model of liquidity preference has important implication that velocity is not a constant but instead is positively related to interest rates, which fluctuate substantially. Keynes rejected constancy of velocity, though that the velocity is unstable. The Keynes's liquidity preference theory posed question on the classical quantity theory that the movement of the quantity of money determines the nominal income.

Milton Friedman developed a theory of the demand for money in 1956 in a famous article, '' the quantity theory of money a restatement." Friedman treated money as any other asset. He used the theory of asset demand to derive a demand for money as a function of the expected return on money and permanent income. Unlike, Keynes, Friedman viewed money and goods as substitutes, people choose between them when deciding how much money to hold. The assumption of money and goods are substitutes indicates that changes in the quantity of money may have direct effect on the aggregate spending.in contrary to Keynes. Friedman did not take the expected return on money to be a constant. He also suggests that changes in interest rates should have little effect on the demand for money and random fluctuations in the demand for money can be predicted accurately by the money demand function. The main thing in his theory is that he believed that the demand for money is stable and insensitive to interest rate changes.

In the school of economic thought there is no conclusive explanations of the aggregate money demand. The monetarists think that the stability of income velocity of money (V) is crucial, whereas Keynesian have criticized the notion of stability of velocity of money. Neo-Keynesians are less confident and argues the two disagreement is exaggeration. The quantity theory of money was generally supported the explanation of changes in money income until Keynes developed the income expenditure approach. It is common to now to speak of conflict between Keynesians on one hand in spite of the fact that modern monetarists accept much of the Keynesians analysis and many contributions of the monetarists are accepted by those labelled as Keynesians (Wang and Qiu, 2005).

The most influential model among money demand models for developing countries is '' the hypothesis of monetization'' which describes that the proposition of transactions made in money (monetization ratio) will keep growing as development continue. The monetary expansion is not only expected to meet the needs of income growth, but also to the newly monetized economy. In

this sense, the money supply above the growth rate of inflation and income growth is not ''excess money'' in the real sense, as it is used to meet the needs brought by the monetization instead of contribution to inflation (Baye, 2011).

1.2. STATEMENT OF THE PROBLEM

Money plays an important role in facilitating business transactions in a modern economy. Another effect of money on the overall growth and development of the economy is the point where monetary and fiscal policies play their roles. Theoretically, the quantity of money in the economy and its consistency with the absorptive capacity of the economy support the essence of the monetary policy (Rami, 2010).

A pre-request for monetary targeting strategy is a stable money demand function, which in turn needs the stability of velocity. The simplest way to inquire in to what happened to the money demand is to look at the behavior of the velocity of circulation (Siklos, 1993 and Omer, 2009). If we try to go further looking at velocity to estimate demand functions for the various definitions of money and obtain estimates of elasticity of demand for money, we encounter in a number of problems; there is very serious identification problem (how do we know whether we are estimating demand function, not supply function or some meaningless hybrid). Another problem is that we would expect the demand for money to fluctuate a lot; this is because it depends on expectations and by definition, it is easy to switch between holding money and other assets. The amount of money to hold is a short term decision that can be changed rapidly as expectations change. Finally, it is hard adequately to take account of the many institutional changes which have taken place, most of it which probably have major impact on the demand for money such institutional changes include changes in the way the financial system is regulated, changes in the roles of different financial institutions and changes in technology.

The study of the behavior of the velocity of income has aroused the interest of many researchers. The increasing research works on the behavior of money is as a result of its importance in setting convincing monetary policy programs. The volume of money supply and its speed of circulation relate money to the economic activity in a country. Therefore, the velocity of money is very important in the design and implementation of monetary policy. Indeed, the numerical value of velocity of money and its determining factors plays a major role in ensuring the effectiveness of

monetary policy for the purpose of ensuring price stability and rapid economic growth in any country (Akinlo, 2012).

The study of the behavior of income velocity is very crucial when the financial markets are underdeveloped and choices of monetary instruments are limited. Additionally, with interest rates ineffective, monetary operations mainly depend on targeting money aggregates. To set appropriate targets, a reasonable velocity path is essential. In Ethiopia, a working assumption in the past has been that velocity is declining by 2% each year, implying monetization and financial deepening. However, the recent inflation in Ethiopia posed serious question on the above approach. As IMF (2008), for the year 2004/05- 2006/07, inflation consistently exceeded the levels implied by the differentials between broad money and real GDP growth. While broad money growth undershot levels that are consistent with single digit inflation, assuming declining velocity, inflation average over 14 percent and was on average 7% points higher than the differentials between broad money growth and real GDP growth. This ''puzzle'' suggests a need to carefully examine the behavior of income velocity, specifically where inflation is high.

The search for predictable movements in velocity is closely related to studies on the determinants of and shifts in money demand. Studies in developing countries generally find evidence for stability of money demand, unit income elasticity and a statistically significant impact of inflation on money demand. In the case of Ethiopia, Sterken (2004) examined transactions demand for narrow money (m1) for 1966-94. His finding confirmed that money demand has stable and inflation has serious effect on money demand. In contrary to this find, Haile (2003) examined the behavior of money demand functions for 1970/71 to 2002/2003 in Ethiopia by estimating both narrow and broad definitions of money. His finding reveals that the money demand functions are unstable which contradicts with the finding of Sterken.

This reveals that there is a need for examining about the income velocity in developing countries. In developing countries context velocity may not be affected only by technical innovations, but also by the expansion of the financial sector, the monetization the economy, the growth of income among other things (Ramsaran, 1991). As to my knowledge, there is no relevant works done in the area of income velocity in Ethiopia. So, the present study identified and examined some of the determinants of income velocity in Ethiopia including financial development in the income velocity function.

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1.3. OBJECTIVE OF THE STUDY

Generally objective of the study is to identify key determinants of income velocity in Ethiopia from 1970/71 up to 2010/11 and give relevant recommendations which enables appropriate use of monetary policy.

The study specifically:

- ✓ Examine the trend of both narrow and broad definition of income velocity in Ethiopia from 1970/71 to 2010/2011;
- ✓ Examine the short run as well as long run determinants of both narrow and broad definition of income velocity;
- ✓ Give implications of the finding that would help the country to set appropriate policies.

1.4. SCOPE OF THE STUDY

Money is something measurable. The measurement of money is an empirical matter. There are different measures of money supply such as M0 which is currency, M1 is the sum of currency plus demand deposits, M2 is M1 plus quasi money(saving and time deposit), M3 is M1 plus net time deposits of banks and etc. (Gupta, 2007). In this study the narrow (M1) and broad money definitions (M2) has be used in order to examine the determinants of income velocity of narrow money (VM1) and broad money (VM2) in Ethiopia between the periods of 1970/71 up to 2010/2011.

1.5 SIGNIFICANCE OF THE STUDY

Studies conducted in developing countries suggests that the use of quantity theory of money to explain the demand for money which is not suitable. Also, the studies conducted were mainly used cross- country data particularly the studies are cross- country comparisons. Since, there is no relevant literature done directly on the behavior of income velocity in Ethiopia These study will provide relevant information for policy makers for designing proper policy. Additionally, it will help other researchers who are interested in these area as a base.

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1.6. LIMITATION OF THE STUDY

In Ethiopia, evaluating the quality of data, there is no adequate, consistent data in domestic sources. The main limitation of the study entirely relies on inconsistency data from different sources. So, the study resorted to use official original sources of Ministry of finance and economic development (Mo FED), International monetary fund (IMF) and National bank of Ethiopia (NBE).

1.7. ORGANIZATION OF THE STUDY

This paper is organized with five parts. Next to this introductory part, the second part comes, which provides a theoretical and empirical review on both demand for money and income velocity of various money definitions. The third part describes methods and procedures followed in the paper. The fourth part presents the descriptive and econometric analyses result obtained using the methods and procedures described in part three. Finally, summary of the main findings and some policy implications are discussed in part five.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

This chapter presents the various theories and empirical studies on the behavior of income velocity and money demand. The first part of the chapter deals with the theoretical literature and the second reviews the numerous empirical researches on the behavior of income velocity and money demand, both in developed and developing countries, including Ethiopia.

INTRODUCTION

Money possesses three interdependent functions, unit of account, medium of exchange and store of value. As a unit of account, money measures the values of economic resources with its representative value determined by a structure roughly described by traditional equation of exchange. The intrinsic value money had in the past was essential to the naive adjustment of its representative value. In modern economy, money is straightly the symbol of value; monetary authority has taken the responsibility to maintain money's representative value stable (Tao, 2001).

The representative value of money depends on two comparative magnitudes: the volume of transactions and the product of quantity and velocity of money. Right for this mechanism, unit of account relies on medium of exchange and store of value, since representative value may not be determined without the circulation of the stock of money. On the other hand, whenever and wherever money serves as medium of exchange or as store of value, it must at the same time serves as unit of account. So, unit of account is well harmonious with other functions of money. On the contrary, medium of exchange and store of value are distinct functions of money; which represent the motion character and the rest character of money respectively. The two opposite characters of money are indivisible from each other. As medium of exchange, money stops now and then for a short rest; as store of value, money moves early or late for liquidity, albeit the two characters are indirectly proportional to one asset.

Thus, money is an object of two characters, to judge which character is more essential depends on how to define money and how to observe money. The simple sum broad sense money dilutes the motion character by including large amount of less liquid assets; individual depositors deem their savings as rest assets, which have been liquid in the financial system that keeps solely for

society a minimum reserve. The most liquid asset for settlement; so the monetary authorities are likely to view the stock of money as relatively rest and absolute motion.

2.1 THEORETICAL LITERATURE

The income velocity of money is defined as the ratio of nominal income (that is, the birr value of income at current prices) to the money stock. If Y represents the real quantity of goods and services produced and P, the average price paid for these goods and services, then PY is the value of nominal income and V [=PY/M] is the income velocity of money, where M represents the money stock (Rami, 2010).

2.1.1. The equation of exchange

The origin of the quantity theory of money is attached to the classical theory, which states that all markets for goods continuously clear and relative price adjust flexibly to ensure that equilibrium is reached. Therefore, the economy is assumed to be always at full employment levels, except for temporary deviations caused by real disturbances, and the role of money is simply to serve as a unit to express prices and values.

Money facilitates the exchange of goods and services and its use satisfies double coincidence of wants, that is, it serve as a medium of exchange. Money is neutral; it does not influence the determination of relative goods price, real interest rates and aggregate real income. The role of money as a store of value is regarded as limited under the classical assumption of perfect information and negligible transaction costs. However, the classical economists recognized that some particular quantity of real money holdings would be needed by the economic entities under certain special circumstances. This therefore led to the formulation of the quantity theory of money (Tsheole, 2006).

The quantity theory of money explains the role of money as a medium of exchange. In this classical work, it is stated that money affects nothing but the price level. The quantity theory suggests a direct and propositional relationship between the quantity of money and the price level.

The theory has two alternative but equivalent expressions. The first version is the "the equation of exchange "associated with Irving Fisher and the second is the "Cambridge approach or cash balance approach".

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The equation of exchange by Irving Fisher formal stated as:

$$MsV_T = PT \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .2.1$$

Where

    Ms is the quantity of money in circulation

    V_T is the velocity of circulation or rate of turn over

    P is the price level and

    T is the volume or number of transactions

The equation says that total spending (MV) equals what is bought (PT). It is an equilibrium condition which shows that money is held simply to facilitate transactions and has no intrinsic satisfaction. In the equation of exchange $\overline{Ms}$ is the active variable, V_T and T are taken as constants; therefor changes in P result from changes in Ms. The money supply causes the price level to change.

$$\overline{Ms}\,\overline{V_T} = P\overline{T} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .2.2$$

Where bars over Ms, V_T and T shows that the variables are independently determined. By treating $\overline{Ms}$ as exogenous and having $\overline{V_T}$ and $\overline{T}$ as constant, the price level will vary in direct proportional to the quantity of money.

Quantity theorists assumed that total physical output and the income velocity of money are unaffected by changes in the money stock and can safely be assumed to remain constant in the short run. For given values of Y and V, the equation of exchange indicates that a change in the money stock of a certain percentage must result in a change in the price level of the same percentage. Thus, a necessary inference from the quantity theory assumptions regarding the insensitivity of the level of output and the income velocity of money to changes in the money stock is that the rate of price inflation is determined by the rate of change of the money stock and the "natural" growth rate of real output. Quantity theorists believed that the level of output in the economy is determined by the availability and productivity of land, labor, and capital and was not affected by the money stock (Xueping, 1999).

As mentioned by Higgins (1978) the view that "money is a veil" that only disguises the real functioning of the economy was expressed briefly by a leading proponent of the quantity theory, Irving Fisher:

" . . . *Except during transition periods, the volume of trade, like the velocity of circulation of money, is independent of the quantity of money. An inflation of the currency neither increase the product of farms and factories, nor the speed of trains or ships. . . . The whole machinery of production, transportation, and sale is a matter of physical capacities and technique, none of which depend on the quantity of money . . . .*"

Thus, Fisher assumed that the potential output of the economy is not affected in the short run by changes in the supply of money. In general, proponents of the quantity theory believed that the actual level of output is normally equal to the potential level of output. They denied that a situation in which there were unemployed resources could persist except during "transition periods" to full employment equilibrium. Thus, the quantity theorists' assumption that real output is unaffected by changes in the money supply resulted from their belief that the ability to increase output is at all times constrained by physical capacity limitations and the existing technology of production. The assumption that the velocity of money is constant was regarded as valid by the proponents of the quantity theory because the rate of turnover of money balances was believed to depend on economic and social relations that are unaffected by changes in the money stock. Taking Fisher saying as mentioned in Higgins (1978):

"The average rate of turnover . . . will depend on the density of population, commercial customs, rapidity of transport and other technical conditions, but .not on the quantity of money".

Given the various constraints imposed by the economic and social organization, the quantity theorists assumed that there is a fixed relation between total expenditures and the amount of money held to finance those expenditures. Thus, the demand for money was believed to depend only on the level of income and on social customs and institutional relationships.

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2.1.2 Cambridge version of the quantity of money

A number of economists from Cambridge University which includes A. Marshall and A. C. Pigou discovered an identical result with Irving Fisher in the analysis of the relation between money and the volume of transactions by using different approach. Cambridge economists did not studied the demand for money by looking solely at the level of transactions and the institutions that affect the way people conduct transactions as the key determinants. In The Cambridge Economists approach, individuals are allowed some flexibility in their decisions to hold money and are not completely bound by institutional constraints such as whether they can use credit cards to make purchases. Accordingly, the Cambridge approach did not rule out the effects of interest rates on the demand for money (Tillers, 2004).

Although there is Consistency in the two equations, the analyses conducted by Irving Fisher and the Cambridge economists differ noticeably (Xueping, 1999).
First, the theories developed by Irving Fisher and the Cambridge economists use distinctive approaches to the problem. The focus of the Cambridge quantity theory of money is not on the analysis of market equilibrium but on the choice of individual economic agents. In contrast to the Fisher theory concerning factors that affect the quantity of money needed for conducting transactions, the Cambridge theory focuses on the quantity of money that economic agents would like to hold under certain circumstances.

Second, in addition to an argument in the Fisher theory that money serves as a medium of exchange, the Cambridge economists view money also as a store of value; hence the volume of transactions is a significant yet not the only factor having an impact on the demand for money.

Finally, The Cambridge theory deals also with the role of wealth and interest rates. With wealth of economic agents increasing, the volume of financial assets (including money) held for storing wealth should have grown. Assuming that wealth, the volume of transactions and the level of income are proportional, the demand for money is also proportional to the nominal income. The Cambridge version of the equation of exchange focuses on the fraction, k, of income held as money balances. Thus, the Cambridge version can be expressed as:

$$M\,d = kPY \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..2.3$$

Where, Md is the demand for money in nominal terms

PY is the nominal level of income

K is the fraction of spending that people have and own in the form of money balances

When all other things are equal, Md is proportional to the nominal level of income (PY) for each individual. The k in the Cambridge equation is merely the inverse of V, the income velocity of money balances, in the original formulation of the quantity theory. The variable k might depend on other variables depending on individual choice or taste such as interest rate (opportunity cost) and wealth. If there is money market equilibrium, that is $\overline{Ms}$ V= PY we can obtain $Ms * (^1/_k) = \overline{Ms}$ V= PY. Since in equilibrium M = Ms = Md we then can have MV= PY, that is, an equivalent expression to quantity theory formulation. The variable V is determined by the institutional and technological factors; unlike in fisher's approach.

The important properties of this theory are that it accepts that money is a medium of exchange and can be held for transaction purposes, it recognizes the store of value functions and successfully draws attention to the possible effects of interest rates and expectations on demand for money. The major critics to the Cambridge economists money demand is that, they failed to explicitly treat interest rates in their theory as the determining factor for demand for money rather, interest rates are implied in the optimizing behavior of individuals.

2.1.3. Keynes's liquidity preference theory

In his famous book of The General Theory of Employment, Interest, and Money written 1936, John Maynard Keynes completely ignored the classic view that velocity was a constant and developed a theory of money demand that focused on the importance of interest rates. His theory of the demand for money, which he called the liquidity preference theory, asked the question: why do individuals hold money? He postulated that there are three motives behind the demand for money: the transactions motive, the precautionary motive and the speculative motive (Mutsau, 2013).

Transactions motive:

In the classical approach, individuals are assumed to hold money because it is a medium of exchange that can be used to carry out every day transactions. Following the classical way, Keynes emphasized that this component of the demand for money is determined primarily by the level of people's transactions. The transactions demand for money arises from the lack of synchronization of receipts and disbursements. In other words, people are not likely to get paid at the exact instant they need to make a payment, so between paychecks people keep some money around in order to buy materials. Keynes believed that these transactions were proportional to income, like the classical economists, he considered the transactions component of the demand for money to be proportional to income.

Precautionary motive:

Keynes went further than the classical analysis by recognizing that people hold money as a protection against an unexpected need in addition to holding money to carry out current transactions. Because people are uncertain about the payments the might want, or have, to make. If people do not have money with which to pay, they will incur a loss. When you are holding precautionary money balances, you can take advantages of the sale. Keynes believed that the amount of precautionary money balances people want to hold is determined primarily by the level of transactions that they expected to make in the future and that these transactions are proportional to income. Therefore, he considered the demand for precautionary money balances is proportional to income.

Speculative motive:

The transactions motive and the precautionary motive for money emphasized medium of exchange function of money, for each refers to the need to have money on hand to make payments. If Keynes had ended his theory with the transactions and precautionary motives, income would be the only important determinant of the demand for money, and he would not have added much to the classical approach. Keynes agreed with the classical Cambridge economists that money is a store of wealth and called this reason for holding money the speculative motive. He also considered that wealth is tied closely to income, the speculative component of money demand would be related to income.

Keynes believed that interest rates have an important role to play in influencing the decisions regarding how much money to hold as a store of wealth. Keynes divided the assets that can be used to store wealth into two categories: money and bonds. He also asked why individuals would decide to hold their wealth in the form of money rather than bonds. Keynes assumed that the expected return on money was zero in his time, unlike today. For bonds, there are two components of the expected return: the interest payment and the expected rate of capital gains. It is obvious that, when interest rates rise, the price of a bond falls. If you expected interest rates to rise, you expect the price of the bond to fall and suffer negative capital gains. In this case, people would want to store their wealth as money because its expected return is higher; its zero return exceeds the negative return on the bond.

Keynes assumed that individuals believe that interest rates moves towards some normal value. When interest rate are below the normal value, people expect the interest rate on bonds to rise in the future and so expect to suffer capital loss on them. Therefore, people will be more likely to hold their wealth as money rather bonds, and the demand for money will be high. In other way, if interest rates are above normal value, people expect interest rates to fall, bond prices to rise and capital gains to be realized. At higher interest rates, they are more likely to expect the return from holding a bond to be positive, thus exceeding the expected return from holding money. They will be more likely to hold bonds than money, and the demand for money will be quite low. From Keynes's view, one can conclude that as interest rates rise, the demand for money falls. Therefore, money demand is negatively related to the level of interest rates.

Putting the three motives together:

Keynes carefully distinguished between nominal quantities and real quantities. He reasoned that people want to hold a certain amount of real money balances --an amount that the three motives indicated would be related to real income Y and to interest rates i. Keynes developed the following money demand equation, known as the liquidity preference function, which says that the demand for real money balances Md/P is a function of i and Y:

$$Md/p = f(i,y)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots2.4$$
$$(-) \quad (+)$$

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Where the minus sign below i in the liquidity preference function means that the demand for real money balances is negatively related to the interest rate, and plus sign below Y means that the demand for real money balances and real income Y are positively related. Keynes thought that the demand for money is related not only to income but also to interest rates which is the major departure from Fisher's view of money demand in which interest rates have no effect on money demand (Mishkin, 2004).

Because the transactions motive and precautionary motive demand for money is positively related to real income Y, speculative motive demand for money is negatively related to interest rate i, the demand for real money balances Md/P can be rewritten as:

$$M d / p = L1(y) + L2(i) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.2.5$$

Where L1 means the transactions demand for money; L2 means the speculative demand for money. By deriving the liquidity preference function for velocity PY/M, we can see that Keynes's theory of the demand for money implies that velocity is not constant, but instead fluctuates with movements in interest rates. The liquidity preference equation can be rewritten as:

$$p / Md = 1 / f(i,y) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.2.6$$

Multiplying both sides of this equation by y and recognizing that Md can be replaced by M because they must be equal in money market equilibrium, we solve for velocity:

$$V = PY / M = Y / f(i,y) \dots\dots\dots\dots\dots\dots\dots\dots.2.7$$

It is know that the demand for money is negatively related to interest rates; when i rises, $f(i,y)$ goes down, and therefor velocity rises. In other ways, an increase in interest rates encourages people to hold lower real money balances for a given level of income; because of this, the rate at which money turns over (velocity) must be higher. This view implies that because interest rates have significant fluctuations, the liquidity preference theory of the demand for money shows that velocity has significant fluctuations as well.

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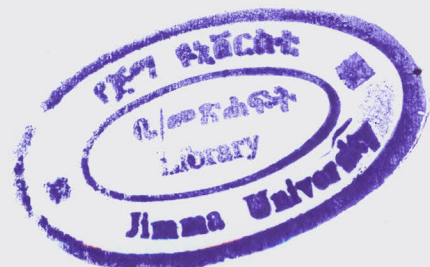
The Keynes model implies that money demand depends on the normal level of interest rates that cannot be directly observed. Changes in this level may figure as a second cause for unstable velocity of money.

2.1.4. Further Developments in the Keynesian Approach

2.1.4.1 The Tobin model

Keynes's analysis of the speculative demand for money was open to several serious criticisms. Criticism of John Maynard Keynes' analysis of the speculative money demand most often focuses on more straightforward assumptions, as the condition regarding the individual choice to either place capital in bonds or hold it as monetary assets does not in comprise a possibility of a portfolio diversification. In the objective of eliminating this shortcoming, James Tobin developed a speculative money demand model in which, along the expected return on assets, he incorporated risk of return on assets as an additional portfolio-formation factor.

According to this model, economic agents are not willing to assume risk. A constant expected return is a significant feature of monetary assets. That means, James Tobin considered a case of a zero expected return. In turn, bond prices may be subject to fluctuations, the return on them comprises risk, and a negative return is also possible. Hence risk-averse economic agents may still wish to use monetary assets for storing value, because in this way the portfolio volatility would be limited. James Tobin's analysis shows that portfolio diversification is possible by involving monetary assets, and hence, despite the zero return, money may serve as a medium for storing value. The model shows that individual will hold simultaneously bonds and money as a store of value. Tobin's argument for the speculative money demand seems to rest on more solid ground as his suggestions is probably a more realistic description of people's behavior than Keynes's (Gupta, 2007).

However, Tobin's attempt to improve on Keynes's rationale for the speculative demand for money was only partly successful. It is not clear still that the speculative demand exists. What if there are assets that have no risk like money but earns higher interest? Will there be any speculative demand for money? No, because an individual will always be better off holding such asset rather than money. Even if the resulting portfolio has no higher risk it will get a higher expected return.

2.1.4.2 Baumol-Tobin theory of the transactions demand for money

William Baumol and James Tobin independently developed similar money demand models, which showed that monetary assets held for conducting transactions might be affected by interest rates. It is assumed that an individual(household or firm) faces the following situations: a given income received periodically, cash purchases of equal amounts of spread over time throughout the period, option of holding transactions funds in the form of money or risk-free income- yielding bonds(or non-money financial assets) and given cost in exchanging bonds for cash per transaction. Then, the problem of the transactions demand for money presented as the problem of determining the optimal amount of cash the individual would hold. In other ways, this can be taken as the problem of minimizing the total cost of financing transactions. This cost has two components: interest foregone on the average of cash balances held and transactions cost of buying and converting bonds to money, if a part or whole of the transactions funds are first held in bonds and then changed into cash in instalments. Without any doubt, if too much cash is held the interest income foregone will be too high. Because of this, the optimal amount of transactions balances will be in somewhere in between and can be uniquely determined mathematically (Tillers, 2004).

If the total value of transactions made in a particular period is Y, the brokerage fee related to trading bonds is b and the interest rate is r, the minimization of total expenses leads to the amount of money required for transaction purposes:

$$M = \sqrt{by/2r} \dots\dots\dots\dots\dots\dots\dots\dots\dots 2.8$$

The analysis yields the following interesting results:

1). the optimal level of transactions cash increases with the total value of expenditures to be made during the period. But, it is found to be a function of the square root of total expenditures, implying strong economies of scale in an individual's transactions demand for cash. This is the most important result of the Baumol-Tobin theory of money demand and which goes against the neoclassical theory which proposes the transactions demand for money to be a proportional function of income or expenditure; and

2). the optimal level of transactions cash varies inversely with the rate of interest rate.

It should be understood that, in practice, the above results concerning the management of transactions cash are likely to be important for only large firms and organizations and not for small economic units.

The finding of Baumol-Tobin analysis can be putted as follows; as interest rates increase, the amount of cash held for transactions purposes will decline, which in turns implies that velocity will increase as interest rates increase. In other words, the transactions motive part of the demand for money is negatively related to the level of interest rates. The main idea in the Baumol-Tobin analysis is that in one side there is an opportunity cost of holding money that is the interest that can be earned on other assets. On the other side there is a benefit of holding money that is the avoidance of transaction costs. When interest rates rises, people will try to economize on their holdings of money for transactions purposes, because, the opportunity cost of holding money has increased. By applying simple models, Baumol and Tobin showed something that the transactions demand for money, and not just the speculative demand will be sensitive to interest rates.

2.1.4.3. Precautionary demand for money approach

Precautionary demand for money models have developed along similar lines to the Bamol-Tobin framework. The precautionary demand for money framework postulates that people are uncertain about the payments they might want, or have to make, hence there is demand for money balances for these unknown expenditures. People do hold money for this precautionary motive. The more money the person holds, the less likely that the person incurs the costs of illiquidity. There is, however a trade-off between money and interest. That is, the higher money the person holds, the higher interest is forgone. The precautionary demand for money approach argues that people optimize the amount of money held for precautionary purposes by carefully weighing the interest costs versus the advantage of not being caught insolvent. Therefore, the precautionary demand for money is negatively related to interest rates. The implication of precautionary models is that an increase in the overall volume of transactions would lead to a less than proportional increase in money holding. So, we have similar result to the one found for the Baumol-Tobin analysis that is, the precautionary demand for money is negatively related to rates of interest (Mishkin, 2004).

2.1.5. Friedman's modern quantity theory of money

Building on the work of earlier scholars, including Irving Fisher of Fisher Equation fame, Milton Friedman improved on Keynes's liquidity preference theory by treating money like any other asset. Although Friedman in his analysis of demand for money frequently reference to Irving Fisher, actually his work is closer to that of Keynes. He concluded that economic agents (individuals, firms, governments) want to hold a certain quantity of real, as opposed to nominal, money balances. If inflation erodes the purchasing power of the unit of account, economic agents will want to hold higher nominal balances to compensate, to keep their real money balances constant. As Friedman argued, the level of those real balances was a function of permanent income (the present discounted value of all expected future income), the relative expected return on bonds and stocks versus money, and expected inflation. The same to Keynes, Freidman accepted that people wants to hold certain amount of real money balances (quantity of money in real terms) (Lothian, 2009).

Formally the Friedman money function is as follows:

$$Md/_p = f(Yp, rb - rm, re - rm, \pi e - rm)\dots\dots\dots\dots 2.9$$

$$(+) \quad (-) \quad (-) \quad (-)$$

Where Md / p = demand for real money balances (Md = money demand; P = price level)

Yp = Friedman's measure of wealth, known as permanent income

(Technically, the present discounted value of all expected future

Income, but more easily described as expected average long-run income)

rb = expected return on bonds

rm = expected return on money

re = expected return on equity (common stocks)

πe = expected inflation

f means "function of" (not equal to)

<+> = increases in

<-> = decreases in

The term $rb - rm$ and $re - rm$ explains the expected returns on bonds and equity relative to money and $\pi e - rm$) represents the expected returns on goods relative to money.

So, the demand for real money balances, according to Friedman, increases when permanent income increases and declines when the expected returns on bonds, stocks, or goods increases versus the expected returns on money, which includes both the interest paid on deposits and the services banks provide to depositors. This all makes perfectly good sense when we think about it. If people suspect they are permanently wealthier, they are going to want to hold more money, in real terms, so they can buy caviar and fancy golf clubs and what not. If the return on financial investments decreases as compared to money holding, they will want to hold more money because its opportunity cost is lower. If inflation expectations increase, but the return on money does not, people will want to hold less money, ceteris paribus, because the relative return on goods (land, gold, turnips) will increase. In other words, expected inflation here proxies the expected return on nonfinancial goods.

The modern quantity theory is generally thought superior to Keynes's liquidity preference theory because it is more complex, specifying three types of assets (bonds, equities, goods) instead of just one (bonds). It also does not assume that the return on money is zero, or even a constant. In Friedman's theory, velocity is no longer a constant; instead, it is highly predictable and, as in reality and Keynes's formulation, pro-cyclical, rising during expansions and falling during recessions. Finally, unlike the liquidity preference theory, Friedman's modern quantity theory predicts that interest rate changes should have little effect on money demand. The reason for this is that Friedman believed that the return on bonds, stocks, goods, and money would be positively correlated, leading to little change in $rb - rm, rs - rm$ or $\pi e - rm$ because both sides would rise or fall about the same amount. That insight essentially reduces the modern quantity theory to $Md/P = f(Yp < +>)$ (Tillers, 2004).

When comparing the money demand frameworks of Friedman and Keynes, several differences arise:
1). Friedman considers multiple rates of return and considers the relative returns to be important;
2). Friedman viewed money and goods as substitutes;
3). Friedman viewed permanent income as more important than current income in determining money demand

Friedman's money demand function is much more stable than Keynes. This because of the terms considered in Friedman's money demand function: permanent income is very stable, and the spread between returns will also be stable since returns would tend to rise or fall all at once, causing the spreads to stay the same. This implies that, In Friedman's model changes in interest rates have little or no impact on the demand for money. This is not true in Keynes' model. Finally, if the terms affecting money demand are stable, then money demand itself will be stable. Also we can conclude that, velocity will be fairly predictable.

2.2. EMPIRICAL LITERATURE

Empirical evidence on the trends in income velocity in advanced countries is adequate and quite clear. For less developed countries it is not only inadequate but difficult to compare because of different time periods taken and the data used. Below empirical literatures on behavior of income velocity and demand for money is reviewed. These is because of as Friedman and Schwartz (1982) mentioned the analysis of the behavior of velocity is an analysis of the demand for money.

Bordo and Jonung (1986) constructed a global velocity curve for both narrow and broad measure of velocity by using data for more than 80 countries from early 1950's to the early 1980's. In order to limit the number of countries studied, they excluded all countries with a population of less than 2.5 million inhabitants in 1975 and countries for which less than nine consecutive observations of velocity exists. They adopted the grouping of the world economies suggested by the World Bank in the world development report 1983. In the report the following four major groups of countries isolated : (1) industrial market economies with an average GNP per capita of $11,120 in 1981, (2) upper middle –income economies with an average GNP per capita of $ 2,490 in 1981, (3) lower middle-income economies with an average GNP per capita of $850, and (4) low-income economies. The four groups are of roughly equal size: there are 19 industrialized countries, 19 upper middle – income economies, 27 lower middle –income and 19 low-income countries. The finding reveals that velocity displays a u- shaped pattern. The u- shaped pattern of velocity is explained by an approach which they stressed on the influence of institutional factors. On secular basis the downward trend in velocity is due to a process of monetization while the upward trend is explained by financial development.

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Bordo *et.al* (1993) tried to study the common features in velocity, income and interest rates across industrialized countries. The countries considered in the study are Canada, the U.S., the U.K, Norway and Sweden relying on a sample of annual observations for a century starting from 1870 up to 1986. With the same sample period and countries considered in the sample, Siklos (1993) also analyzed the nature of the long run relationship among traditional and institutional determinants of velocity. The researchers followed Johansen procedure testing techniques to analyze their data. Their finding give support for the view that there exists a unique long run relationship in velocity but not income and interest rates and the common feature in velocity is more apparent after World War II than before it. However, before World War II, common features in velocity are more apparent for the U.S. and Canada, and separately, for Norway and Sweden. Both of them showed that only a model which includes institutional change proxies possesses a single common stochastic trend in the pooled time series, as well as long run elasticity consistent with theoretical predictions except for U.S in Siklos (1993) result. In addition, Siklos (1993) found that a conventional model of velocity was found to be statistically unstable in the long run. Finally, the hypothesis of the researchers that proxies for institutional change can improve our understanding of the long run behavior of velocity for a cross-sections of countries is certainly relevant.

Tillers (2004) and Tsheole (2006) examined the demand for broad money in Latvia and Botswana respectively by using annual data. Tillers (2004) analyzed demand for money from the period 1977-1995 and Tsheole (2006) used the period between 1974 and 2003. The researchers followed VAR approach to analyze the data. Their finding confirms the existence of stable money demand in both countries.

Akinlo (2012) and Altayse and Adamy (2013) analyzed the impact of financial development on velocity of money in Nigeria and Sudan (under interest free financing) respectively. Akinlo (2012) used quarterly data from 1986: I up to 2010: IV whereas Altayse and Adamy (2013) used annual data from 1992 up to 2012 to analyze the data by Johansen procedure. The researchers used different proxy of financial development, Akinlo (2012) used time deposit currency ration and Altayse and Adamy (2013) used demand deposit currency ratio. Both of them found that the existence of unique and statistically significant relationship between financial development and velocity of narrow money. Their result shows that per capital income and financial development

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has significant positive effect on income velocity. Additionally, Akinlo (2012), reveals that the estimated parameters of the financial development is significant only in the long run for velocity of broad money.

Akhtaruzzaman (2008), Gill (2010) and Nunes, et al (2005) identified the determinants of income velocity in Bangladesh, Pakistan and Portugal respectively. Gill(2010) and Nunes, *et.al* (2005) examined income velocity of broad money from 1973/74 up to 2005/2006 and 1854 up to 1998 respectively whereas Akhtaruzzaman (2008) examined velocity both narrow and broad money from1973:I up to 2007:V. The researchers used co integration and vector auto regression techniques to identify the determinants of income velocity. Their finding confirmed financial development as a major determinant of income velocity. Further, the finding of Gill (2010) and Akhtaruzzaman (2008) suggests that economic growth and inflation is major source of variation in income velocity.

In same way, Bodgan (2002) and Omer (2009) assessed behavior of money velocity. Bodgan (2002) followed VAR approach to analyze the behavior velocity of narrow money from 1996 up to 2002 in Romania. Omer (2009) used Auto regressive distributed lag model (ARDL) to examine the long run behavior of logarithm of currency velocity (LV0), narrow money velocity (LV1) and broad money velocity (LV2) from 1975 up to 2006 in Pakistan. In contrast to the finding of Gill (2010), Omer (2009) and Akhtaruzzaman (2008), Bodgan (2002) result showed income velocity is less influenced by output variability and he found that it is mainly governed by exchange rate. Additionally, the finding of Omer (2009) reveals that LV0 and LV2 is independent of interest rate which contradicts with the result of Gill (2010). Finally, Omer (2009) found that income, interest rate and inflation significantly affects LV1.

In Ethiopia as to my knowledge there is no literature directly done the income velocity. Give the limitation of directly assessing the behavior of demand for money, there is limited number of literature done around money demand in Ethiopia.

Haile (2003) and Sterken (2004) examined the money demand equation for Ethiopia using annul data from 1970/71 up to 2002/03 and quarterly from 1966 up to 1994 respectively. Haile (2003) examined the behavior demand for both narrow and broad money definition whereas Sterken (2004) assessed the demand from narrow money. The two researchers applied different methods of analysis, Haile (2003) used Engle Granger two stage produce and Sterken (2004) followed VAR

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approach. Haile (2003) found that money both narrow and broad money definition is unstable in contrast to the finding of Sterken (2004) which showed the existence of stable narrow money demand in Ethiopia in the study period. The result of Haile (2003) can criticized by the method of analysis he applied even though it is possible to follow it, but there are many methods analysis that have advantage over Engle granger test such as Johansen procedures. Johansen overcome the drawbacks of the Engle-Granger two stage procedure: the low power of the test, the relative conservative critical values for the co integration tests based on the Augmented Dickey-Fuller (ADF) statistic used in earlier tests of co integration and it also not permits one to determine how many co integrating relationships exist between the series of interest (Siklos, 1993).

In summary, the quantity theory suggest a direct and proportional relationships between the quantity of money and the price level. The first version of the theory is the equation of exchange, which says that total spending equals what is bought. It gives support for constant income velocity. The second version, Cambridge approach, argued income velocity of circulation is determined by the institutional and technological factors even though regarded as exogenous. The finding of Gill (2010), Akharuzzaman (2008) and Nunes, *et.al* (2005) gives support for this view, which argued financial development as a major factor influencing velocity. This theory give attention to the possible effect of interest rates and expectations on demand for money. But, fails to treat interest rates explicitly as the determining factor in the money demand function.

Keynes money demand equation shows that interest rate and income has negative and positive effect on the real money demand respectively. He also argued that velocity is not constant, but instead fluctuates with interest rates. In contrast to this view, the finding of Bodgan (2002), Omer (2009) and Gill (2010) showed that VM1 is less influenced by output variability, LV0 and LV2 is independent of interest rate fluctuations.

Milton Friedman in his money demand analysis concluded that money demand is stable, which enables us to conclude that velocity is also stable. In support of this view, the findings of Omer (2009) found that stable LV1 and Tillers (2004) and Sterken (2004) found stable money demand. In contrast to the above finding Haile (2003) found unstable money demand.

Generally, given the limitation of directly estimating the demand for money and contradicting result obtained by researchers reveals that there is a need for empirically analyze the determinants of income velocity in Ethiopia.

PART THREE

3. METHODS AND PROCEDURES

In this part key determinants of income velocity were identified from theory with their expected sign and also methods of data analysis that used in the study where discussed.

3.1. DATA TYPE AND SOURCE

The study has used secondary data collected from different sources such as ministry of finance and economic development (Mo FED), National bank of Ethiopia (NBE) and International Monetary Fund (IMF). The data type under consideration is all time series in type.

3.2. MODEL SPECIFICATION

In the industrial countries unclear distinction between money and near monies may be one of the major factors underlying the stability issues of velocity. In the context of developing countries, velocity may be affected not only by technical innovations, but also by the expansion of the financial sector, the monetization of the economy, the growth of income among other things. Bordo and Jonung (1987) suggest that in addition to its traditional determinants, velocity is a function of institutional changes in the financial system. These institutional developments proceed roughly in two phases. First, most economies experience a monetization phase. During this period money is used more intensively to settle transactions. At the same time, the speed with which the banking system spreads throughout the economy produces rapid growth in deposits and notes. A second stage is characterized by growing financial sophistication, during this period the number of substitutes for notes and bank deposits grows (Bordo *et.al*, 1993).

Modern quantity theory indicates that the velocity function depends on some measure of income and price level. As discussed above, the rapid growth of institutions, especially the banking system, also affect the way people conduct their economic transactions. A measure of financial sector development should enter along with measures of income and inflation.

Provide the theoretical and empirical discussions in the earlier sections and following Akharuzzaman (2008) and Bodgan (2002) the below income velocity determinants are identified for econometric testing.

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Real Effective Exchange Rate (REER): REER represents real effective exchange rate and is expected to have positive coefficient. Depreciation of local currency causes a higher cost of holding local currency so that velocity should increase.

The national bank of Ethiopia defines real effective exchange rate as:

$$REERt = \sum_{t=1}^{n} \frac{Ci\ CPIh}{Ch\ CPIi}\ Wi \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..\dots3.2$$

Where Ci and Ch represents currency of ith country and the home economy respectively.

$CPIh$ and $CPIi$ are the consumer price indices of the home country and the ith country.

Wi is the trade weight of the ith country.

Financial development: As mentioned by Akhtaruzzaman (2008) there are many variables that can be considered as a proxy for financial   development i.e. growth of financial institutions that is, evolution of number of bank branches, financial innovation, demand deposit-currency ratio (DD/C), time deposit-currency ratio (TD/C), demand deposit-time deposit ratio (DD/TD) and etc. Financial institutions intermediate in sector by collecting funds from surplus spending individuals and giving loans to deficit spending business sector. In such process   the banks contribute to the economic development of a country. The bank outputs as a measured by deposit increases as the banking sector continue to develop. So, it is better to measure the financial development through the volume of deposits as banks contribute to economic development of a country through it.

 Most of developing countries lack alternative financial assets to money because of this people substitute demand deposit for time deposits as income increase. This implies that as financial development continues, banks collect more time deposit than demand deposit. In these study DD/TD were used as a proxy for financial development and it is expected to have positive or negative sign depending on stage of financial development of the country.

3.3. ECONOMETRIC TESTING

3 .3.1. Unit root test

Time series data many times faces the problem of non-stationary. When time series data are not stationary and used in econometric equation it leads to the problem of spurious regression.

$$(VMi)t = f(GDP, CPI, DD/TD, REER)t \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 3.1$$

Where   GDP = gross domestic product

DD/TD = demand deposit divided by time deposit (a proxy for financial development)

CPI   = consumer price index (a proxy for price)

REER = real effective exchange rate

$i = 1, 2$

t= time period

All variables are in logarithms.

Even though in the literature interest rate is assumed to have significant effect on income velocity. However, in Ethiopia interest rate is ineffective for long period of time and also National bank of Ethiopia changed the minimum deposit rate only twice in more than ten years. For this reason, in this paper interest rate is not included as determinant of income velocity in Ethiopia.

3.2.1. Variable Definition and their Expected Sign

Income velocity (VM1 and VM2): the income velocity measures that-were-used in this study are measured by gross domestic product in the numerator. The denominator money stock includes narrow money definition (M1) for VM1 and broad money definition (M2) for VM2.

Gross domestic product (GDP): The variable GDP is a measure of income and can have positive or negative effect on velocity. The way changes in GDP affect velocity depends on the assumption about the income elasticity of demand for money. If income elasticity of demand for money exceeds unit it has a negative impact on VM and vice versa.

Consumer price index (CPI): the price level is measured by the consumer price index. The effects of expected inflation can be interpreted in two ways, (1) if there is a one-time rise in the price level the demand for money may remain unchanged. (2), however, if continuous price increases are expected the public in general will try to reduce their demand for money and instead hold assets whose value is not adversely affected by inflation. In other words money is spent as soon as it is received. Thus in times of rising prices, velocity of circulation increases.

In order to avoid this problem it is necessary to investigate the time series data for their stationarity (Gujarati, 2003).

A time series variable is said to be stationary if its mean and variance are constant over time and the value of covariance between the two time periods depend on distance or lag. If the mean, variance, and auto covariance of the individual time series are not time-invariant, these time series are stationary. Stationary variables contain deterministic (fixed) trends, while non-stationary variables contain stochastic (i.e. random) trend (Maddala, 1992). To test for stationarity one alternative way that has recently become popular is known as the unit root test.

To test for unit root there are many approaches developed by different scholars. Augmented dickey fuller (ADF) test is used in this study.

It involves estimating the following regressions:

$$\Delta Xt = \delta Xt - 1 + \sum_{i=1}^{P} \psi i \, \Delta Xt - i + 1 + u1t \ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

$$\Delta Xt = ao + \delta Xt - 1 + \sum_{i=1}^{P} \psi i \Delta Xt - i + 1 + u2t \ldots\ldots\ldots\ldots\ldots\ldots (3.4)$$

$$\Delta Xt = ao + \delta Xt - 1 + \sum_{i=2}^{p} \psi i \Delta Xt - i + 1 + a2t + u3t \ldots \quad \ldots\ldots\ldots\ldots (3.5)$$

In short ADF test estimates the following regression:

$$\Delta Xt = ao + \delta 1t + \delta 2Xt - 1 + \sum_{i=1}^{k} \Delta \, \psi iXt - i + et \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.6)$$

Testing for unit roots using equation (3.3) assumes no intercept and time trend, equation (3.4) accounts for the existence of an intercept term and equation (3.5) is including intercept and deterministic term to test for the unit root (where t is the time or trend variable).

In each case, the *null hypothesis* is that $\delta = 0$; that is, there is a unit root—the time series is no stationary. The alternative hypothesis is that δ is less than zero; that is, the time series is stationary. Dickey and Fuller have shown that under the null hypothesis that $\delta = 0$, the estimated t value of the coefficient of X_{t-1} follows the tau (τ) statistic. These authors have computed the critical values of the *tau statistic* on the basis of Monte Carlo simulations (Gujarati, 2003).

In case the variables are found to be non-stationary after first difference, we repeat the test using the second difference as dependent variable ($\Delta 2Xt - 1$) and so on till we come up with stationary transformation of the original variable.

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The ADF-test tries to solve the problem of non-white noise residuals by adding lags of the dependent variable. It should be stressed that the ADF-test is quite adequate as a data descriptive device under the maintained hypothesis that the variables in a sample are integrated of order one.

In the above case if the individual time series are integrated of order one, I (1), and hence non-stationary the next step is to examine the co integration among the series.

3.3.2. Co-integration tests

Regressing a no stationary variable Yt upon a no stationary variable Xt may lead to a so-called spurious regression, in which estimators and test statistics are misleading. The use of non-stationary variables not necessarily results in invalid estimators. An important exception arises when two or more I (1) variables are co integrated, that is, if there exists a particular linear combination of these no stationary variables which is stationary. In such cases a long-run relationship between these variables exists. Often, economic theory suggests the existence of such long-run or equilibrium relationships (Verbeek, 2004).

Two time series Yt and Xt are said to be co integrated of order (d, b) where $d \geq b \geq 0$, if both time series are integrated of order d, and there exists a linear combination of these two time series, say $a1Yt + a2Xt$, which is integrated of order (d-b), in mathematical terms this definition is written as:

If $Yt \sim I(d)$ and $Xt \sim I(d)$, then $YtXt \sim CI(d,b)$ if $a1Yt + a2Xt \sim I(d-b)$ Where CI is the symbol of co integration

Granger (1983) introduced the notion of co integration to describe the relationship between two or more time series which appears to share a common trend as a statistical description of the long run in economics. A large literature has emerged which has refined and improved the original single equation testing procedure presented in Engle and Granger (1987; EG). A rapidly growing empirical literature also exists which has applied these tests to a variety of economic problems.

To determine whether the variables are integrated or otherwise, the study has applied the Standard maximum likelihood method of Johansen (1988) and Johansen and Juselius (1990). Among the qualities of Johansen's approach is that, unlike the EG procedure, it permits the investigator to determine the number of co integrating relationships which may exist between the series of

interest. In addition, Johansen's procedure enables one to perform a variety of tests of various restrictions imposed on a model. Also, since Johansen's procedure uses the vector autoregressive (VAR) approach all the variables are treated as endogenous. Finally, whereas the EG procedure is estimated via ordinary least squares (OLS), the Johansen procedure resorts to maximum likelihood estimation (Bordo *et.al*, 1993).

This test involves estimating the following unrestricted vector autoregressive (VAR) model:

$$Yt = Ao + \sum_{j=1}^{p} AjYt - j + \varepsilon t .... 3.7$$

Where Yt is an (n×1) vector of non- stationary I(1) variables, Ao is an (n×1) vector of constants, p is the number of lags, Aj is a (n× n) matrix of estimable parameters and εt is an (n× 1) vector of independently and identically distributed innovations. If Yt is co integrated, Equation (3.7) can be generated by a vector error correction model (VECM):

$$\varDelta Yt = Ao + \sum_{j=1}^{p-1} \Gamma j \varDelta Yt - j + \Pi Yt - 1 + \varepsilon t .... 3.8$$

Where $\Gamma j = -\sum_{i=j+1}^{p} Ai$ and $\pi = \sum_{j=1}^{p} Aj - I$. Δ is the difference operator, Γ and Π represents coefficient matrices, and I is an n × n identity matrix. The coefficient matrix Π is known as the impact matrix, and it contains information about the long run relations. Johansen's methodology requires the estimation of the VAR Equation (3.8) and the residuals are then used to compute two likelihood ratios (LR) test statistics that can be used in the determination of the unique co-integrating vectors of Yt. The co-integrating rank can be tested with two statistics: the trace test and the maximal eigenvalue test.

Trace Test

In the equation form, trace test is presented as:

$$\lambda trace = -N \sum_{i+r+1}^{M} ln[1 - (r*)2]\ldots\ldots\ldots\ldots\ldots\ldots3.9$$

Here, N is the number of observations; M is the number of variables; and $r*$ is the i correlation between ith pair of I variables. λ has a chi-square distribution with M-r degrees trace of freedom. Large values of λ give evidence against the trace hypothesis for fewer co-integration vectors.

Maximum Eigen value Test

According to Johansen and Juselius (1990), this test is more influential than the trace test. Maximum Eigenvalue test evaluates the null hypothesis H: r=0 against alternative hypothesis H: r=1. The following equation is considered for this test:

$$\lambda max = -Tln(1 - \lambda r + 1)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots3.10$$

The optimal lag length is chosen based on the minimum values of AIC (Akaike Information Criterion) and SBIC (Schwarz' Bayesian Information Criterion).

The existence of a long run relationship also has its implications for the short run behavior of the I(1) variables, because there has be some mechanism that drives the variables to their long run equilibrium relationship. This mechanism is modeled by an error-correction mechanism (ECM), in which the equilibrium error also drives the short run dynamics of the series. The ECM is given by:

$$\Delta Yt = \alpha 0 + \sum_{i=1}^{n} \beta i \, \Delta Yt - i + \sum_{i=0}^{n} \theta \Delta Xjt - i + \delta ECTt - 1\ldots\ldots\ldots\ldots\ldots3.11$$

Where, Δ denotes the first difference operator, $\Delta Yt - i$ is lagged first differences of the endogenous variable, $\Delta Xjt - i$ is the current and lagged first differences of the explanatory variables and $ECTt - 1$ is the error correcting term.

Finally, all the econometrics testing made in this study is conducted by using econometric software package STATA11 and EVIEWS6.

PART FOUR

4. RESULTS AND DISCUSSION

In this part trend income velocity and the results obtained by using the methods of estimation presented in part three is discussed with their interpretations. This includes the test results of unit root test, co integration test and the output of both the short run and long run relationships among the co integrated variables.

4.1. TREND IN INCOME VELOCITY

According to Bordo and Jonung (1987), over time velocity should form a U shaped curve, reflecting two opposite forces: monetization and financial innovation (emergence of money substitutes). Monetization—the rise of the monetary economy at the expense of barter—would increase demand for money. On the other hand, with modern financial innovations, complex transactions might require less money. The relative balance of these two forces would create velocity curves with three stages: (1) Velocity falls as monetization dominates. (2) Velocity is flat, with the two forces roughly balanced and (3) Velocity rises when financial innovation dominates.

In Ethiopia, in the sample period considered between 1970/71 up to 2010/11 income velocity exhibits a downward slope in years starting from 1970/71 up to 2002/03 both for narrow and broad money velocity. But, recently starting from 2002/03 the trend in velocity is showing an upward slope because of different reasons. The Figure below: 4.1 and Figure: 4.2 shows the trend in income velocity of both narrow and broad money definitions in Ethiopia respectively.

Figure: 4.1.The long run behavior of income velocity of narrow money between 1970/71-
2010/11
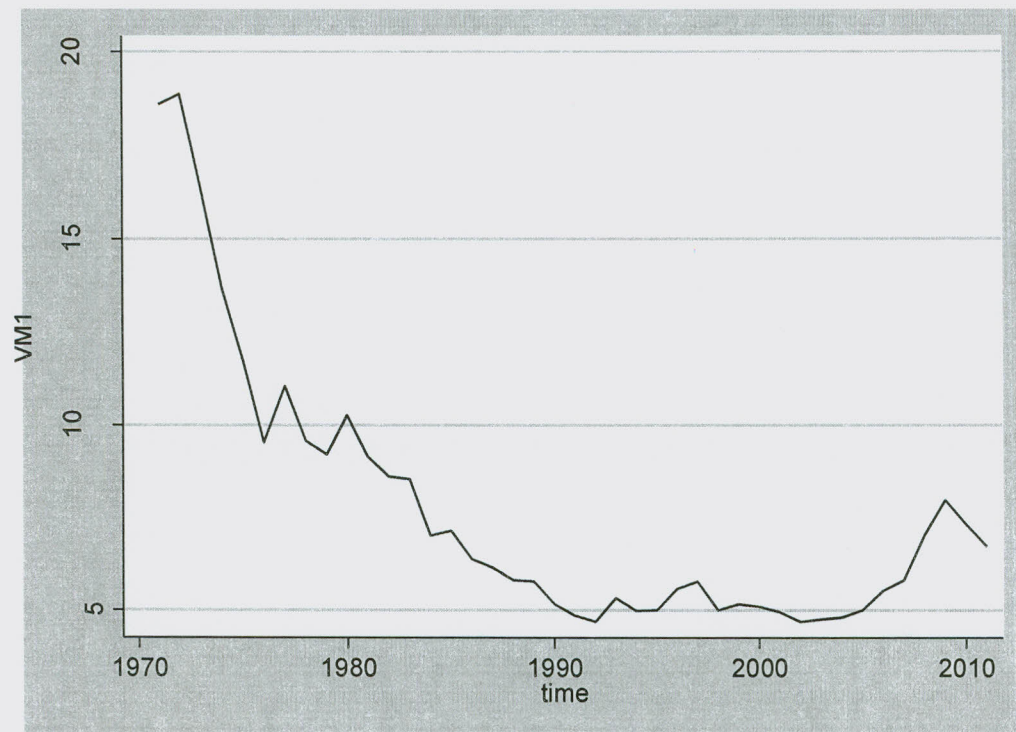
Source: NBE and own computation

One of main reason that can be associated with recent rising trend in income velocity is the double digit inflation recorded in the country. The high inflation rates seem to have reduced the incentives for holding money in the country and led to an increase in velocity in recent years. Inflation in Ethiopia has generally been modest rising temporarily when harvest were poor. However, since 2003/04 inflation stayed in double digits and continued to rise despite favorable harvests.

Figure: 4.2. The long run behavior of income velocity of broad money between 1970/71 –
2010/11
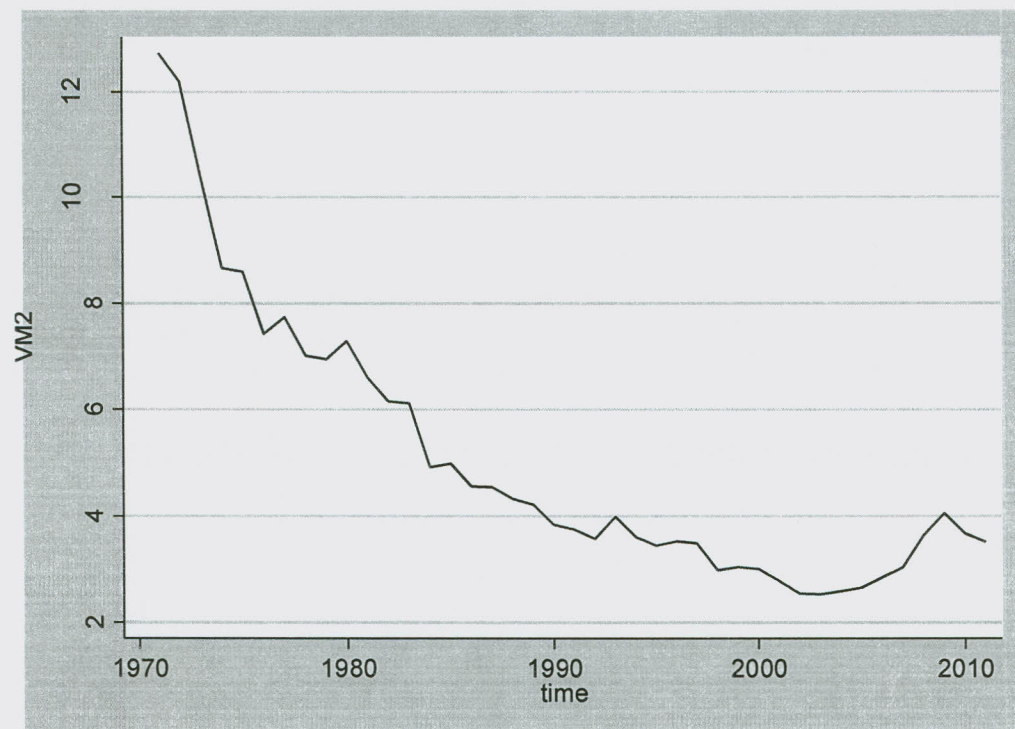
Source: NBE and own computation

Inflation also eroded the credibility of using money as a store of value. Because the real interest rate on deposit accounts was significantly negative and declining, people have been switching to consumption or alternative investment to hold their wealth. With limited presence of alternative financial investment in Ethiopia, high inflationary expectations appear to have caused a shift away from future consumption towards current consumption. This implies that rising income velocity.

The Table below: 4.1 shows the recent growth rate of income velocity both for narrow and broad money definition.

Table: 4.1. Growth rate of income velocity (in %)

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
GVM1	0.8767	0.40775	10.5499	5.0391	20.9588	13.3802
GVM2	1.9906	2.7371	7.2039	6.9548	19.9569	11.6144

Source: NBE and own computation

As seen from the above, income velocity showed an increasing growth rate and reaching an ever higher growth in the year 2007/08 both for the broad and narrow money velocity in the sample period under consideration.

In addition to the above, setting of money growth targets that are higher than the desired level of nominal GDP because of the working assumption can be the other reason for the recent increase in income velocity in the country. In the past, money growth remained typically around 10 percent. But, in recent years broad money growth has accelerated. The below table shows the growth rate of narrow and broad money definitions in Ethiopia.

Table: 4.2. The growth rate of narrow and broad money definition (in %)

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
GM1	8.9334	16.9893	18.04478	11.8397	24.3819	19.3557	19.1293	24.5102	45.2686
GM2	10.5283	15.7115	19.5881	15.3302	22.1541	20.3527	21.0139	26.5692	39.2073

Source: NBE and own computation

Even though now a days inflations is continuously declining, at the same time both narrow and broad money definitions are showing continuous increasing trend which will have a positive effect on income velocity.

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4.2. ECONOMETRIC TEST RESULT

4.2.1. Unit root test

Most Macro time series data tend to exhibits either a deterministic and /or stochastic trend. This implies that the variables are non-stationary. This means variables under consideration has mean, variances and covariance that are not time invariant. The direct application of ordinary least square to non-stationary data may result in regression which are misspecified or spurious in nature. Therefore, all the variables that are used in study were tested for unit root using Augmented-Dickey-Fuller test (ADF). In this test, there are three models: without intercept and trend, with intercept, and with intercept and trend. All the three model has the null hypothesis of the time series under consideration has unit root or is non stationary. The alternative hypothesis states that the series has no unit root or is stationary. The result of unit root test is presented in the below tables.

Table: 4.3. Result of Unit Root Test of Variables at Level

Variables at level	specification	ADF unit root test			
		Test statistics	1% critical value	5% critical value	p- value
LVM1	With no C and T	-1.549	-2.639	-1.950	
	With C	-2.331	-3.668	-2.966	0.1623
	With C and T	-1.329	-4.260	-3.548	0.8805
LVM2	With no C and T	-1.457	-2.641	-1.950	
	With C	-1.689	-3.668	-2.966	0.4369
	With C and T	-1.042	-4.251	-3.544	0.9381
LGDP	With no C and T	0.926	-2.638	-1.950	
	With C	0.067	-3.655	-2.961	0.9637
	With C and T	0.029	-4.251	-3.544	0.9945
LCPI	With no C and T	-0.836	-2.639	-1.950	
	With C	-2.240	-3.662	-2.964	0.1921
	With C and T	-2.226	-4.260	-3.548	0.4751
LREER	With no C and T	-0.911	-2.641	-1.950	
	With C	-0.566	-3.668	-2.966	0.8785
	With C and T	-2.284	-4.270	-3.552	0.4428
LDDTD	With no C and T	0.193	-2.638	-1.950	
	With C	-1.761	-3.655	-2.961	0.4002
	With C and T	-1.825	-4.251	-3.544	0.6925

Notes: The lag order for the series was determined by the SBIC and AIC

The above result in Table: 4.3 show that the null hypothesis of non-stationary cannot be rejected in the three models. Since the variables are non-stationary at level, next step is to check the first difference of the variables. The below Table: 4.4 shows the unit root test of variables at first difference.

Table: 4.4. Result of Unit Root Test of Variables at First Difference

Variables at first difference	specification	ADF unit root test			
		Test statistics	1% critical value	5% critical value	p- value
DLVM1	With no C and T	-3.328	-2.639	-1.950	
	With C	-3.502	-3.662	-2.964	0.0079**
	With C and T	-4.761	-4.260	-3.548	0.0005*
DLVM2	With no C and T	-3.136	-2.639	-1.950	
	With C	-3.466	-3.662	-2.964	0.0089**
	With C and T	-4.196	-4.260	-3.548	0.0045**
DLGDP	With no C and T	-4.152	-2.639	-1.950	
	With C	-4.271	-3.662	-2.964	0.0005*
	With C and T	-5.256	-4.260	-3.548	0.0001*
DLCPI	With no C and T	-4.677	-2.641	-1.950	
	With C	-4.677	-3.668	-2.966	0.0001**
	With C and T	-4.621	-4.270	-3.552	0.0010**
DLREER	With no C and T	-3.794	-2.642	-1.950	
	With C	-3.954	-3.675	-2.969	0.0017*
	With C and T	-4.064	-4.279	-3.556	0.0071**
DLDDTD	With no C and T	-3.669	-2.639	-1.950	
	With C	-3.717	-3.662	-2.964	0.0039*
	With C and T	-3.701	-4.260	-3.548	0.0223**

Notes: * and ** denotes the rejection of the null hypothesis of unit root at the 1% and 5% level of significance respectively.

As can be seen from the above result in Table: 4.4 the null hypothesis of non-stationary is rejected at the 1% and 5% level of significance. So, after taking first differences all variables become stationary. From this , it can be concluded that all the variables in the co-integration regression are first difference stationary that is, each series is characterized as integrated of order one (I(1)).

The result of formal unit root tests confirms that a standard regression result model is not appropriate for testing the relationship between both narrow and broad money velocity and other variables specified in the model. But, we can apply ordinary least square (OLS) by taking the first difference of the variables. However, there is a problem of losing long run relationships in the

approach of differencing. This problem can be solved by applying co-integration techniques, hence the need for testing for co-integration. The next step is to identify whether or not there is a co-integration relationships between the variables.

4.2.2. Test of co-integration

Once we have identified variables as non-stationary, the only way to infer about the long run relationship is to apply some co-integration techniques .Since we are now certain that the variables are integrated of order one (I (1)), the next step is to test if a long run relationship exists among the variables in our model. The Johansen maximum likelihood procedure is applied for this purpose to a vector auto regression (VAR) version of the equation. Variables LVM1, LGDP, LCPI, LREER and LDDTD for narrow money velocity and LVM2, LGDP, LCPI, LREER and LDDTD for broad money velocity are entered in the model. However, to implement Johansen we are not only required to determine the order of integration among the variables, the (r), but also an optimal lag length (k) must be chosen for the VAR system.

There are many tests that can be used to choose appropriate lag length. These are the Log Likelihood (LL), the Akaike information criteria (AIC), the Schwarz information criteria (SIC) and the Hannan-Quinn information criteria (HIC). The optimal lag length for this study is determined by using the two information criteria, which are multivariate information criteria: namely, Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC). Accordingly, the optimal lag length used in the both model of income velocity is found to be two and lag two is appropriate to carry the co-integration test. The result of lag order selection criteria is reported on the appendix A.

4.2.2.1. Test of co-integration

Having found that the optimal lag length two for both model of income velocity, we employed the Johansen maximum likelihood procedure to find out the number of co-integration relationships in a VAR version of the estimated equation. Two types of test statistics are used to determine the rank of the model in this study; namely the trace test and the maximum Eigen/likelihood ratio test. The trace test (λ trace) tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of n co-integrating vectors, where n is the number of endogenous variables, for

$r=0,1,2\ldots,n-1$. The maximum Eigen-value test, on the other hand, tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of $r+1$ co-integrating vectors.

Table: 4.5. Result of Johansson co integration test for Model One

Trace Test						
Null hypothesis	Alternative hypothesis	LL	Eigen value	Trace Statistic	5% Critical value	conclusion
R= 0*	R= $\geq$ 1	-7.8889774	-	73.6469	68.52	Single co - integrating vector
R $\leq$ 1**	R = $\geq$ 2	6.7925607	0.52900	44.2838	47.21	
R = $\leq$ 2	R = $\geq$ 3	16.713328	0.39876	24.4423	29.68	
R = $\leq$ 3	R = $\geq$ 4	24.329917	0.32335	9.2091	15.41	
R = $\leq$ 4	R = $\geq$ 5	27.866519	0.16587	2.1359	3.76	
Maximum Eigen value Test						
Null hypothesis	Alternative hypothesis	LL	Eigen value	Max Statistic	5% Critical value	conclusion
R= 0*	R = 1	-7.8889774	-	39.3631	33.46	Single co - integrating vector
R $\leq$ 1**	R = 2	6.7925607	0.52900	19.8415	27.07	
R = $\leq$ 2	R = 3	16.713328	0.39876	15.2332	20.97	
R = $\leq$ 3	R = 4	24.329917	0.32335	7.0732	14.07	
R = $\leq$ 4	R = 5	27.866519	0.16587	2.1359	3.76	

*Indicates rejection of the null hypothesis at 5% level of significance

** Shows the rank selected at 5% level of significance

The statistics of the Johansen's co-integration test in Table: 4.5 reveals that long-run relationship exist among the variables under study. Both the trace statistics and the maximum Eigen/likelihood ratio test results showed the presence of one co-integrating equations at 5% level of significance for this study. The trace test shows that the null hypothesis of r=0 co-integrating relation is rejected and the alternative r≥0 co-integrating vector is accepted. This means that there is one co-integrating equations because the null hypothesis of r≤ 1 could not be rejected in the next step. Additionally, the result of maximum Eigen value test shows the rejection of the null hypothesis of no co-integration presence on the basis of existence of one co-integration equation (tested at 5 percent significance level). This implies that the alternative hypothesis (H: r=1) one co-integrating equation could be accepted.

Similarly, for the second model, trace and Max-Eigen value statistics confirms the existence of one co-integrating vector. Thus, the existence of one co-integrated vector is supported by the empirical evidence, which implies that long-run relationship exist among the variables.

Table: 4.6. Result of Johansson co integration test for model two

Trace Test						
Null hypothesis	Alternative hypothesis	LL	Eigen value	Trace statistics	5% Critical value	Conclusion
R = 0*	R = ≥ 1	- 2.6560014	-	75.4447	68.52	Single co – integrating vector
R = ≤ 1**	R =≥ 2	14.728935	0.58997	40.6749	47.21	
R = ≤ 2	R = ≥ 3	24.677862	0.39963	20.7770	29.68	
R = ≤ 3	R = ≥4	31.185713	0.28376	7.7613	15.41	
R = ≤ 4	R =≥ 5	34.561759	0.15897	1.0092	3.76	
Maximum Eigen value Test						
Null hypothesis	Alternative hypothesis	LL	Eigen value	Max statistics	5% critical value	Conclusion
R = 0*	R = 1	- 2.6560014		34.7699	33.46	Single co - integrating vector
R = ≤ 1**	R = 2	14.728935	0.58997	19.8979	27.07	
R = ≤ 2	R = 3	24.677862	0.39963	13.0157	20.97	
R = ≤ 3	R = 4	31.185713	0.28376	6.7521	14.07	
R = ≤ 4	R = 5	34.561759	0.15897	1.0092	3.76	

*Indicates rejection of the null hypothesis at 5% level of significance

** Shows the rank selected at 5% level of significance

In order to determine the unique co-integrating vector, it is normalized on the LVM1 for the first model and LVM2 for the second model. The long run coefficients of income velocity for both definition of money are reported in Table: 4.7 and Table: 4.8.

Table: 4.7. Normalized long run coefficients of model one: LVM1 as dependent variable

variables	coefficients	Standard error	p-value
LVM1	1.0000	-	-
LRGDP	.8701658	.3503658	0.013
LCPI	-.0220844	.0046335	0.000
LREER	-.243435	.0757263	0.001
LDDTD	.3526628	.0432401	0.000
_cons	-7.134898		

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Table: 4.8. Normalized long run coefficients of model two: LVM2 as dependent variable

variables	coefficients	Standard error	p-value
LVM2	1.0000	-	-
LRGDP	1.561435	.5700249	0.006
LCPI	-.0433902	.0079943	0.000
LREER	-.5694023	.1224574	0.000
LDDTD	.2308279	.0735029	0.002
_cons	-9.215843		

4.2.2.2. The long run equation for model one

The Johansen co-integration test result reported in Table: 4.5 shows that there is one co-integrating equation among the variables included in model one. Based on this and by normalizing on LVM1 for the model, the result of long run equation is reported below.

$$LVM1 = 7.134898 - 0.8701658LGDP + 0.0220844LCPI + 0.243435LREER - 0.3526628LDDTD$$

$$(0.013) \qquad (0.000) \qquad (0.001) \qquad (0.000)$$

Diagnostic tests

Vector normality test: Jarque-Bera test

$$Chi^2(2) = 1.349 \ (0.50936)^*$$

Vector auto correlation test: Lagrange-multiplier test

lag	Chi^2	df	Prob > chi^2
1	25.6232	16	0.05957*
2	20.3741	16	0.20384 *

Ho = no auto correlation at lag order

*shows fail to reject the null hypothesis

Vector residual Heteroskedasticity tests

$$Chi^2(180) = 177.3315 (0.5423)$$

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After estimation of a long run model, it is advisable to check if the disturbances of the model are auto correlated and normally distributed. If the disturbances are auto correlated, it shows that there are some variables missing or there is some misspecification in the model. The LM test for auto correlation in the residuals of the long run model discussed in Johansen (1995) is implemented. Null hypothesis of the test is that there is no auto correlation at lag j. The null hypothesis of Jarque-Bera test normality test is the residual is normally distributed.

For the above model we cannot reject the null hypothesis that there is no auto correlation in the residuals up to a maximum of two lags, this implies the test gives no suggestions of model misspecification. In the same way, for the test of normality, we cannot reject the null hypothesis of normally distributed residual for the model of narrow money definition. Finally, we fail to reject the null hypothesis of homoscedasticity.

The result of the long run coefficient of all the first model of velocity are generally in conformity with our theoretical foundation. According to the result, logarithm of gross domestic product has a significant negative sign with LVM1. According to fry (1988) it indicates that the stage of economic development of Ethiopia is at lower stage. The result implies, other things being constant, one percent increase in the LGDP will decrease the LVM1 by 0.8701658 percent in the long run. This is in line with the finding of Ndanshau (1996) and Akhtaruzzaman (2008).

The result of the co-integration analysis shows that the proxy for financial development affects the income velocity of narrow money definition negatively. This implies that the lower the value of the proxy variable, the greater the level of financial development and the higher the income velocity. This result is consistent with the finding of Akhtaruzzaman (2008).

Additionally, LCPI and LREER found to have a significant and positive effect on LVM1. The result implies that for the consumer price index, a one percent increase in LCPI will increase the LVM1 by 0.0220844 percent in the long run. The same to this finding, Omer (2010), Gill (2010) and Altayse and Adamy (2013) found negative sign of price level in the model of velocity of narrow money definition.

4.2.2.3. The long run equation for model two

The result of Johansen co-integration test in Table: 4.6 shows that there is one co-integrating equation among the variables in model two. The below result shows the long run equation for LVM2 (by normalizing on LVM2).

$$LVM2 = 9.215843 - 1.561435LGDP + 0.0433902LCPI + 0.5694023LREER - 0.2308279LDDTD$$

| | (0.006) | (0.000) | (0.000) | (0.002) |

Diagnostic test

Vector normality test: Jarque-Bera test

$$Chi^2(2) = 0.400 \ (0.81886)*$$

Vector auto correlation test: Lagrange-multiplier test

lag	Chi^2	df	Prob > chi^2
1	5.0622	16	0.52009 *
2	14.0620	16	0.59410 *

Ho = no auto correlation at lag order

*shows fail to reject the null hypothesis

Vector residual Heteroskedasticity tests

$$Chi^2(180) = 172.1721 (0.6493)$$

The same to the first model, in the vector diagnostic test for the long run model of income velocity of broad money definition, we cannot reject the null hypothesis. That is we cannot reject the null hypothesis of no auto correlation in the residual up to a maximum lags of two and the null hypothesis of normal distribution. In addition, we also fail to reject the null hypothesis of homoscedasticity. This tests gives no suggestions of model misspecification.

Gross domestic product has significant negative relationship in the model of LVM2 and confirms the hypothesis that income velocity declines as income increase. The negative sign of LGDP in the equation supports the idea of Milton Friedman that argue there is a negative relationship

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between measure of income and velocity. He assert that over long periods the public increases its money holdings faster than income as income rise, leading to a fall in velocity. In general, one unit increase in the LGDP will decrease LVM2 on average by 1.561435 percent in the long run. The findings of Ndanshau (1996) and Akhtaruzzaman (2008) give supports for this result.

For the above co integration, financial development through its proxy has negative sign in the model of income velocity of broad money velocity. The negative sign of LDDTD implies that the lower the value of the proxy variable, the greater the level of financial development and the higher the velocity of money. This result is the same with the finding of Akhtaruzzaman (2008). Keeping other things constant, the coefficient of LDDTD implies, a one percent increase in LDDTD will leads to a reduction of 0.3306069 percent on LVM2 in the long run.

The same to the first model, log of real effective exchange rate has a statistical significant positive effect on LVM2. This highly significant LREER variable simply means that the depreciation of the local currency causes the income velocity to increase. The result of Bodgan (2002) and Akinlo (2012) gives support for positive effect of exchange rate on income velocity of broad money definition.

In addition, LCPI proved to be a significant determinant of income velocity of broad money definition. The variable has a positive sign which implies that at the times of rising prices, velocity of circulation rises. In quantum, a one percent increase in the LCPI will increase LVM2 by 0.0190251percent in the long run. This result is consistent with the finding of Omer (2010) and Gill (2010).

Next, the stability conditions of the VAR model estimated is checked using the Eigen value stability test. If the VAR is stable, impulse response function and variance decomposition have known interpretations.

4.2.3. Stability test

Hamilton (1914) shows that if the modulus of each Eigen value of the companion matrix is strictly less than one, the estimated VAR is stable. A companion matrix is coefficient matrix which is obtained while rewriting a VAR (p) as VAR (1).

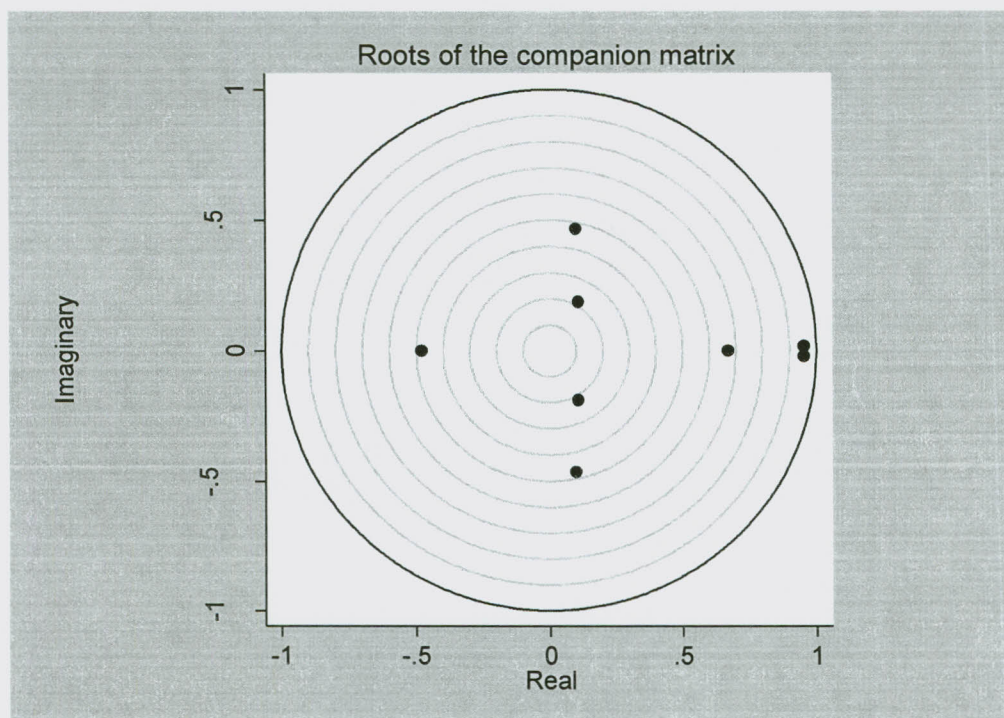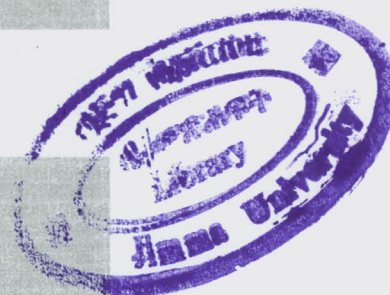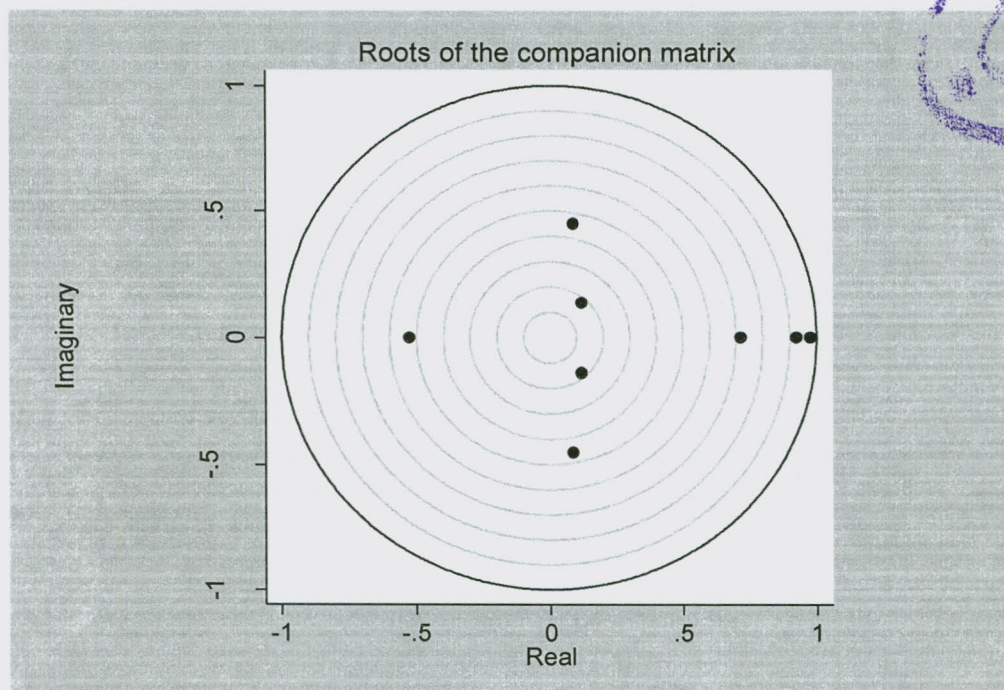Figure: 4.3. Eigen values Stability Condition for LVM1

Roots of the companion matrix

Figure: 4.4. Eigen values Stability conditions for LVM2

Roots of the companion matrix

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As shown on the above Figure: 4.3 and Figure: 4.4, the modulus of each Eigen value lies within a unit circle; this means the estimates of the VAR model satisfy the Eigen value stability condition for both models. Finally, the computed impulse response and variance decomposition result is reported on the appendix B up to E.

4.2.4. The short run dynamic models

Having already obtained the long run model and estimated the coefficients, the next step will be estimation of coefficients of the short run dynamics. According to Engle and Granger (1987), if the variables are co-integrated, then there exists a valid error correction representation of the data. Hence, an error correction model will be estimated that incorporates the short-term interactions and the speed of adjustments to wards long run equilibrium. In the error correction model, the short run disequilibrium is approximated by the first lag of the estimated long run linear combination.

The ECM coefficients explains how quickly / slowly variables return to equilibrium and it should have a statistically significant coefficient with negative sign. The coefficient of Error correction tells us about whether the past values of the variables affect the current values of the variables under study and, a significant coefficient means that past equilibrium errors plays a role in determining the current outcomes.

The short run dynamics of the income velocities have been given in table below for the two definitions of money. According to Omer (2010), not much interpretation could be attached to the short run coefficients. All they show is the dynamic adjustments of these variables. However, the negative coefficient of the error correction term with statistical significant t-statistics (or p-values) confirms the co integration among the variables in the two models.

4.2.4.1. The short run dynamic model for model one

According Bannerjee *et.al*. (1998) as mentioned in Altaye and Adam (2013), argued that a highly significant error correction term is further proof of the existence of stable long run relationship. Indeed, he has argued that testing the significance of ECM_1, which is supposed to carry a negative coefficient, is relatively more efficient way of establishing co-integration. The coefficient of ECM_1 is equal to -.3212789 for short run narrow money definition model, which imply that deviation from the long term equilibrium is corrected by 32.12789 percent in one year period.

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Table: 4.9. Results of short run dynamic model for model one

Variables	Coefficients	Standard error	p-value
_cons	-.040248	. .0200285	0.044
DLVM1_1	-.1342464	.194722	0.491
DLGDP_1	.7930734	.4658746	0.089
DLGDP_2	.7447817	.335218	0.026
DLCPI_1	-.0034605	.0019685	0.079
DLREER_1	-.0365523	.158146	0.817
DLDDTD_1	.0891457	.0629429	0.157
ECM_1	-.3212789	.0847825	0.000
R^2 = 0.4418			

Notices: insignificant lags are not reported except for the first lag

Diagnostic test

VEC normality test: Jarque-Bera test

$Chi^2(2) = 0.157(0.92466)*$

VEC auto correlation test: Lagrange-multiplier test

lag	Chi^2	Df.	Prob. > chi^2
1	28.9763	25	0.26491 *
2	21.1634	25	0.68346 *

Ho = no auto correlation at lag order

*shows fail to reject the null hypothesis

Besides, the result of VEC diagnostic test shows that estimated model cannot reject the null hypothesis of LM test up to lag two and the null hypothesis Jarque-Bera test. In other words the null hypothesis of no autocorrelation in the residuals up to maximum of two lags cannot be rejected, this test gives no suggestion of model misspecification. In addition, in the Jarque-Bera normality test we cannot reject the null hypothesis of normally distributed error term. These test results show that the estimated error correction model is statistically adequate.

Among the estimated short run coefficients of income velocity narrow definitions, only the coefficients of two period lagged values of LGDP found to be statistically significant.

4.2.4.2. The short run dynamic model for model two

Table: 4.10. Results of short run dynamics model for model two

Variables	Coefficients	Standard error	p-value
_cons	-.0172663	.0202099	0.393
DLVM2_1	-.195196	.2114262	0.356
DLGDP_1	.6902176	.442212	0.119
DLCPI_1	-.002149	.001017	0.035
DLREER_1	-.0744911	.1424952	0.601
DLDDTD_1	.0468312	.0576719	0.417
ECM_1	-.1329906	.0570472	0.020
R^2 = 0.3589			

Notices: insignificant lags are not reported except for the first lag

Diagnostic test

VEC normality test: Jarque-Bera test

$Chi^2(2) = 0.043 (0.97875)*$

VEC auto correlation test: Lagrange-multiplier test

lag	Chi^2	df	Prob > chi^2
1	26.8955	25	0.36112 *
2	12.3141	25	0.98385 *

Ho = no auto correlation at lag order

*indicates fail to reject the null hypothesis

The various diagnostic test reported above for income velocity of broad money shows the statistical adequacy of the model. Jarque-Bera test shows that the null hypothesis of normally distributed residual cannot be rejected. In the same way, we cannot reject the null hypothesis of no auto correlation in the residuals up to a maximum of two lags in the Lagrange-multiplier test.

In contrast to the long run coefficients, in the short run model only the one period lagged value of LCPI is found to be statistically significant.

The error correction term (ECM_1), which measures the speed of adjustment to restore equilibrium in the dynamic model, appear with negative sign and is statistically significant at 5 percent level of significance, ensuring that long run equilibrium can be attained. The estimated ECM_1 coefficient is equal to -.1329906, which implies that 13.29906 percent of the disequilibrium in the previous period is corrected in one year which is low. ECM suggests that the speed of adjustment

/ feedback effect towards the long run equilibrium takes many years for full adjustments when there is a shock in the system, indicating the longer lags structure and under developed financial sectors.

PART FIVE

5. CONCLUSION AND POLICY IMPLICATION

In this part conclusion and some policy recommendations are presented. The conclusion section gives brief summary of the result obtained in the part four and the policy implication section presents policy options driven from the result obtained in part four.

5.1. CONCULISION

There is a long history in monetary theory dealing with the question of the determinants of velocity, generally defined as a measure of nominal aggregate income over a measure of the money supply. Understanding fluctuations overtime in this aggregate is seen as one way in which the problem of formulating monetary policy can be addressed. Accordingly, this study assessed the determinants of income velocity of both narrow and broad money definition in Ethiopia. The study has investigated the relationship between the variables by utilizing the Johansen Maximum Likelihood procedure using annual data from 1970/71 up to 2010/11.

In the models, gross domestic product, financial development as proxy of demand deposit as a ratio of time deposit (DD/TD), price level measured by CPI and real effective exchange rate are included as determinants of income velocity of both narrow and board money definition.

Since the data under consideration are all time series in nature, unit root test for each variable has been conducted using ADF unit root test. The result of unit root test report revealed that all variables are stationary after first differencing. After identifying the order of integration, the Johansen Maximum likelihood estimation technique has been conducted to identify the order of integration / rank of co-integrating relations. The result demonstrated the existence of one co-integrating equation for both narrow and broad money definition. Then to find the unique co-integrating vector, it has been normalized on income velocity for both money definitions.

The result of long run equation estimated produced coefficients that are consistent with theoretical expectations for both money definitions. Economic growth found to have a significant negative relationship with income velocity of both narrow and broad money definitions. These implies that the Ethiopian economic development is at early stage. Prices level as measured by CPI and real

effective exchange rate have significantly significant positive effect on income velocity of both money definitions in the long run.

Whereas a proxy for financial development have a significant negative effect on income velocity of both money definition. This reveals that the Ethiopia economy might be operating at earlier stage of financial development.

The assumption that income velocity is stable or constant yields the conclusion that exists of predictable link between money stock and output, the empirical evidence demonstrated a stable income velocity both for narrow and broad money definition.

Lastly, the error correcting term (ECMt-1), has negative statistical significant coefficients in both definition of income velocity. The result implies that we can attain the long run relationship among the variables in the co integrating equation.

5.2. POLICY IMPLICATION

From the results and discussion in part four, the following policy options are forwarded:

Firstly, in both money definition, income velocity is found to be significant with positive sign. This implies that, the government or monetary authority is better to focus on creation of more economic activities rather than proposing creation of new currency in order sustain the economic growth.

Secondly, the monetary authority is better to take in to account the stability and level of exchange rate since the exchange has significant positive effect on income velocity of both money definition in Ethiopia. There is need to properly coordinate the monetary and exchange rate policies. Suitable and sustainable monetary and fiscal policies that reduce the level of money supply into the economy, stem the hide of inflationary pressure and enhance output would help to stabilize the exchange rate. In addition, the significance of real effective exchange rate shows that the Ethiopian economy is significantly dependent on foreign goods.

Thirdly, the negative significant coefficient of proxy of financial development in the income velocity equation implies that the financial system might be operating at early stage of development. So, it better to design the policies that will enhance the development of the financial

system by the government. This is main because of underdeveloped financial sector results in major obstacle for the effectiveness of monetary policy.

Finally, it is important for the central monetary authorities to take in to consideration stages of economic development in forecasting income velocity of both money definition.

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APPENDICIES

APPENDIX: A. VAR Lag Order Selection Criteria

Table: A1 lag selection criteria for LVM1

Endogenous variables: LVM1 LRGDP LREER LCPI LDDTD

Sample: 1971 2011

Included observations: 37

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-142.2142	NA	0.001966	7.957522	8.175214	8.034269
1	5.326742	247.2307	2.65E-06	1.33369	2.639839*	1.794169*
2	34.67871	41.25141*	2.26e-06*	0.925714*	3.493056	1.94266
3	62.8743	32.0058	2.35E-06	1.098448	4.408779	2.153658
4	87.00865	20.87295	3.90E-06	0.972505	5.544029	2.584182

* indicates lag order selected by the criterion

Table: A2 lag selection criteria for LVM2

Endogenous variables: LVM2 LCPI LDDTD LRGDP LREER

Sample: 1971 2011

Included observations: 37

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-154.12	NA	0.003742	8.601099	8.818791	8.677846
1	6.2744	268.7696	2.52E-06	1.282465	2.588614*	1.742944*
2	38.0778	44.69661*	1.88e-06*	0.914716*	3.309323	1.758927
3	58.3959	23.06381	3.00E-06	1.16779	4.650856	2.395734
4	82.2258	20.60965	5.06E-06	1.231038	5.802562	2.842714

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

APPENDIX: B. IMPULSE RESPONSE FOR MODEL ONE

Table: B1 impulse response for LVM1

Period	LVM1	LGDP	LCPI	LREER	LDDTD
1	0.09072	0	0	0	0
2	0.07942	0.00563	0.02482	0.00367	-0.0059
3	0.0954	0.02116	0.02854	0.01007	-0.0205
4	0.10519	-0.0019	0.03207	-0.0005	-0.0368
5	0.10012	-0.0136	0.02982	-0.0019	-0.0489
6	0.0876	-0.0122	0.02162	0.00162	-0.0603
7	0.08858	-0.0223	0.02126	-0.0003	-0.0659
8	0.08643	-0.0301	0.01934	-0.0005	-0.0674
9	0.07803	-0.0284	0.01678	0.00194	-0.0704
10	0.07885	-0.0292	0.01617	0.00268	-0.0709
Cholesky Ordering: LVM1 LGDP LCPI LREER LDDTD					

Figure: B2 impulse response for LVM1

Response to Cholesky One S.D. Innovations

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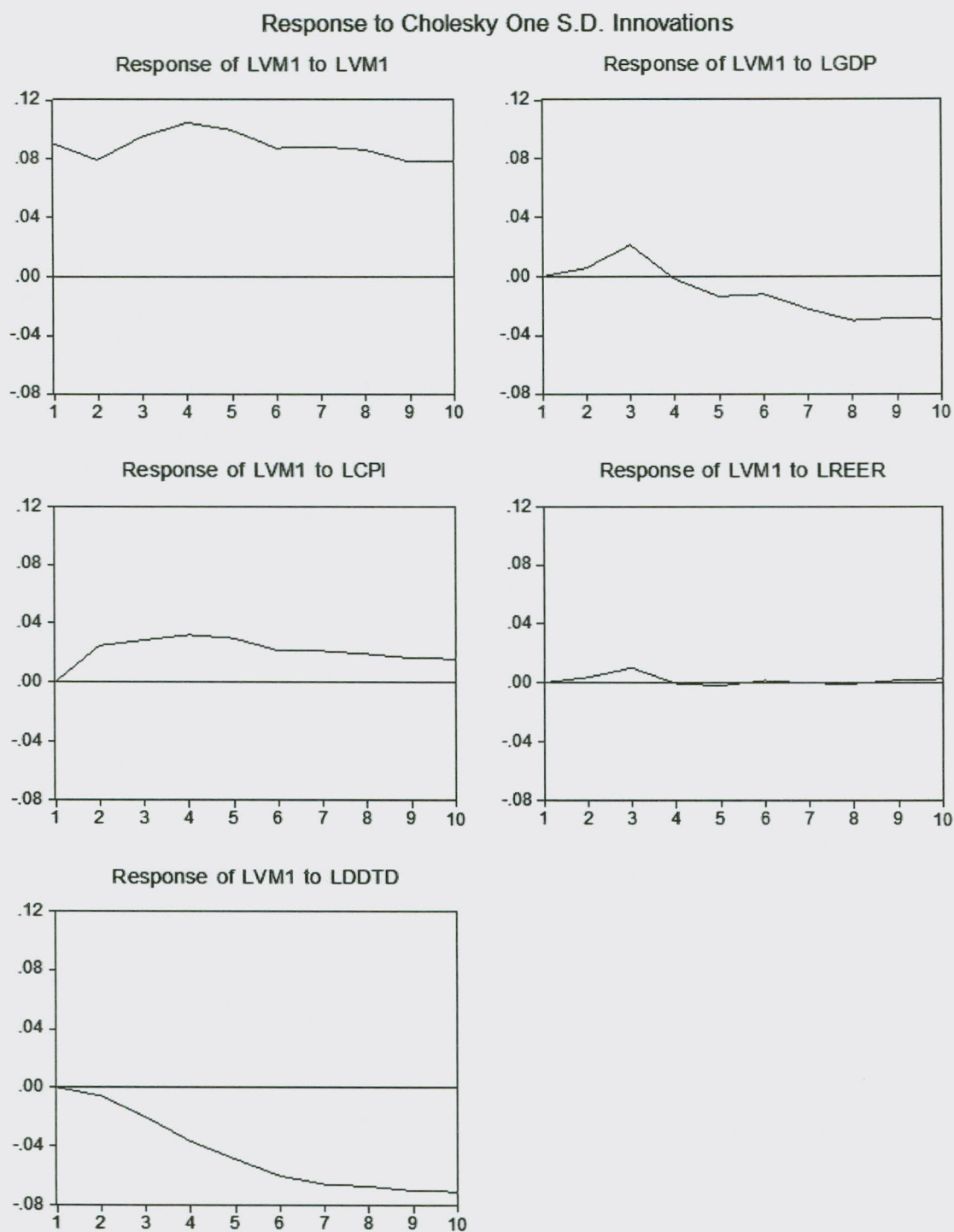
APPENDIX: C. VARIANCE DECOMPOSITION FOR MODEL ONE

Table: C1 variance decomposition for LVM1

Period	S.E.	LVM1	LGDP	LCPI	LREER	LDDTD
1	0.09072	100	0	0	0	0
2	0.12343	95.4317	0.20786	4.04285	0.08831	0.22927
3	0.16161	90.5098	1.83482	5.47789	0.4396	1.73792
4	0.19892	87.7029	1.21982	6.21466	0.29067	4.57194
5	0.23036	84.2851	1.25737	6.31018	0.22386	7.92347
6	0.25495	80.6152	1.25669	5.87068	0.18678	12.0706
7	0.27953	77.1023	1.67893	5.46185	0.1555	15.6015
8	0.30239	74.0569	2.42619	5.07655	0.13315	18.3072
9	0.32183	71.2607	2.91826	4.75385	0.12118	20.946
10	0.34048	69.028	3.34047	4.47281	0.11444	23.0443
Cholesky Ordering: LVM1 LGDP LCPI LREER LDDTD						

Figure: C2 variance decomposition for LVM1

Variance Decomposition

Percent LVM1 variance due to LVM1

Percent LVM1 variance due to LGDP

Percent LVM1 variance due to LCPI

Percent LVM1 variance due to LREER

Percent LVM1 variance due to LDDTD
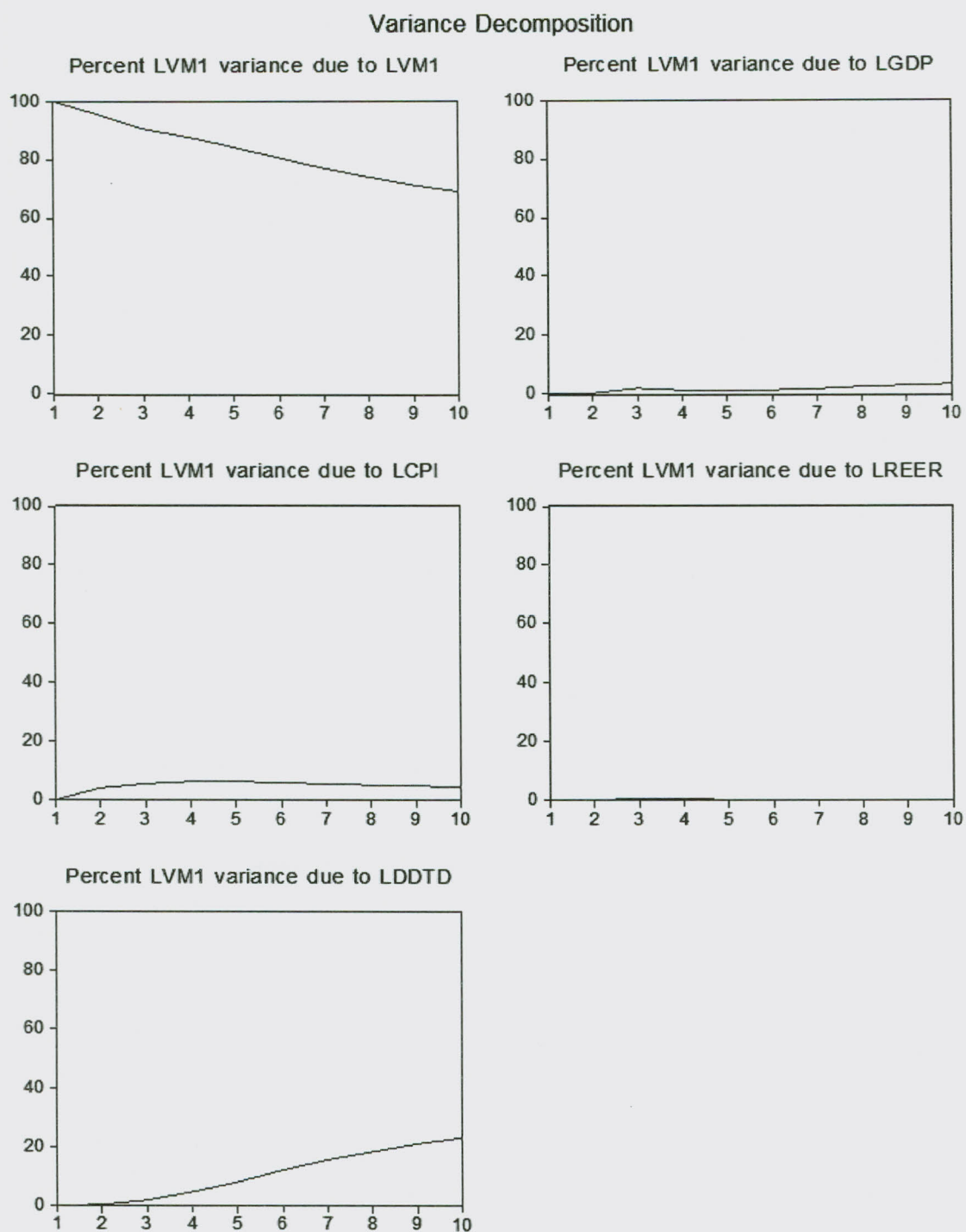
APPENDIX: D. IMPULSE RESPONSE FOR MODEL TWO

Table: D1 impulse response for LVM2

Period	LVM2	LGDP	LCPI	LREER	LDDTD
1	0.08422	0	0	0	0
2	0.08254	0.0035	0.02337	0.00141	0.0045
3	0.10012	0.01729	0.02022	0.02149	-0.0089
4	0.11667	0.00775	0.02954	0.01867	-0.0135
5	0.1218	0.00265	0.032	0.01556	-0.0169
6	0.11424	0.0077	0.03105	0.01815	-0.0203
7	0.11755	0.00459	0.034	0.01871	-0.0233
8	0.12147	-0.0015	0.03566	0.01871	-0.024
9	0.11715	-0.0007	0.03555	0.0207	-0.0254
10	0.1162	-0.0005	0.03575	0.0221	-0.0273
Cholesky Ordering: LVM2 LGDP LCPI LREER LDDTD					

Figure: D2 impulse response for LVM2

Response to Cholesky One S.D. Innovations

Response of LVM2 to LVM2

Response of LVM2 to LGDP

Response of LVM2 to LCPI

Response of LVM2 to LREER

Response of LVM2 to LDDTD
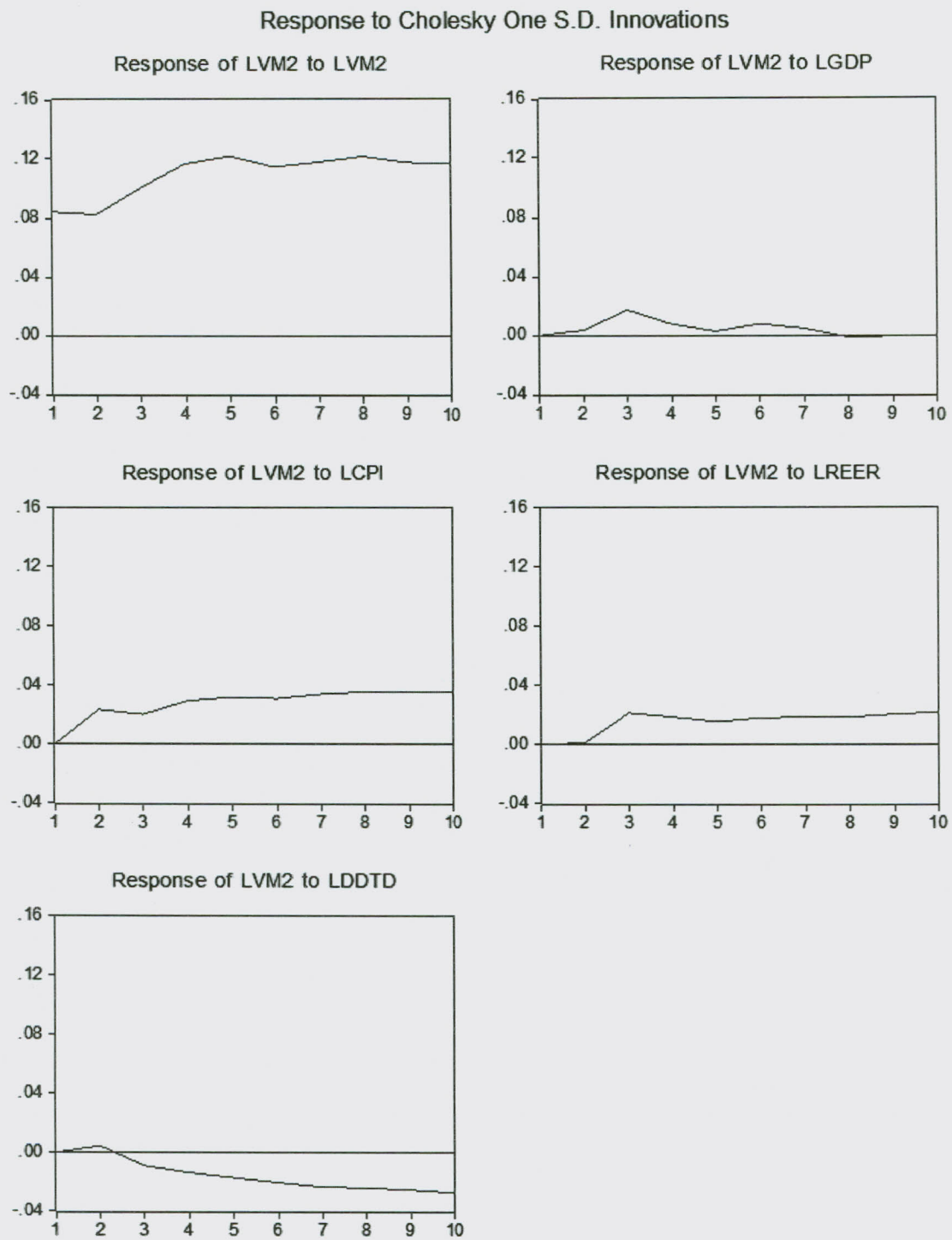
APPENDIX: E. VARIANCE DECOMPOSITION FOR MODEL TWO

Table: E1 variance decomposition for LVM2

Period	S.E.	LVM2	LGDP	LCPI	LREER	LDDTD
1	0.08422	100	0	0	0	0
2	0.12036	95.9907	0.08462	3.77092	0.01376	0.13996
3	0.1605	92.8984	1.2077	3.7073	1.80049	0.38609
4	0.20207	91.9368	0.90879	4.47609	1.98905	0.68927
5	0.23922	91.5227	0.66067	4.98343	1.84228	0.99095
6	0.26841	90.8169	0.60716	5.29658	1.92047	1.35886
7	0.29653	90.1216	0.52138	5.65427	1.97174	1.73098
8	0.32386	89.6226	0.43922	5.9528	1.98662	1.99878
9	0.34777	89.0683	0.38127	6.20692	2.07721	2.26631
10	0.37008	88.5116	0.33688	6.41425	2.19084	2.5464
Cholesky Ordering: LVM2 LGDP LCPI LREER LDDTD						

Figure: E2 variance decomposition for LVM2

Variance Decomposition
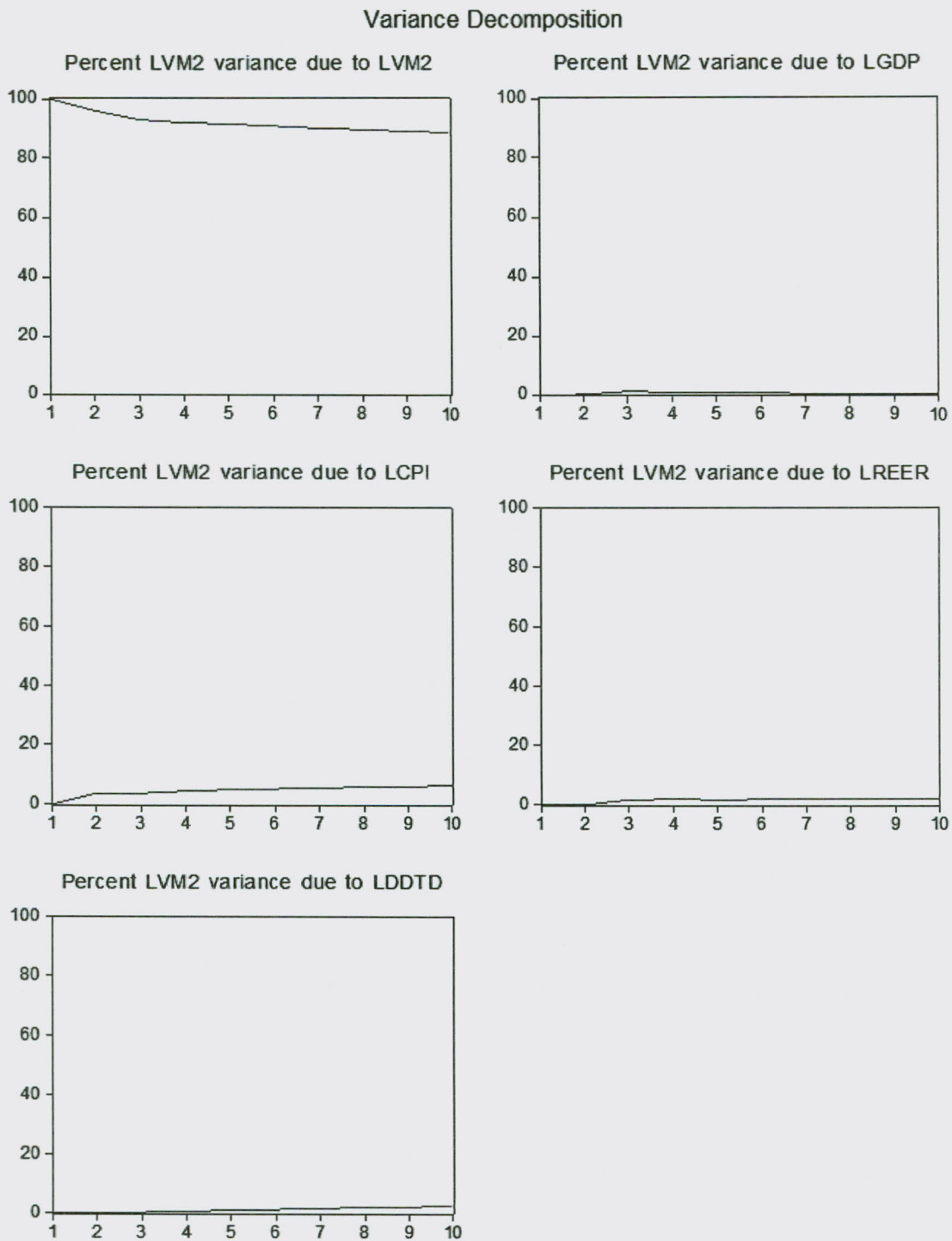
APPENDIX: F.VEC RESIDUAL HETEROSKEDASTICITY TESTS: FOR MODEL ONE

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 05/20/14   Time: 11:54

Sample: 1971 2011

Included observations: 38

Joint test:

Chi-sq	df	Prob.
342.9131	330	0.3008

Individual components:

Dependent	R-squared	F(22,15)	Prob.	Chi-sq.(22)	Prob.
res1*res1	0.626577	1.144043	0.4017	23.80993	0.3573
res2*res2	0.520800	0.741009	0.7451	19.79041	0.5961
res3*res3	0.606349	1.050221	0.4714	23.04128	0.3994
res4*res4	0.761920	2.182002	0.0619	28.95296	0.1462
res5*res5	0.800220	2.731020	0.0528	30.40834	0.1089
res2*res1	0.707400	1.648386	0.1611	26.88119	0.2158
res3*res1	0.633093	1.176467	0.3796	24.05753	0.3442
res3*res2	0.493667	0.664763	0.8129	18.75936	0.6601
res4*res1	0.553166	0.844068	0.6498	21.02030	0.5195
res4*res2	0.835314	3.458293	0.0803	31.74193	0.0819
res4*res3	0.684631	1.480148	0.2193	26.01596	0.2510
res5*res1	0.734151	1.882867	0.1051	27.89775	0.1791
res5*res2	0.870163	4.569518	0.1010	33.06619	0.0609
res5*res3	0.624113	1.132074	0.4101	23.71630	0.3623
res5*res4	0.896615	5.913143	0.0501	34.07138	0.4083

APPENDIX: G. VEC RESIDUAL HETEROSKEDASTICITY TESTS: FOR MODEL TWO

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 05/20/14   Time: 11:57

Sample: 1971 2011

Included observations: 38

Joint test:

Chi-sq	df	Prob.
354.0241	330	0.1738

Individual components:

Dependent	R-squared	F(22,15)	Prob.	Chi-sq(22)	Prob.
res1*res1	0.722904	1.778770	0.1269	27.47037	0.1939
res2*res2	0.515505	0.725459	0.7593	19.58920	0.6087
res3*res3	0.631250	1.167179	0.3858	23.98749	0.3479
res4*res4	0.711524	1.681700	0.1515	27.03791	0.2098
res5*res5	0.817511	3.054393	0.1050	31.06541	0.0948
res2*res1	0.533505	0.779758	0.7094	20.27318	0.5660
res3*res1	0.700034	1.591166	0.1789	26.60129	0.2268
res3*res2	0.428995	0.512249	0.9251	16.30181	0.8006
res4*res1	0.733154	1.873279	0.1070	27.85984	0.1804
res4*res2	0.835268	3.457128	0.1083	31.74017	0.0819
res4*res3	0.754163	2.091640	0.0725	28.65820	0.1549
res5*res1	0.691086	1.525330	0.2019	26.26128	0.2406
res5*res2	0.869314	4.535416	0.1021	33.03394	0.0614
res5*res3	0.726841	1.814232	0.1190	27.61996	0.1886
res5*res4	0.887865	5.398520	0.1008	33.73887	0.0522