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ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

RELATIVE EFFECTIVENESS OF MONETARY AND FISCAL POLICIES ON ECONOMIC GROWTH IN ETHIOPIA: VECTOR AUTOREGRESSION APPROACH

A thesis submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment of the requirements for the Degree of Masters of Science in Economics (Economic Policy Analysis) in the School of Economics

By

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"Relative Effectiveness of Monetary and Fiscal Policies on Economic Growth in Ethiopia: VAR Approach."

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Acronyms

ADF:	Augmented Dickey Fuller
AIC:	Akaike Information Criteria
ARMA:	Autoregressive Moving Average
FPE:	Final Prediction Error
HQ:	Hannan Quinn information criteria
IRFs:	Impulse Response Functions
KPSS:	Kwiatkowski, Phillips, Schmidt and Shin
LR:	Likelihood Ratio
MoFED:	Ministry of Finance and Economic Development
NBE:	National Bank of Ethiopia
OLS:	Ordinary Least Square
PP:	Phillips-Perron
SC:	Schwarz Criteria
VARs:	Vector Autoregressions
VDCs:	Variance Decompositions
VECM:	Vector Error Correction Model

Abstract

The study empirically investigates the relative effectiveness of fiscal and monetary policies on economic growth in Ethiopia. With the objective of finding out the relative strength of monetary and fiscal policies on economic growth, the study used an unrestricted vector autoregressions (VARs) framework, based on the St. Louis equation, to compute variance decompositions (VDCs) and impulse response functions (IRFs). Neither government expenditure nor money supply (M2) was found to be statistically significant in the co-integrating equations estimated suggesting that the policy variables are neutral in the long run. The results derived from the VDCs and IRFs imply that monetary policy alone has a significantly positive impact on GDP growth in Ethiopia. However, the impact of fiscal policy on GDP growth remains broadly insignificant. The outcome of this study, thus, supports the views of the proponents of the St. Louis Model that monetary policy is relatively more effective than fiscal policy in stimulating economic activity.

1. Introduction

1.1. Background of the Study

Sustainable output growth with relatively stable inflation and exchange rates is one of the important components of any macroeconomic stabilization policy. In order to accomplish this policy objective, there are two main alternative policy options: monetary and fiscal policy actions (Rahman, 2005). The study of the effectiveness of monetary and fiscal policy is equivalent to the study of the relative effectiveness of monetarism and Keynesian economics (Ali et al, 2007).

The classical theory of income and employment is usually built around, as noted in Chingarande (1999), Say's law which states, "supply creates its own demand". If this were true, the economy would never experience either unemployment or under-consumption since there would be no dearth of demand and total expenditure within an economy would always be adequate to match total production at full employment level, given the profit motive. This group of economists believes that it is the forces of supply and demand which are essential in determining the level of economic activity. The classical quantity theory of money, associated with early economists such as Fischer and Say, assume that money supply is exogenously determined, so that causation between money and price is only one-directional. This theory mainly looks at the relationship between the money in circulation, spending, output, employment and prices. Classical economists argue that these variables do not mainly depend on the quantity of money in circulation. Therefore, money does not play any role in the determination of output, employment and income, which are major activities in the economy. Classical theory therefore indicates that money is neutral.

The Keynesians on the other hand believe that change in money supply may affect the level of output indirectly via interest rate and investment. Keynesians point out several reasons why the classical mechanism may not deliver full employment equilibrium including that wages and prices may not be flexible, income rather than interest rate may determine savings and the liquidity trap (Rebman et al., 1982). The Keynesians advocate expansionary fiscal or monetary policy as a cure to deficiency in effective aggregate demand. They believe that this would induce private spending. It is worth mentioning, however, that the Keynesians do not recommend monetary policy as a remedy for slump as it is manifested with the pitfall of liquidity trap. The efficacy of monetary policy diminishes when the demand for money is highly elastic and when investment function is interest inelastic (Rebman et al., 1982).

The monetarists believe that money can affect real variables in the short run but only nominal magnitudes in the long run. The monetarists argue that if the economy operates at less than full employment level, then an increase in money supply will lead to a rise in output and employment because of a rise in expenditure, but in the short run only (Kuroda, 1995). Friedman opposed fine-tuning and all activist policy. Fine-tuning refers to short-run interventionist approach to the economy using monetary and fiscal policies to control fluctuations in demand; and activist policy refers to Government policies that involve explicit actions designed to achieve specific goals. A common type of activist policy is that designed to stabilize business cycles, reduce unemployment, and lower inflation, through government spending and taxes (fiscal policy) or the money supply (monetary policy). Activist policies are also term discretionary policies because they involve discretionary decisions by government. A contrast to activist policy is automatic

stabilizers that help stabilize business cycles without explicit government actions. Moreover Friedman advocated an outcome-blind monetary rule: just keep the money supply growing steadily at non-inflationary rate (Kuroda, 1995).

As an integral part of the national macroeconomic stabilization policy, monetary and fiscal policies are designed to fine-tune the fluctuations of the economy and in particular, fluctuations in the economic growth, inflation and unemployment rates (Rahman, 2005). The monetary policy is conducted with a view to achieving multiple objectives such as maintaining price stability with a low inflation rate and fostering higher economic growth. It is seen as a fundamental government policy with respect to the quantity of money, interest and exchange rates, which are believed to have a predominant role on aggregate demand, inflation and output (Rahman, 2005). The fiscal policy, on the other hand, deals with the revenue and expenditure of the government. The government is responsible for providing all the major public goods and services through its administrative, development and welfare-oriented programs, which are not feasible for the private sector to supply.

Right after the end of Great Depression, there was a widespread credence that fiscal policy is more effective on economic activity. Keynes's "General Theory" provides basic theoretical and practical ground for active fiscal policy. Nonetheless, starting from the late 1960s, the failure of 1968-surtax policy in the United States of America introduced a new ground for monetarist attack claiming that fiscal policy has a very little effect on aggregate demand and monetary policy is more important than most people had thought to be (Gramlich, 1971 as cited in Rahman, 2005). This owes much to the "rise" of the

doctrine of monetarism and to the "defeat" of the popular interpretation of Keynesian fiscal policy.

The history of raising government revenue in Ethiopia during the post 1941 period date back to March 1942 when a proclamation was issued stating that in order to accomplish the establishment of the government, the prosperity of the country and the well-being of its people, land taxes shall be levied (Eshetu, 1994). Though the objective of the tax levying was stated as being the restoration of the government, anonymous in it was that it was imperative to exploit available and additional sources of revenue to ensure the country keep track of modernization. In fact, government revenue and expenditure was too small in the early years. Shiferaw (1992) reckoned, employing a methodology which is never mentioned in his study, the revenue and expenditure in Birr of the government in saddle of the day. Government revenue was 28 million and 69 million in 1943/44 and 1944/45, respectively. On the other hand, government expenditure stood at 26.8 million and 69 million in 1943/44 and 1944/45, respectively (Shiferaw, 1992 as cited in Eshetu, 1994). The National Bank of Ethiopia was established in 1963 by Proclamation 206 of 1963 and began operation in January 1964 (National Bank of Ethiopia, 2009). Prior to this proclamation, the Bank carried out dual activities, i.e. commercial banking and central banking. The proclamation raised the Bank's capital to 10 million Ethiopian dollars and granted broad administrative autonomy and juridical personality.

1.2. Statement of the Problem

The relative significance of fiscal and monetary policies has been one of the most debated and unsettled issues in economics (Ali et al, 2007). Even though there is a consensus about the effectiveness of both fiscal and monetary policies, there has been a continuing

debate about the relative effectiveness and relative stability of fiscal and monetary policies (Gupta and Laumas, 1983).

Indicators of fiscal and monetary policies typically are designed to show the effects of government or monetary authority actions on some endogenous variables of interest or nominal gross national product (GNP) (Blinder and Goldfeld, 1976). There has been a major shift within macroeconomic policy making over the past two decades or so in terms of the importance of monetary policy relative to fiscal policy, with monetary policy gaining considerable importance and fiscal policy being so downgraded that it is rarely mentioned (Arestis and Sawyer, 2003). Andersen and Jordan (1968) introduced a monetarist model for economic stabilization which has since come to be known as the St. Louis model (Raj and Siklos, 1986). This model allows for the influence of monetary policy on income directly rather than indirectly (through the interest rate and investment) as in a Keynesian model. There has been extensive research on the relative effectiveness of monetary and fiscal policy ever since the publication of the results of the St. Louis model that gave upper hand for monetary policy over fiscal policy in the United States. Despite the fact that the choice of optimal policy mix in developing countries carries critical importance for their economic growth, the relative effectiveness of different policy tools has not been investigated in depth.

Further, it is believed that the question of relative effectiveness of fiscal and monetary policies on economic growth is empirical rather than theoretical (Albert et al., 1965, as cited in Gupta and Laumas, 1983). Hence, it is not possible to generalize about the effectiveness of a given policy tool from the studies undertaken and conclusions reached in developed nations to poor countries. It is, therefore, worth investigating the relative

effectiveness of these policy tools taking the concrete socioeconomic and political realities of a country. In fact, a few studies have been undertaken on the effectiveness of policy tools in sub-Saharan Africa. Among those Saxegaard (2006) investigated the link between excess liquidity and the effectiveness of monetary policy in the region. Moreover, Heller et al. (2006) examined, on a draft Paper prepared for UN-WIDER Conference on Aid: Principles, Policies, and Performance (June 16-17, 2006), managing fiscal policy in low income countries. However, studying the effectiveness of fiscal and monetary policies independently can hardly guarantee one to reach at conclusions like one policy tool is superior over the other in a given region (country). To date, at least to the researcher's knowledge, no systematic attempt has been made to analyze the relative effectiveness of fiscal and monetary policies in Ethiopia. To this end, the study intends to contribute to filling the gap of dearth of studies of relative effectiveness of different policy tools in poor nations by attempting to empirically investigate the relative effectiveness of fiscal and monetary policies on economic growth in Ethiopia.

1.3. Hypothesis of the Study

In this study the relative effectiveness of fiscal and monetary policies on economic growth in Ethiopia was empirically investigated. The testable hypothesis was that:

- ✓ Monetary policy is more effective in stimulating economic growth than fiscal policy in Ethiopia.

1.4. Objectives of the Study

The general objective of the study is to empirically investigate the relative effectiveness of fiscal and monetary policies on economic growth in Ethiopia.

Specifically, the study:

1. Examines the effectiveness of fiscal policy on economic growth.
2. Explores the effectiveness of monetary policy on economic growth.
3. Tests the St. Louis equation against Ethiopian data on the relative strength of fiscal and monetary policies in effecting economic growth.

1.5. Limitations of the Study

Data from different sources was found inconsistent. The researcher resorted to official original sources of each data set such that data for GDP and government expenditure (G) was taken from Ministry of Finance and Economic Development (MoFED), data for money supply (M2) and interest rate from National Bank of Ethiopia (NBE) and data for export (X) from Ethiopian Revenue and Customs Authority.

1.6. Significance of the Study

The rationale of the study is to serve as a spring board as well as reference material for researchers interested in further investigation of the relative effectiveness of monetary and fiscal policies on economic growth in Ethiopia and Sub Saharan Africa.

2. Review of Related Literature

2.1. Review of Theoretical Literature

Under the assumption that the IS curve slopes downwards from left to right and the LM curve slopes upwards from left to right, both fiscal and monetary policies could be used to affect the equilibrium values of income and the interest rate. However, the potency of fiscal and monetary policies can be shown to depend upon the slopes of the IS and the LM curves, and it can be shown that, in extreme cases, one or other of these policies loses all power in controlling the level of income (Rebmann et al., 1982). Apparently the effect of monetary and fiscal policies on output and interest rate is not perceived the same when viewed from Keynesian and classical perspective. Indeed different perceptions about outcomes of policy actions emanates from the fact that different schools of thought hold distinct assumptions about how the overall economy works. The views of different schools of thought about how fiscal and monetary policies alter real output are outlined below.

2.1.1. The Classical or Extreme Monetarist Case

Implicit in the classical model is the view that the price system works, so that price adjustment ensures that all markets clear, including, of course, the labor market, where the real wage may be viewed as the price of labor. The classical model in its purest form assumes that the labor market clears via real-wage adjustment, and that the demand for labor depends only on the properties of the production function. This gives rise to the classical dichotomy, or the property of the value of the real variables in the model being determined independently of the value of the nominal money stock. Hence government control of the money stock allows it to control only nominal variables (Hillier, 1997).

Acceptance of this view implies little role for government in macroeconomic management of the economy, though it may be assigned the role of ensuring that laws are established and obeyed which permit the price system to operate successfully. Any unemployment which occurs in the economy is seen as being caused by rigidities in the way of the price system's success; for example, trade union pressures or minimum wage legislation may prevent the real wage from falling to its market clearing level.

In the classical case (monetarist extreme case) the LM curve is vertical. This is due to the demand for money being totally unresponsive to changes in the interest rate. The interest elasticity of the demand for money is said to be zero (Rebmann et al., 1982). If the demand for money is purely a function of the level of income, then the demand for money will equal the supply of money at some level of income regardless of the value of the interest rate. With an interest inelastic demand for money of this type the income velocity of circulation of money is constant as in the classical model; hence the label 'the classical case'. However, one need to note that the key feature of the classical model is the assumption of real wage adjustment and market clearing in the labor market, rather than the constancy of the income velocity of circulation.

The relevance of the classical case for policy is that it implies that fiscal policy cannot affect the level of income, but can affect only the rate of interest (Hillier, 1997). The effect is only to push up the interest, leaving the level of income unchanged. The rising interest rate does nothing to release funds from idle to active-balances, and causes total or complete crowding out, since the interest rate rises until private investment spending is cut by as much as government spending has been increased. Put the other way, increased government expenditure yields nothing worthy except for it suffocates private

investment. As a result, the money market and goods market return to equilibrium at the same level of income as before the fiscal stimulus took place. In such circumstances only monetary policy has an effect on income (Hillier, 1997). An increase in money supply shifts the LM curve outwards away from the origin by providing more funds for active balances. These will be voluntarily held only if the level of income rises, which occurs as a result of lower interest rates generating higher levels of private investment.

Since the classical case emphasizes the relevance of monetary policy and rules out the usefulness of fiscal policy, it is sometimes given the alternative name of the 'extreme monetarist' case (Rebmann et al., 1982). One needs to note, however, that neither the monetarist nor the classicists would argue that the level of real income could be permanently increased by an increase in the nominal money stock. Rather, their case rests fundamentally on the assumed stability of the laissez-faire economy about full employment, and the inability of the government to intervene usefully in the economy. Consequently, Monetarists favor stable, predictable, non activist policies (Rebmann et al., 1982).

2.1.2. The Keynesian Views

Typically the Keynesians have held that fiscal policy is much more effective policy tool, and this view was particularly strong in the early years of Keynesianism. At its most extreme the demand for money was depicted as perfectly interest elastic, a condition known as the liquidity trap which gives rise to a horizontal LM schedule. In addition, investment and consumption were regarded as more or less invariant with respect to the interest rate. The liquidity trap is the name which was given by Sir D.H. Robertson (1915) to the special case where, no matter how much the money supply is increased; the

rate of interest refuses to fall to a level which induces a level of investment sufficient to generate full employment (Rebmann et al., 1982).

The liquidity trap may be represented in the IS-LM diagram as a horizontal segment of the LM curve at a certain minimum interest rate. At that level the interest rate is so low that everybody expects it to rise in the future and so expects capital losses on bond holdings. Therefore, once the rate of interest reaches the minimum level, any increase in the money stock will be added to idle balances, and no one will use the money to buy bonds. In Keynes's words, 'liquidity preference may become virtually absolute in the sense that almost every one prefers cash to holding a debt which yield so low a rate of interest'(Rebmann et al., 1982). The price of bonds and the rate of interest do not, in these circumstances, change as the money supply is increased, and monetary policy becomes impotent as a means of increasing the level of income. All that happens as the money supply rises is that the demand for idle balances absorbs the increase in the money supply the interest rate does not fall, more investment is not induced, and income remains unchanged.

The Keynesian attitude towards fiscal policy was particularly strong in the 1940s. It was really not until the mid-1970s that monetary policy was taken more seriously (Rebmann et al., 1982).

Even though discretionary fiscal policies where labeled ineffective since 1970s by most industrialized countries, the recent global financial crisis left no option for policy makers except commending for the huge unprecedented public spending and tax cut programmes. Governments seized on John Maynard Keynes's idea that fiscal stimulus -

public spending and tax cuts - can help lift their economies out of recession. The sudden resurgence of Keynesian policy is a stunning reversal of the orthodoxy of the past several decades, which held that efforts to use fiscal policy to manage the economy and mitigate downturns were doomed to failure. Only Germany remained publicly skeptical that fiscal stimulus will work (Giles et al., 2008). The new Keynesian consensus was set out in the communiqué issued by the Group of twenty leading industrialized and emerging economies in November (2008), in which they vowed to "use fiscal measures to stimulate domestic demand to rapid effect" within a policy framework "conducive to fiscal sustainability" (Giles et al., 2008). National leaders of developed nations pledged to save the jobs of the day and to ensure job creation to the days to come through expansionary fiscal policies.

Most literature show that worldwide shift towards Keynesian deficit financing has occurred since 2007. Partly this is the result of the credit crisis impeding the effectiveness of monetary policy, partly the fact that interest rates could not be cut further in the US and Japan, and also partly because banks would not lend to many households and companies even if they want to borrow. But the move towards using fiscal policy as a means of boosting advanced economies was not favored by some economists who trace the experience of the 1970s (Giles et al., 2008). The point of contention of those who were against the fiscal stimulus programmes was that unsustainable fiscal positions can destroy confidence.

2.1.3. The Neoclassical Views

The growing body of post war academic work in the neoclassical tradition gradually influenced politicians and broke the earlier consensus regarding demand management policies. There was a decisive swing away from Keynesian macroeconomic policies by a number of western governments in the late 1970s and early 1980s (Hillier, 1997). This period of Keynesian decline has also seen an extension in the use of private monopoly power accompanied by an increase in micro level government intervention. Neither of these interrelated developments appeals to those of neoclassical persuasions who see the growth of rigidities in the market mechanism and of extra market power as major sources of our current macroeconomic problems (Rebmann et al., 1982). So the neoclassical revival in economic policy is far from complete, but the alternative that is gaining ground is not so much Keynesianism but variants of corporatism in which the major economic decision makers are the state and other powerful interest groups.

The neoclassical resurgence in macroeconomics has, over the years, evolved a number of facets. One has been to emphasize the importance of monetary policy and to down grade that of fiscal policy (Rebmann et al., 1982).

The crowding-out issue has been one focus of the debate. Crowding out is a revival of the prewar 'notorious' treasury view which refuted Keynes's argument that public works could reduce unemployment. Keynesians had regarded this issue as dead and buried (Rebmann et al., 1982). The fact that crowding out will occur at full employment is not a matter for dispute. But the extent to which it will diminish the effectiveness of fiscal policy when resources are not fully employed has been a source of disagreement. The

extreme Keynesian views regarding the interest elasticities of the demand for money and of investment have not been upheld.

The debate between Keynesians and neoclassicists has now moved on from the relative effectiveness of fiscal and monetary policy to the question of whether Keynesian macroeconomic policies are even feasible (Hillier, 1997).

One aspect of the neoclassical critique is that the lags between changes in one variable which result in changes in another are both long and very imperfectly known. Given the complexities and uncertainties surrounding our knowledge of how the economy works, the government is most unlikely to be able to fine tune the economy (Hillier, 1997). Its knowledge of when to act with what variables and by how much is totally inadequate to enable discretionary macro policies to have the desired effect.

A further critique of Keynesian economic policy models is that they assume that the existence of government policy does not modify the behavior of individual agents so as to alter the coefficients (parameters) of the structural equations constituting the model. According to this critique, macroeconomic models should incorporate rationally formed expectations of economic agents about future values of variables (Rebmann et al., 1982). Expectations are rational when they are formed by using the model of the economy which is thought to explain its workings; the application of the rational expectations hypothesis to macroeconomics has been an important development in the last few years. Models incorporating fully rational expectations have been developed to show that both fiscal and monetary policy will have no impact at all on the variables if the government's policy

reaction to economic events has been forecast by the private sector (Rebmann et al., 1982).

One can distinguish three facets of the neoclassical critique of Keynesian economic policy:

i- Monetary policy is more important than fiscal policy. This is demonstrated by an appeal to empirical evidence on the relevant interest elasticities which are interpreted by means of comparative-static equilibrium analysis in an ISLM model.

ii- Discretionary fiscal and monetary policy cannot be successfully implemented because of insufficient knowledge of the dynamics of the economy.

iii- Fiscal and monetary policy can have very little impact on the real variables because of the formation of rational expectations by private sector decision makers.

2.2. Review of Empirical Literature

2.2.1. Effectiveness of Monetary Policy

Rasche and Williams (2005) addressed, in an extensive analysis, the changing views of the role and effectiveness of monetary policy, inflation targeting as an "effective monetary policy," monetary policy and short-run (output) stabilization, and problems in implementing a short-run stabilization policy in an article titled 'The Effectiveness of Monetary Policy'. Monetary policy and its effectiveness are something of moving targets At times "monetary policy" has referred to central bank actions to influence and/or target some measure of the money stock. Frequently, though certainly not always, the definition of monetary policy focused on a measure of "high powered money" – liabilities of the

central bank. For a long time, this was the definition incorporated in theoretical models. In the policy arena this definition was the foundation of the "monetarist revolution" in the 1960s and 70s. A counter definition that was likely the dominant perspective of policymakers was that monetary policy referred to central bank actions to influence and/or target short-term interest rates or nominal exchange rates. In a model with "rational expectations," the price level (and all other nominal variables) could be indeterminate if central banks set targets for nominal interest rates, because the economy would lack a "nominal anchor." Appropriately defined interest rate rule would avoid such indeterminacy: the interest rate rule had to include a "nominal anchor."

Rasche and Williams (2005) presented different scenarios in which monetary policy was praised for its effectiveness and other circumstances at which it was dubbed as useless. The legacy of the great depression, in the 1940s through 1960s, rendered monetary policy ineffective subscribing to the excerpts of the then entitled committees of the United Kingdom and the United States of America. However, a decade later, perspectives on the effectiveness of monetary policy had changed; and, in some circles, monetary policy was viewed as equally important as fiscal policy for affecting both inflation and output fluctuations. The 1960s saw the rise of "monetarism." The finding of the day that sustained inflation was a monetary phenomenon and that central banks should be held accountable for maintaining price stability was the most remarkable plank for the monetarism platform. Their study has documented that in the eyes of monetarists, inflation control was not the only concern of the monetary authorities. The monetarists

saw monetary policy as having significant effects on short run fluctuations in real output, though not affecting long-run output growth.

The study by Rasche and Williams (2005) has further documented that with the "rational expectations revolution" in macroeconomics came the "policy ineffectiveness proposition" of the New Classical Macroeconomics. The initial interpretations of this paradigm were that, in any macroeconomic model, the assumption of rational expectations would render monetary policy ineffective in influencing real output, both in the short run and long run. Hence there was no role for monetary policy in output stabilization. Nonetheless, it was demonstrated in subsequent research that it was the interaction of the rational expectations hypothesis and an assumption of perfectly flexible wages and/or prices that generated the "policy ineffectiveness proposition." The outgrowth of this insight was the "New Keynesian" perspective. With the widespread use of "New Keynesian" models, the monetarist tenets about how "monetary policy" impacts economic activity are widely held throughout academia and central banking circles today, though most academics and almost all central bankers would disown a monetarist label, they argue.

The second subject addressed in Rasche and Williams' (2005) study is how effective are central banks at hitting explicit numeric inflation targets? The performance of those countries that have announced explicit numeric inflation targets was examined in the study to address the question of the effectiveness of monetary policy. It is immediately apparent from their graphical analysis that the period-to-period (month-to-month or

quarter-to-quarter) annualized rate of inflation is highly volatile in all of the countries that pursue an explicit numeric inflation target. The study showed that if effective monetary policy were to be defined in terms of stability of high-frequency rates of inflation, then all of these central banks would have to be judged as failing to achieve the objective. However, based on moving averages of the observed rates of inflation as a metric of the effectiveness of explicit numeric inflation targeting, it was unveiled that there were a number of inflation targeting countries in which Monetary policy has been very effective.

The third subject Rasche and Williams (2005) addressed is 'How Effective Are Central Banks at Short-run (Output) Stabilization?' The study which was intended to reconcile the contradicting evidences that on one hand there exists "case study" evidence supporting the idea that monetary policy does impact output fluctuations in the short run, the most prominent evidence of which highlights the contractionary effects of monetary policy, and On the other hand the existence of volumes of VAR analyses that fail to determine a major role for monetary policy in short-run stabilization. The study cites Friedman and Schwartz to embark on their analysis with the premise that the Federal Reserve put the "great" in the Great Contraction. The paper subscribes to the excerpt that follows from Friedman and Schwartz: "The monetary character of the contraction changed drastically in late 1930, when several large bank failures led to the first of what were to prove a series of liquidity crises involving runs on banks and bank failures on a scale unprecedented in our history. ...The drastic decline in the stock of money and the occurrence of a banking panic of unprecedented severity did not reflect the absence of power on the part of the Reserve System to prevent them. Throughout the contraction, the

System had ample powers to cut short the tragic process of monetary deflation and banking collapse. Had it used those powers effectively in late 1930 or even in early or mid-1931, the successive liquidity crises that in retrospect are the distinctive feature of the contraction could almost certainly have been prevented and the stock of money kept from declining, or indeed, increased to any desired extent. Such action would have eased the severity of the contraction and very likely would have brought it to an end at a much earlier date."

The study further subscribed to Romer and Romer's study of 1989 which constructed case studies of six episodes from World War II through 1979 in which they unearthed that the Fed deliberately took action to induce a recession to reduce inflation. This evidence supports their hypothesis that the monetary policy actions had a significant negative impact on real output in all of these instances. Nonetheless the study did not live up to its promises to deliver definitive answer about the effectiveness of monetary policy in output stabilization except for it solicited that considerable care and additional research is required to ensure that a valid identified model of the economy has been constructed from which to draw inferences about the effectiveness of monetary policy as a tool for short-run stabilization of an economy.

The last subject Rasche and Williams (2005) addressed is 'Problems in the Implementation of Short-run Stabilization Policy.' It is documented in the study that one important issue for the implementation of short-run stabilization policy that did not receive much attention for a considerable period of time is the inherent uncertainty of the environment in which central bankers make decisions: lack of accurate information about the contemporary state of the economy; inability to forecast accurately the future path of

the economy; and lack of accurate information about how policy actions impact the economy. Furthermore, it is pointed out that two problems face central bankers (and policymakers in general) in assessing the need for a short-run stabilization action: lags in the availability of data and measurement error in preliminary data.

Wong (2000) employed the method of rolling vector autoregression to analyze the variability in the effect of monetary policy on economic activity employing monthly data over the sample period from 1959:01 to 1994: 12 (432 observations) for the United States of America. He used non borrowed reserves as a measure of monetary policy on the ground that non-borrowed reserves are "the only monetary aggregate which the Federal Reserve Open Market Committee can directly control." In the VAR estimation, the following variables were included: The log of industrial production index (D), the log of consumer price index (P), the log of non borrowed reserves (NBR), the federal funds rate (FF), the log of commodity price index (PCOM), and the log of total reserves (TR). It is justified that the log of commodity price index variable is included to alleviate the well-documented "price puzzle": A rise in price level in the short run after a contractionary monetary shock- a contradiction to conventional wisdom. Assuming that policymakers have contemporaneous information about prices and output, the following structural vector autoregression was specified.

$$X_t = b + B_0 X_t + B_1 X_{t-1} + \cdots + B_p X_{t-p} + c v_t \qquad 2.1$$

where v_t is a serially uncorrelated vector of mutually uncorrelated shocks driving the evolution of X_t. Each shock is assumed to have a unit variance. In particular, the fourth element of v_t ($v_t(4)$) is the monetary shock. With the additional assumption that c is an identity matrix, the coefficients in the structural vector autoregression were recovered from the coefficients of the reduced form, and the impulse response functions was computed, dX_{t+j/dv_t}. The study focused on the impulse responses of output and price levels to the monetary shock, that is, dY_{t+j/dv_t} anddP_{t+j/v_t}, respectively. As Y_t, P_t, and NBR_t are in natural logarithms, these two impulse responses are interpreted as the elasticities of output and price levels with respect to a shock of non borrowed reserves. His study revealed robust support for short run price stickiness and long-run output neutrality. Moreover, it was found that the responses of output and price levels to monetary shocks are quite variable. The study identified seven episodes of differing responses, and it unfolded that the effects of monetary policy are stronger when monetary shocks are negative and are related to some gradual changes in the economy.

Toida (1983) addressed the problem of choosing an intermediate target for monetary policy applying a method for testing non-nested hypotheses to the process of choosing an intermediate target for monetary policy. The paper applied a specific form of the test suggested by Davidson and MacKinnon (1981), joint test (j-test), using the United states of America data from 1961 through 1980. The non-nested procedure to test alternative hypotheses represented by six different specifications of the model of nominal GNP was employed. Each specification includes a different measure o f monetary policy. The six hypothesized monetary policy variables are as follows: Board base (monetary base published by the Board of Governors of the Federal Reserve System); St. Louis base

(monetary base published by the Federal Reserve Bank o f St. Louis); non borrowed base (Broad base minus adjustment borrowing); M_1; M_2; *and* M_3.

The following model was specified in his study that includes current and lagged values of a monetary policy variables and fiscal policy variable, and estimated using ordinary least squares method.

$$Y_t = C + \sum_{i=0}^{n_j} m_i X_{j,t-i} + \sum_{i=0}^{2} g_i G_{t-i} + u_{jt,} \qquad 2.2$$

Where:

Y = percentage change in nominal GNP

G = percentage change in high-employment government expenditures

X = percentage change in the jth monetary policy variable and

u_{jt} = error term associated with the model

Toida (1983) undertook the non-nested procedure that requires estimates of the parameters of the model under null and the alternative hypotheses, as well as the choice parameter. Since it is necessary to impose a priori constraints on the parameters of the alternative model so as to identify the choice parameter, he included the fitted values of GNP growth rates under the alternative hypothesis. Following Detailed pair wise-J-test, the study unveiled that all of the hypotheses except M_1 are rejected by at least one alternative at one percent critical region. Moreover, the test revealed that each of the higher monetary aggregates rejects each measure o f the monetary base, but no measure of the monetary base rejects any measure of the money supply. The study suggested that

the Federal Reserve should target the narrowest measure of money supply, asserting that M_1 was unambiguously the aggregate most closely related to economic activity for the period 1961 through 1980.

Rangrajan (1998) undertook critical review of different seminal articles to enquire the role of monetary policy in India. The investigation came up with the conclusion that "inflation control policies should not be viewed as inimical to growth promotion policies. Monetary policy remains an important instrument through which both objectives can be achieved. Developments in recent years have shown that it is possible to contain the inflationary pressure on the economy while maintaining a sustained improvement in growth" (Rangrajan, 1998).

Kanagasabapathy (2001) enquired the monetary policy underpinnings of India by reviewing the salient features of monetary policy of the same. The enquiry found out that monetary policy environment, framework and operating procedures in India had undergone significant changes since the 1990s. He asserted that these changes, inter alia, have allowed market forces to play a greater role providing the Reserve Bank much needed room in the implementation of its monetary policy. Under the new liberalized environment of the nineties, while there was basically no change in the key objectives of the monetary policy, namely, price stability and the provision of adequate credit to the productive sectors, these objectives are sought to be achieved in an environment of orderly conditions in financial markets and by strategically relying more and more upon indirect instruments like Bank Rate and Open Market Operations. In a broader framework, the objectives of monetary policy in India continued to be price stability and

growth. These are pursued, inter alia, through ensuring credit availability, with stability in the external value of the rupee as well as overall financial stability. The relative emphasis on any one of the objectives is governed by the prevailing circumstances (Reddy, 2000, as cited in Kanagasabapathy, 2001).

Saxegaard (2006) examined the pattern of excess liquidity in sub-Saharan Africa and its consequences for the effectiveness of monetary policy. The study tested the hypothesis that the monetary policy transmission mechanism is weakened when bank liquidity is excessive in the Central African Economic and Monetary Community (CEMAC), Nigeria, and Uganda. The approach adopted in the study is divided into two stages. First, a model of excess bank liquidity which helps to differentiate between excess bank liquidity held for precautionary purposes and reserve holdings in excess of that level was estimated. Second, the author estimated regime-switching models of the transmission mechanism for each case study. In particular, a threshold vector autoregressive (TVAR) model is estimated in the study that formalizes the idea that the monetary policy transmission mechanism switches between different regimes, depending on the amount of excess bank liquidity in the economy.

The study distinguished the effect of precautionary and involuntary reserves on the effectiveness of monetary policy. In terms of the potential inflationary effects, his study hypothesized that, involuntary excess liquidity is likely to be rapidly lent out if demand conditions in the economy improve. Hence, the amount of liquidity in the economy may rapidly increase without a loosening of monetary policy at a time when liquidity conditions should be tightened. This in turn carries with it the risk of increased inflation.

Precautionary excess liquidity, on the other hand, is likely to be less footloose and thus pose less of a risk in terms of inflation. Furthermore, the study asserted that if banks hold excess reserves only for precautionary purposes, then monetary policy would be effective. A loosening of monetary policy, for example by lowering the reserve requirement, would increase excess liquidity above the level demanded by commercial banks for precautionary purposes. Hence, banks would expand lending by lowering the cost of borrowing or reducing the rationing of loans. Similarly, contractionary monetary policy would lead banks to contract lending to maintain their desired level of excess reserves. However, if the holdings of excess liquidity are involuntary in the sense that banks are unable to expand lending, then attempts by banks to boost credit demand by lowering the cost of borrowing will be largely ineffective. An expansionary monetary policy in that case would simply inflate the level of unwanted excess reserves in commercial banks and not lead to an expansion of lending. Similarly, contractionary monetary policy will simply cause banks to reduce their unwanted reserves, and will only affect monetary policy if it reduces reserves to a level below that demanded by banks for precautionary purposes.

Saxegaard (2006) applied an approach to separate statutory excess reserves into precautionary excess reserves and involuntary excess reserves.

A specification of the following form was estimated:

$$\alpha_1(L)EL_t = \alpha_2(L)X_t^1 + \alpha_3(L)X_t^2 + \nu_t \qquad 2.3$$

where EL_t is the ratio of statutory excess reserves to total deposits and X_t^1 and $X_t^2$are vectors of variables that explain, respectively, the precautionary motive for holding excess reserves and the involuntary build-up of excess reserves. v_t is a well-behaved error term and $\alpha_j(L)EL_t$are vectors of lag polynomials, where L is the lag operator. He estimated the model with one lag on the ground that relatively large set of regressors coupled with a relatively short sample size was used. In particular, the model included the following explanatory variables:

$$X^1 = \{RR^{\div}, VOL_Y{}^{+}, VOL_{CD}{}^{+}, VOL_{PS}{}^{+}, VOL_{GOV}{}^{+}, PORT^{+}, Y^{+}, r_D^{+}\} \quad 2.4$$

$$X^2 = \{DEP_{PS}{}^{+}, DEP_G{}^{+}, CRED_{PS}{}^{\div}, CRED_G{}^{\div}, BOND^{\div}, AID^{+}, OIL^{+}, POIL^{+}, r_L{}^{+}\} \quad 2.5$$

Where RR is the ratio of required reserves to total private sector deposits. VOL_Y and , VOL_{CD} are five year moving averages of the standard deviation of the output gap and the cash to deposit ratio, respectively. , VOL_{CD} is additionally weighted by the five-year moving average of the cash to deposit ratio. , VOL_{PS} and , VOL_{GOV} are five year moving averages of the standard deviation of private sector and government deposits divided by the five year moving average of these variables. PORT is the ratio of demand to savings deposits and Y is the output gap. r_D is the central bank discount rate. DEP_{PS} and DEP_G are, respectively, private sector and government deposits, expressed as a fraction of GDP. $CRED_{PS}$ is the ratio of private sector credit to GDP whereas $CRED_G$ is the ratio of bank credit to the central government and public enterprises to GDP. BOND is the ratio of securitized domestic debt to GDP whereas AID and OIL are the ratios of aid inflows and oil exports to GDP. POIL is the quarterly percentage change in the oil-price. Finally, r_L is

the commercial bank lending rate. The author's expectation was that an increase in the reserve requirement would, other things being equal, lower excess liquidity. VOL_Y and VOL_{CD} *were* expected to be positively correlated with the demand for excess liquidity. The author claims about the inclusion of the measures of the volatility of deposits - VOL_{PS} and VOL_{GOV} - as banks will tend to hold a higher level of reserves to protect themselves against unexpected withdrawals if the deposit base is relatively volatile. Similarly, the ratio of demand deposits to time and savings deposits – PORT - is included to capture the effect of a high proportion of short-term deposits on the volatility of commercial banks' liabilities. The author also included the output gap Y to proxy for demand for cash. In particular, in a cyclical downturn the author expected the demand for cash to fall and commercial banks to decrease their holdings of excess reserves. Finally, he included the discount rate r_D as a proxy for the cost of liquidity for banks. Other things being equal, the author expected banks to hold a larger amount of excess reserves if the cost of borrowing at the discount window is high. The author failed to provide full description of the explanatory variables in the vector X^2 on the ground that there is less theoretical guidance concerning the choice of variables that explain the involuntary portion of excess liquidity. Because of the presence of several explanatory variables that are likely to be endogenous, OLS estimation is known to be inconsistent. Hence, he estimated the models using the instrumental variables (IV) estimator.

The study evinced that an increase in the volatility of private sector deposits increases commercial banks' holdings of excess liquidity as banks act to insure themselves against shortfalls in liquidity. The author, however, unveiled that increasing volatility of

government deposits appears to lower excess liquidity: that proved to be remarkably robust across different specifications and to changes in the sample period. Neither did the author find that there is any indication that changes in the maturity structure of commercial banks' loan portfolios have any significant effect on excess reserves. The study found no significant effect from changes in the reserve requirement and he asserted that this is not surprising given that reserve requirements were only introduced in the CEMAC region in 2001. Holdings of involuntary reserves in the CEMAC region was found to largely reflect movements in commercial banks' assets and liabilities. In particular, increases in private sector and government deposits both appeared to increase excess reserves whereas increases in credit to the private sector and the public sector lowered excess liquidity. It was found a significant positive effect on excess liquidity from increases in the aid to GDP ratio, suggesting that there may have been problems in absorption capacity. However, the study didn't find direct effect from changes in the oil price despite the importance of oil revenues in these countries. The author argued the reason for this appeared to be the inclusion of government deposits. Once government deposits were excluded from the model, the oil price became significant with the expected sign on the coefficient and only a slight deterioration in the performance of the model. In the study it is justified the finding that oil revenues only lead to a build-up of excess reserves to the extent that the economy is unable to absorb these revenues and they are deposited in the banking system.

Finally Saxegaard (2006) evaluated the effect of involuntary excess liquidity on the monetary transmission mechanism by analyzing the response of the economy to an

exogenous monetary policy shock within a structural VAR framework. Even though it is recommended that VAR models should only be estimated on a single policy regime in order to ensure that the monetary policy transmission mechanism is stable, the hypothesis about the effect of involuntary excess liquidity made him to expect the monetary policy transmission mechanism to change during the course of the sample. In other words the author expected there to be non-linearities in the monetary policy transmission mechanism because of changes in the level of involuntary excess liquidity in the economy. It is argued that one possible solution to this problem would simply be to include involuntary excess liquidity as an exogenous regressor in the VAR. The approach followed in the study explicitly acknowledged the possibility of non-linearities in the transmission mechanism as a result of changes in excess liquidity by estimating a threshold VAR (TVAR) whereby the economy switches between regimes depending on the size of involuntary excess liquidity relative to some threshold.

The study employed the following benchmark reduced form two-regime TVAR specification:

$$\begin{pmatrix} Y_t \\ M_t \end{pmatrix} = C_i(L)\begin{pmatrix} Y_{t-1} \\ M_{t-1} \end{pmatrix} + \begin{pmatrix} \nu_{it}^{Y} \\ \nu_{it}^{M} \end{pmatrix} \text{ for } i = 1,2 \qquad 2.6$$

$$i = 1 \text{ if } EL_t^I \leq \tau, i = 2 \text{ if} EL_t^I \geq \tau$$

Where ν_{it}^{Y} and ν_{it}^{M} are, respectively, regime dependent vectors of non-policy and policy shocks with covariance matrix $\sum_i^Y$ and $\sum_i^M$. $C_i(L)$is a regime dependent matrix lag polynomial of autoregressive parameters, and EL_t^I is the threshold variable whose value relative to a threshold τ determines the prevailing regime. The author divided the variables into a non-policy block Y_t and a policy block $M_t$under the control of the

monetary policy authorities. The vector of variables in the non-policy block consists of real GDP and inflation, whereas the nominal exchange rate and $M_0$are included in the vector of policy variables. For Nigeria, he also included the oil price as a variable in the non-policy block. For the CEMAC region the study incorporated the first lag of the oil price and the first lag of the aid to GDP ratio as exogenous regressors so that the fit of the model can be improved. Finally, in Uganda data on the first lag of the aid to GDP ratio was included.

With respect to differences in the monetary policy transmission mechanism across regimes, the study evinced evidence that in Nigeria and Uganda an unexpected contraction in reserve money lowers inflation more when involuntary excess liquidity is low than when involuntary excess liquidity is high. The results suggest that these differences are significant at the 95 percent level. This suggests that, consistent with the hypothesis, commercial banks are unresponsive to signals from the central bank when they hold involuntary excess reserves. Hence, the monetary policy transmission mechanism, and thus the ability of the central bank to influence demand conditions, is weakened. The study unfolded that the same does not hold true for the CEMAC region, however. In both regimes, the price level does not respond significantly to unexpected changes in reserve money. He documented that the fact that the post-devaluation sample used to estimate the TVAR for the CEMAC region may be characterized by relatively high involuntary excess liquidity across both regimes as possible explanation for the finding. If so then one would not expect to see differences in the monetary policy transmission mechanism across regimes. This is because the hypothesis implies that

monetary policy is ineffective as long as banks have involuntary excess liquidity, regardless of how much of it they hold.

2.2.2. Effectiveness of Fiscal Policy

Raj and Siklos (1986) presented an evaluation and some new evidence on the role of fiscal policy in the St. Louis model. The paper used seasonally adjusted quarterly data of the US covering the period 1947: I to 1984: IV which the authors claimed that the period included a rich variety of economic events, including the relative economic tranquility of the 1950s and 1960s, a decade of large oil price shocks, wage price controls, world-wide inflation and proliferation of government regulations of the 1970s, and finally the government deregulation and monetary restraint of the early 1980s. The study tested the null hypothesis that fiscal policy has no effect on income conditional on monetary policy against a more general non-parametric two-sided distributed lag model. The study employed used non-parametric multivariate spectral methods in particular, and time series methods generally to evaluate the St. Louis expenditure equation.

The model used for testing the null hypothesis that fiscal policy (g) has a zero long run effect on income (y) conditional on monetary policy (m) is of the form:

$$y_t = a + B(L)\dot{m}_t + C(L)\dot{g}_t + D(L)e_t \qquad 2.7$$

Where the dot over each variable represents the log-change and (e_t) is a sequence of independent and identically distributed $(0, \sigma^2)$ random variables. Further,B(L), C(L) and D(L) represent infinite degree polynomials (two-sided) in the lag operator L. The alternative hypothesis in for the above model is quite general and involves a fairly weak

set of assumptions. Any finite parameter model is therefore viewed as an approximation of the correctly specified infinite parameter model above. Further, the one-sided distributed lag coefficients with the contemporaneous lag term (as in the St. Louis model) are embedded in the finite parameter approximation to the model above by imposing zero restrictions on excluded lead coefficients of m and g. The study tested the validity of these restrictions against the data. Since the choice of the truncation point on which the resolution of the spectral estimates depend and the choice of an appropriate spectral window are important, the authors used the Parzen window and followed the general procedure outlined by Jenkins and Watts in selecting the truncation point.

The study showed that both monetary policy and fiscal policies have statistically significant partial coherences with income at cycles of about 6 to 12 quarters. Further, the study evinced that the conditional income-monetary-policy relation is stronger relative to the conditional income-fiscal-policy relation in terms of the size and significance of the partial coherence and the gain.

Martin and Fardmanesh (1990) investigated the empirical relationship between fiscal variables and growth. Their study addressed empirically the impact on growth performance of the share of government activities in GDP by considering taxes, government expenditures and budget deficits simultaneously. The authors claim that adhering to this approach helps to circumvent the conceptual flaw stemming from the partial focus in the then existing studies and consequently provides a more comprehensive empirical basis for policy analysis. The methodology they used is cross-sectional and inclusive of 76 countries, in which Ethiopia is embraced, for the period

1972-81. To account for differences in their levels of development, they grouped countries by income level into low-, middle-, and high-income groups.

The authors used three relations to measure the impact on economic growth of the share of government activities in GDP, using cross-national linear regression analysis for 76 developed and developing countries. The study set the premise that fiscal activities exert their impact on growth via factor accumulation and/or factor productivity. The rate of increase in real GDP represents economic growth and constituted their dependent variable. Relation (1) included only the share of taxes, expenditures and deficits in GDP as explanatory variables. Consequently, their estimated coefficients measure their overall impact on growth via both the availability of factors of production - capital and labor - and their productivity. Relation (2) included two additional explanatory variables representing the rate of growth of the (services of) capital stock and labor services. In this case the estimated coefficients of the three fiscal variables capture only their impact on growth via the productivity channel. Thus, a comparison of their magnitudes with those of Relation ((1) indicates whether these fiscal variables affect growth primarily through factor accumulation or/and factor productivity. Relation (3) used the share of net nontax revenues in GDP in place of that of deficits in Relation (2). Consequently, the estimated coefficients of the tax and expenditure variables include their indirect effect through induced changes in the budget deficits as well.

The three relations examined are:

$$RGDP = a_0 + a_1 TAX + a_2 EXP + a_3 DEF + e \qquad 2.8$$

$$RGDP = b_0 + b_1 TAX + b_2 EXP + b_3 DEF + b_4 K + b_5 L + f \quad 2.9$$

$$RGDP = c_0 + c_1 TAX + c_2 EXP + c_3 NTR + c_4 K + c_5 L + g \quad 2.10$$

where, RGDP is average annual growth rate in real GDP; TAX is total tax revenue as % of GDP; EXP is total expenditures as % of GDP; DEF is overall deficit or surplus as % of GDP; NTR is net nontax revenues as % of GDP; K is share of gross fixed capital formation in GDP; L is rate of population growth; and e, f, g are random disturbance terms.

The study employed the share of gross investment in GDP as a proxy for the rate of growth of the (services of) capital stock, K, and population growth as a proxy for growth in labor services, L.

Martin and Fardmanesh's (1990) study evinced that the strongest results were for middle-income countries, with larger and more significant coefficients. The results were not very sensitive to the inclusion or exclusion of the factor accumulation variables, indicating that the estimated associations between fiscal variables and real GDP growth are due mostly to the induced changes in factor productivity rather than to induced changes in labor supply and investment. For low-income countries, an opposite pattern was disclosed: higher GDP growth is associated with a lower share of taxes in GDP and with a higher ratio of expenditures to GDP, once their impact through deficits is factored in (Relation 3). The coefficient of the deficit variable revealed as almost zero for these countries.

Regarding the high-income countries in the sample, the study documented that none of the fiscal variables are significant.

Baldacci et al. (2001) undertook an empirical investigation on the effectiveness of fiscal policy in stimulating economic activity. Unlike most of other studies that are confined to advanced economies and emerging market economies, the study by Baldacci et al (2001) embraced large number of countries, including developing ones. The sample the study inquired covered 168 countries over the period 1970-1999. The authors divided countries into six groups, based on the World Economic Outlook (WEO) country classification: advanced economies (ADV), including newly industrialized Asian economies; Africa (AFR); developing Asia (ASIA); Middle East (ME); Western Hemisphere (WH); and countries in transition (CIT).The paper utilized three different and complementary approaches to try to account for interactions between fiscal policy and growth during recession episodes: descriptive analysis, multidimensional statistical analysis, and standard regression analysis.

In the standard regression analysis they estimated two models. The first model included variables that reflect economic policy during the recession, initial conditions, and regional dummy variables. The second model included the same variables reflecting economic policy and initial conditions as the first model, but includes dummy variables for membership in the clusters instead of regional dummy variables. Offering the justification that the effectiveness of fiscal policy can be influenced by several factors, the authors interacted fiscal response with dummies for a flexible exchange rate regime,

open economies, high initial public debt, high initial fiscal deficit, expansionary monetary policy, and the dummy variables in each model. Monetary policy was measured by the change in the interest rate during the recession; thus a positive value indicates an expansionary monetary policy. The writers measured initial conditions by the revenue to GDP ratio before the episode, the current account balance before the episode, and growth before the episode. Regional growth and dummies for episodes occurring in the 1970s and the 1980s were included to capture the common external or other shocks.

Based on the findings of the descriptive analysis, the study came up with the conclusion that recessions accompanied by expansionary fiscal responses are, on average, less severe than recessions accompanied by contractionary fiscal policy. In addition, the descriptive analysis showed that initial conditions, accompanying policies and some other factors appear to be related to the nature and effectiveness of fiscal policy in a recession. Moreover, the descriptive analysis pointed to important differences between various country groups: advanced economies stand out in many respects, which suggests that the results of most of the empirical literature based on advanced economies may not necessarily apply for emerging or developing economies. The exploratory multidimensional statistical approach, on the other hand, revealed weaker link between the fiscal response and growth outcome during a recession than in the descriptive analysis. This approach emphasized the role of a combination of initial conditions, fiscal response, accompanying policies, and other factors, rather than each of these factors considered separately. Furthermore, the regression results depicted that although there

was some role for fiscal and monetary policies in stimulating growth during a recession, the relationship was not very strong.

Pelagidis and Desli (2004) carried out a descriptive investigation of the role of fiscal policy on the European Union nations during economic down turn in an article titled 'Deficits, Growth, and the Current Slowdown: What Role for Fiscal Policy?' The authors set the premise that the hesitation of many conventional-wisdom economists to rely more aggressively on fiscal policy measures in order to keep their public finances more or less balanced may have contributed to the then persisting slowdown. For the rational expectations and real business cycle school economists implementation of expansionary fiscal policy does not help in pursuing the endeavors of ensuring higher economic growth to come out from economic down turn as budget deficits either by money printing or by public borrowing increases public debt and interest rates, crowd out private investment, fuel inflation, and damage medium term growth, that in turn cause an upward adjustment of nominal wages to the new increased level of prices, squeezing profits and postponing corporate investments. Pelagidis and Desli (2004) claim, however, the aforementioned proposition lacked specific empirical support. The study emphatically set it apparent that total demand in an economy is either deficient, or excessive, or just right in restoring output to normal; and consequently government should spend more than it takes from taxes when the economy suffers from deficient demand. In that case, the authors propose, the government should implement fiscal expansion and serve budget deficits either by borrowing from the public (selling government bonds) or by printing money. Moreover, the study documented that crowding out takes place only when the economy enjoys full

employment, and money supply is not sufficient enough to soften the crowding-out effect. The analysis unfolded positive correlation between budget deficits and corporate profits for Germany, Italy, France and Portugal. This finding warranted them to commend that fiscal disequilibrium is a necessary pre-requite for higher profits and economic growth, and therefore public expenditures should be higher than tax revenues, especially in a non-full-employment recession economy, with declining private spending. The pitfall ascribed in their analysis is that casual comparisons or correlations do not necessarily prove causation, as there are plenty of factors with an impact on profits, such as the business cycle, the consumer's response to fiscal spending, the political stability, and other factors.

2.2.3. Relative Effectiveness of Monetary and Fiscal Policies

Gupta and Laumas (1983) examined the relative effectiveness and the relative stability of the fiscal and monetary multipliers, using the usual theoretical IS-LM model. In fact, the authors did not test their theoretical analysis against empirical data of any country. Their study, which lacks an aggregate supply framework, suggested that fiscal policy may be more stable than monetary policy but reached no conclusive remark about the relative effectiveness of fiscal and monetary policies.

Carlson (1975) evaluated the St. Louis equation using monthly data of the US economy. The study used changes in nominal GNP as the dependent variable and alternative measures of fiscal and monetary actions as the independent variable: narrow money as the measure of the monetary variable and high employment federal expenditures as the measure of the fiscal variable. Taking changes in personal income, an individual's total

annual gross earnings coming from wages, business enterprises and various investments. as the proxy to changes in GNP; the study evinced results consistent with those obtained with quarterly data. Results provided evidence in support of conclusions relating to the magnitude and speed of the impact of monetary and fiscal policy actions as derived from quarterly data: monetary policy had strong impact while the effect of fiscal policy was insignificant.

Ali et al. (2007) investigated whether fiscal stance or monetary policy is effective for economic growth in south Asian countries. The study utilized autoregressive distributed lag model (ARDL), a co-integration (panel) test, and error correction method (ECM). To capture the impact of policy variables on economic growth (measured by GDP growth rate), they modeled the following empirical equation:

$$Y_{it} = \alpha + \beta_0 FB_{it} + \beta_1 M2_{it} + \mu \qquad 2.11$$

Whose error correction version of ARDL model is given below:

$$\Delta Y_{it} = \alpha + \beta_1 \sum_{i=1}^{p} \Delta Y_{i,t-i} + \beta_2 \sum_{i=1}^{p} \Delta FB_{i,t-i} + \beta_3 \sum_{i=1}^{p} \Delta M2_{i,t-i} + \lambda_1 Y_{i,t-1} + \lambda_2 FB_{i,t-1} + \lambda_3 M2_{i,t-1} + \mu_{it} \qquad 2.12$$

where Y is GDP growth rate; FB is Fiscal Balance; and M2 is Broad Money

The authors tested the null hypothesis $H_0: \sum \lambda_{it} = 0$, which implies that the long run relationship does not exist, against the alternative$H_1: \sum \lambda_{it} \neq 0$.

The study used nominal values mentioning the advantage of avoiding the difficulty of identifying an appropriate deflator for the series of variables. Time series data that ranged from 1990 through 2007 of four south Asian countries: namely Pakistan, India, Bangladesh and Sri Lanka was employed in the study. The study disclosed that money supply is a significant variable while fiscal balance is reported to have insignificant effect both in the short run and long run. In a nutshell, the study concluded that monetary policy is more powerful tool than fiscal policy in order to enhance economic growth in the case of south Asian economies.

Rahman (2005) examined the relative effectiveness of monetary and fiscal policies on output growth in Bangladesh using vector autoregressive approach. He based his study on the St. Louis equation and utilized an unrestricted vector autoregression (VARs) framework to compute variance decompositions (VDCs) and impulse response functions (IRFs) through 1000 Monte Carlo simulations. The vector of the VAR model he estimated contained annual data from 1975 through 2003 of the variables: Real Government Expenditure (g), Real Money (m), Real Interest Rate (r) and Real GDP (y). The study used variance decompositions (VDCs) and impulse response functions (IRFs) derived from vector autoregressions (VARs) approach to examine the relative impact of monetary and fiscal policy on real output growth. The VDCs show the portion of the variance in the forecast error for each variable due to innovations to all variables in the system. The IRFs show the response of each variable in the system to shock from system variables. The author, therefore, analyzed respective orthogonalized variance

decompositions (VDCs) and impulse response functions (IRFs) to determine the relative strength of monetary and fiscal policies.

The study revealed that monetary policy alone had a significantly positive impact on real output growth in Bangladesh, and the impact of fiscal policy on real output growth was reported to remain broadly insignificant. Rahman's (2005) study complements the views of the proponents of the St. Louis model that monetary policy is relatively more effective than fiscal policy in stimulating real economic activity.

Ajisaf and Folorunso (2002) investigated the relative effectiveness of fiscal and monetary policies in macroeconomic management in Nigeria. They modeled the following functional relationship:

$$Y_t = f(MP_t, FP_t) \qquad 2.13$$

Where Y is a measure of economic activity for which they employed Gross Domestic Product (GDP) as a proxy, MP and FP are measures of monetary and fiscal actions of the government, respectively. The authors used both narrow money (M1) and broad money (M2) as proxies for monetary policy variable while they employed the government revenue receipts (R), government expenditure (E) and government budget deficits (BD) as proxy for fiscal policy variable. And they estimated a long linear model that follows:

$$\ln Y_t = a_0 + b_1 \ln MP_t + b_2 \ln FP_t + e_t \qquad 2.14$$

The authors expected a-priori GDP to be positively related to MP and FP. annual data series from 1970 through 1998 for the estimation was employed. The study followed the Engle-Granger two step test for cointegration in spite of the fact that resorting to Engle-Granger procedure when more than two time series variables are modeled may render

specification inadequate. The study unearthed that monetary rather than fiscal policy exerts greater impact on economic activity in Nigeria. This finding warranted the authors to conclude that the emphasis on fiscal action of the government has led to a greater distortion in the Nigerian economy.

3. Data and Methodology

3.1. Data Type and Sources

Annual data on real government spending, real money supply, real export, real interest rate and real output from 1971 through 2009 was used in the investigation. The source of the data was from Ministry of Finance and Economic Development (MoFED), Ethiopian Revenue and Customs Authority, the National Bank of Ethiopia (NBE), the World development indicators CD-ROM, and CD-ROM from Ethiopian Economic Association.

3.2. Model Specification

In this study the modified St. Louis Equation was employed to investigate the relative effectiveness of fiscal and monetary policies on economic growth in Ethiopia. The original St. Louis equation consisted of changes in nominal GDP as the dependent variable and alternative measures of monetary and fiscal actions as the independent variables (Carlson, 1975). Prominent economists, such as Stein (1980) and Ahmed et al (1984), question the validity of using the St. Louis equation on various stand points. First, they underscore that the St. Louis equation is a reduced form equation: the policy variables embraced in the equation are not statistically exogenous. Second, they claim that the St. Louis equation suffers from specification problem as it omits some other regressors. Third, it is based on constrained Almon lag procedure. On the aforementioned grounds, the results obtained from the St. Louis equation are believed to be biased and inconsistent.

Moreover, structural macro-econometric models, akin to St. Louis macroeconomic model, are bound to be manifested with the problems of identification and endogeneity.

In his seminal work, Sims (1980) introduced vector autoregressions (VARs) that allows feedback and dynamic interrelationships among all the variables in the system and appears to be highly competitive with the large-scale macro-econometric models in forecasting and policy analysis. This study employed Sims' (1980) VAR approach so as to handle the pitfalls associated with the St. Louis equation. The VAR approach addresses the pitfall of endogeneity because it assumes that all the variables in the system are endogenous. In addition, the VAR model takes care of constrained Almon lag problem since it allows selecting the lag length optimally such that estimated residuals are white noise (Taylor et al., 1995).

Furthermore, in an attempt to circumvent the problem of omitted variables ascribed in the St. Louis equation, real exports and real interest rate were included in the original St. Louis equation: hence this paper employed modified St. Louis equation. It is worth noting that since Ethiopia is a small open economy, one can expect the impact of foreign sector on the overall economic activity and economic growth in particular to be nontrivial, if not basic. On the other hand, the fiscal and monetary policies of a country affect the foreign sector performance of the same to a great extent. Consequently, the real export was embraced in the current analysis to proxy for the performance of the external sector of Ethiopia. Furthermore, the effectiveness of fiscal policy apparently depends on how sensitive investment is to interest rate variations; and how far the interest rate is allowed to vary in response to fiscal policy actions, on the other. In spite of the fact that interest rate determination has never been set free (has been repressed) for quite long time in Ethiopia, it worth incorporating it in the model and see empirically its relation with output growth.

The vector of the VAR model, therefore, incorporates Real GDP (Y), Real Government Expenditure (G), Real money supply (M), Real interest rate (I) and Real exports (X).

Real GDP (Y): Real gross domestic product (GDP) is a macroeconomic measure of the size of an economy adjusted for price changes (that is, adjusted for changes in the value of money inflation or deflation.) Gross domestic product is defined as the market value of all final goods and services produced in a geographical region, usually a country. That market value depends on two things: the actual quantity of goods and services produced, and their price. The actual quantity of goods and services produced is sometimes called the volume. Therefore, real GDP was used to capture the overall economic performance.

Real Government Expenditure (G): even though fiscal policy has two components that are government revenue and government expenditure, in this study real government expenditure was used to proxy fiscal policy. Real government expenditure was used because of the focal role government exercises in public expenditure decision more than in revenue collection and besides data on government revenue does not exist for larger part of the sample period.

Real Money Supply (M): Frequently, though certainly not always, the definition of monetary policy focused on a measure of "high powered money" – liabilities of the central bank (Rasche andWilliams, 2005). The rationale for the focus on the growth of the money stock is that, in a fiat money economy, the money stock provides the nominal anchor for the system. Toida (1983) unveiled, in an attempt to fix the problem of choosing an intermediate target for monetary policy, that each of the higher monetary aggregates rejects each measure of the monetary base, but no measure of the monetary

base rejects any measure of the money supply. His study evinced that narrow measures of money supply are most closely related to economic activity. Consequently M2 component of money supply was used as a proxy for monetary policy actions in this study. Money supply (M2) is defined as M1 plus saving deposits plus less than 30 day deposits with the banking system where M1 is notes and coins in circulation plus demand deposits with the banking system.

Real Exports (X): real exports was used as a proxy to external sector performance. On the ground that substantial volume of imports may not be duly reported in accounting, the researcher refrained from using import as proxy for external sector performance. Real export is incorporated in the model on the ground that if missing exogenous variables are closely correlated with the variables representing monetary and fiscal actions, their omission may lead to a serious statistical problem (Taylor et al., 1992). One can a priori expect that fiscal and monetary actions obviously affect the foreign trade sector leading to a high degree of correlation between the two. As a result, it is imperative to embrace a variable representing these external influences in analyzing the comparative effectiveness of monetary and fiscal actions on economic growth in Ethiopia.

Real Interest Rate (I): A counter definition of monetary policy that is likely the dominant perspective of policymakers is that monetary policy referred to central bank actions to influence and/or target short-term interest rates or nominal exchange rates (Rasche andWilliams, 2005). Real interest rate is an interest rate that has been adjusted to remove the effects of inflation to reflect the real cost of funds to the borrower, and the real yield to the lender. The real interest rate of an investment is calculated as the amount

by which the nominal interest rate is higher than the inflation rate. The average of real lending rate and real saving rate was, therefore, employed in this study.

When the variables in the VAR are integrated of order one or more, unrestricted estimation is subject to the hazards of regressions involving nonstationary variables. However, the presence of nonstationary variables raises the possibility of cointegrating relations. The relevant procedure then consist of three steps: determining the cointegrating rank, estimating the matrix of cointegrating vectors, and estimating the VAR. There are several methods of tackling these problems; but the maximum likelihood approach, laid out in a series of papers by Johansen, seems to have attracted the most attention from applied researchers and software developers (Johnston and Dinardo, 1997). Likewise, Johansen's maximum likelihood approach was employed in this study. Following the maximum likelihood approach of Johansen (1988), a vector error correction model (VECM) representation of the VAR(p) model can be written as:

$$\Delta Z_t = \pi Z_{t-1} + \sum_{i=1}^{p-1} \gamma \Delta Z_{t-i} + \delta\varphi + \varepsilon_t \qquad (3.1)$$

where Z_t is nx1 vector composed of nonstationary variables, π and γ are nxn matrices of coefficients, φ is a set of deterministic variables such as constant, trend and dummy variables and ε_t is a vector of normally and independently distributed error terms. The rank of the matrix π gives the dimension of co-integrating vectors. If its rank, r, is

(0<r<n) then π can be decomposed into $\pi = \alpha\beta'$; where α *and* β' are nxr matrices containing adjustment coefficients and co-integrating vector coefficients, respectively.

Hence, equation (1) reduces to:

$$\Delta Z_t = \alpha\beta' Z_{t-1} + \sum_{i=1}^{p-1} \gamma \Delta Z_{t-i} + \delta\varphi + \epsilon_t \qquad (3.2)$$

This means $\alpha\beta' Z_{t-1}$ contains all the long-run information on the process of Z_t. Specifically, the rows of β' are interpreted as the distinct co-integrating coefficients and the rows of α shows the speed of adjustment of dependent variable towards the long-run equilibrium condition.

The Granger representation theorem adheres to methods of testing for cointegration and estimating cointegrating vectors based on ordinary least squares estimation (Taylor et al.,1992). A major advantage of the least squares approach is that it is relatively simple and intuitive. It does, however, suffer from a number of disadvantages. One disadvantage is that the distribution of the test statistics will in general be slightly different in any particular application-they are not invariant with respect to the nuisance parameters which characterize any particular situation (Hatanaka, 1996). Thus, the critical values given in Engle and Granger can be taken only as a rough guide. A more fundamental problem concerns the number of cointegrating combinations which may exist between a set of variables. To portray the series pitfall that emerges as a result of adhering to Engle Granger approach when we have more than two variables, consider two variables, each of

which is integrated of order one $x_t \sim I(1)$ and $y_t \sim I(1)$. Now, if (x_t, y_t) cointegrates with parameter α then:

$$u_t = x_t - \alpha y_t \sim I(0) \tag{3.3}$$

And α can be shown to be unique. To see this, suppose we had another cointegrating parameter, β:

$$\omega_t = x_t - \beta y_t \sim I(0) \tag{3.4}$$

Adding and subtracting βy_t in (3.3):

$$u_t = x_t - (\alpha - \beta) y_t - \beta y_t$$

That is

$$u_t = \omega_t - (\alpha - \beta) y_t \tag{3.5}$$

By assumption, u_t and ω_t are both $I(0)$. The latter three conditions can hold only if α=β, that is, α is unique. Unfortunately, once we consider more than two variables, it is no longer possible to demonstrate the uniqueness of the cointegrating vector. Indeed, it turns out that if we have a vector of N variables, each integrated of the same order, then there can be up to $(N-1)$ cointegrating vectors. Thus, if we cannot reject cointegration between a set of three or more variables, based on least squares methods, we have no guarantee that we have an estimate of a unique cointegrating vector (Taylor et al., 1992). In a system with three variables, for example, it is quite possible that there are two statistically significant distinct cointegrating vectors and that our OLS estimate is a linear combination of them. Johansen (1988) suggests a method for both estimating all the

distinct cointegrating relationships which exist within a set of variables and for constructing a range of statistical tests. The method begins by expressing the data generation process of a vector of N variables x as an unrestricted vector autoregression in the levels of the variables:

$$x_t = \pi_1 x_{t-1} + \pi_2 x_{t-2} + \cdots + \pi_k x_{t-k} \tag{3.6}$$

Where each of the π_i is an $(N \times N)$ matrix of parameters. The system of equations can be reparameterised in error correction model form:

$$\Delta x_t = \Gamma_1 \Delta x_{t-1} + \Gamma_2 \Delta x_{t-2} + \cdots \Gamma_{k-1} \Delta x_{t-k+1} + \Gamma_k x_{t-k} + e_t \tag{3.7}$$

$$\Gamma_i = -I + \pi_1 + \cdots \pi_i, \qquad i=1...,k$$

Thus Γ_k now defines the long run levels solution to (3.6) . Now, if x_t is a vector of $I(1)$ variables, we know that the left hand side and the first $(k-1)$ elements of (3.7) are $I(0)$ but that the last element of (3.7) is a linear combination of $I(1)$ variables. Johansen uses canonical correlation methods to estimate all the distinct combinations of the levels of x which produce high correlations with the $I(0)$ elements in (3.7); these combinations are, of course, the cointegrating vectors. Johansen's approach is a maximum likelihood method of estimating all the distinct cointegrating vectors which may exist between a set of variables. Johansen also shows how one can test which of these distinct cointegrating vectors are statistically significant, and also how to construct likelihood ratio test for linear restrictions on the cointegrating parameters (Hatanaka, 1996).

Therefore, in this study estimation of co-integration vectors and testing for long-run causal relationship in the context of error correction representation of co-integrated variables will be conducted using Johansen (1998) procedure.

To investigate the relative impact of monetary and fiscal policies on real output growth, variance decompositions (VDCs) and impulse response functions (IRFs) derived from vector autoregressions (VARs) approach was used. The VDCs show the portion of the variance in the forecast error for each variable due to innovations to all variables in the system. The IRFs show the response of each variable in the system to shock from system variables. By analyzing respective orthogonalized variance decompositions (VDCs) and impulse response functions (IRFs), the relative strength of monetary and fiscal policies could easily be determined. For example, if the response of real output growth due to monetary innovations is relatively higher and dissipate at a relatively slower rate than that of fiscal innovations, we could conclude that monetary policy is more effective than fiscal policy.

A Cholesky decomposition requires the variables to be ordered in a particular fashion, where variables placed higher in the ordering have contemporaneous impact on the variables which are lower in the ordering, but the variables lower in the ordering do not have contemporaneous impact on the variables those are higher in the ordering. As the objective of this study is to examine the relative impact of monetary and fiscal policies on output growth, output growth was put in the last position. Since interest rate is influenced by the monetary and fiscal policy actions, the interest rate variable was put in the third position in the ordering of the five-variable VAR model. Moreover, since real exports can be influenced by fiscal policy, monetary policy, and interest rate, it was placed in the

fourth position. And finally, the policy variables were put in the first two places. To check the robustness of the outcome, first two places were interchanged between the two policy variables.

3.3. Diagnostic Tests

A stochastic process is said to be strictly stationary if its properties are unaffected by a change of time origin; in other words, the joint probability distribution at any set of times is not affected by an arbitrary shift along the time axis (Verbeek, 2006). This implies that the distribution of x_1 is the same as that of any other x_t, and also, example, that the covariances between x_t and x_{t-k} for any k do not depend upon t. strict stationarity is stronger as it requires that the whole distribution is unaffected by a change in time horizon, not just the first and second order moments. A weakly stationary series has a constant mean and a constant and finite variance. The term stationary, therefore, refers to the condition of weak stationarity in this study. Thus, a time series (X_t) is stationary if its mean,$E(X_t)$, is independent of t, and its variance, $E(X_t - E(X_t))^2$ is bounded by some finite number and does not vary systematically with time (Taylor et al, 1992). Thus, it will tend to return to its mean and fluctuations around this mean will have broadly constant amplitude. A nonstationary series, on the other hand, will have a time-varying mean (or variance) and so we cannot, in general, refer to it without reference to some particular time period.

Nonstationarity of a time series not only presents problems for the consistency of estimation techniques but that the problem of inference is also greatly complicated (Taylor et al, 1992). A model containing nonstationary variables often leads to a problem

of spurious regression, whereby the results obtained suggest that there are statistically significant relationships between the variables in the regression model when in fact all that is obtained is evidence of contemporaneous correlation rather than meaningful causal relations (Harris, 1995). Besides, there is little point in studying impulse response functions and variance decompositions for a nonstationary series (Johnston and Dinardo, 1997). If a time series is not stationary it is necessary to look for possible transformations that might induce stationarity (Johnston and Dinardo, 1997). There are two principal methods of detecting nonstationarity: subjective judgment applied to the time series graph of the series and to its Correlogram, and formal statistical tests for unit roots (Johnston and Dinardo, 1997). It is obviously not easy to judge one series to be stationary and the other nonstationary on the basis of visual inspection of the series alone. A more powerful discriminator is the Correlogram. Correlogram is the autocovariance function estimated by using the sample moments. From the autocorrelation function (Correlogram of the series) we can infer the extent to which one value of the process is correlated with previous values and thus the length and strength of the memory of the process.

There are different approaches that help to accomplish formal statistical tests for unit roots and stationarity. The ADF test tests the null hypothesis that a time series y_t is $I(1)$ against the alternative that it is $I(0)$, assuming that the dynamics in the data have an ARMA structure. The ADF test is based on estimating the test regression

$$y_t = \beta' D_t + \phi y_{t-1} + \sum_{j=1}^{p} \psi_j \Delta y_{t-j} + \varepsilon_t \qquad (3.8)$$

Where D_t is a vector of deterministic terms (constant, trend etc.). The p lagged difference terms, Δy_{t-j}, are used to approximate the ARMA structure of the errors, and the value of p is set so that the error ε_t is serially uncorrelated. The error term is also assumed to be homoskedastic. The specification of the deterministic terms depends on the assumed behavior of y_t under the alternative hypothesis of trend stationarity. Under the null hypothesis, y_t is $I(1)$ which implies that $\phi = 1$. The ADF t-statistic is based on the least squares estimates of (3.8) and are given by (Hatanaka, 1996):

$$ADF_t = t_{\phi=1} = \frac{\hat{\phi} - 1}{SE(\phi)} \qquad (3.9)$$

Whose alternative formulation is:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + \sum_{j=1}^{p} \psi_j \Delta y_{t-j} + \varepsilon_t \qquad (3.10)$$

where $\pi = \phi - 1$. Under the null hypothesis, Δy is $I(0)$ which implies that $\pi = 0$. The ADF t-statistic is then the usual t-statistic for testing $\pi = 0$. The test regression (3.10)is often used in practice because the ADF t-statistic is the usual t-statistic reported for testing the significance of the coefficient of y_{t-1}.

Phillips and Perron (1988) developed a number of unit root tests that have become popular in the analysis of financial time series. The Phillips-Perron (PP) unit root tests

differ from the ADF tests mainly in how they deal with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric autoregression to approximate the ARMA structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression. The test regression for the PP tests is:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + \upsilon_t \qquad 3.11$$

where υ_t is I(0)and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the errors υ of the test regression by directly modifying the test statistics $t_{\pi=0}$. This modified statistics, denoted z_t, is given by:

$$Z_t = \left(\frac{\sigma^{\wedge 2}}{\lambda^{\wedge 2}}\right)^{1/2} . t_{\pi=0} - \frac{1}{2}\left(\frac{\lambda^{\wedge 2} - \sigma^{\wedge 2}}{\lambda^{\wedge 2}}\right).\left(\frac{T.SE(\pi^{\wedge})}{\sigma^{\wedge 2}}\right) \qquad (3.12)$$

The terms $\sigma^{\wedge 2}$ and $\lambda^{\wedge 2}$ are consistent estimates of the variance parameters

$$\sigma^2 = \lim_{T\to\infty} T^{-1} \sum_{t=1}^{T} E(\upsilon_t{}^2) \qquad (3.13)$$

$$\lambda^2 = \lim_{T\to\infty} \sum_{t=1}^{T} E[T^{-1} S_t^2] \qquad (3.14)$$

where $S_t = \sum_{t=1}^{T} \upsilon_t$. The sample variance of the least squares residual $\hat{\upsilon_t}$ is a consistent estimate of σ^2, and the Newey-West long-run variance estimate of υ_t using $\hat{\upsilon_t}$ is a consistent estimate of λ^2.

Under the null hypothesis that $\pi = 0$, the PP Z_t statistic has the same asymptotic distributions as the ADF t-statistic. One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term υ_t. Another advantage is that the user does not have to specify a lag length for the test regression.

The ADF and PP unit root tests are for the null hypothesis that a time series y_t is I(1). Stationarity tests, on the other hand, are for the null that y_t is I(0). The most commonly used stationarity test, the KPSS test, is due to Kwiatkowski, Phillips, Schmidt and Shin (1992). They derive their test by starting with the model:

$$y_t = \beta' D_t + \mu_t + \upsilon_t \qquad (3.15)$$

$$\mu_t = \mu_{t-1} + \varepsilon_t, \qquad \varepsilon_t \sim WN(0, \sigma_\varepsilon^2)$$

where D_t contains deterministic components (constant or constant plus time trend). υ_t is $I(0)$ and may be heteroskedastic. Please notice that μ_t is a pure random walk with innovation variance σ_ε^2. The null hypothesis that y_t is $I(0)$ is formulated as $H_0: \sigma_\varepsilon^2 = 0$, which implies that μ_t is a constant. Although not directly apparent, this null hypothesis also implies a unit moving average root in the ARMA representation of Δy_t. The KPSS

test statistic is the Lagrange multiplier (LM) or score statistic for testing $\sigma_\varepsilon^2 = 0$ against the alternative that $\sigma_\varepsilon^2 > 0$ and is given by

$$KPSS = \frac{\left(T^{-2}\sum_{t=1}^{T} S_t^{\hat{}\,2}\right)}{\lambda^{\hat{}\,2}} \qquad (3.16)$$

where $S_t^{\hat{}} = \sum_{j=1}^{T} \upsilon_j^{\hat{}}$, $\upsilon_t^{\hat{}}$ is the residual of a regression of y_t on D_t and $\lambda^{\hat{}\,2}$ is a consistent estimate of the long-run variance of υ_t using $\upsilon_t^{\hat{}}$.

It is hard to rely on subjective judgment based on visual inspection of the time series graphs; therefore, in this study the formal statistical approaches, ADF,PP and KPSS, were employed to diagnose the stationarity of the variables of the model.

Moreover, since the results of Johansen test can be quite sensitive to the lag length included in the VAR model (Taylor et al., 1995), determination of appropriate lag order is fundamental in VAR approach. The appropriate lag order (k) of the VAR was determined using standard model selection criteria such as Sequential Modified Likelihood Ratio test statistic (LR test), Final Prediction Error (FPE), Akaike Information Criteria (AIC), Schwarz Criteria (SC) and Hannan Quinn information criteria (HQ) test statistics. Optimal lag length that whitens the estimated error terms was identified.

The basic insight of co-integration analysis is that, although many economic time series may tend to trend up or down overtime in a nonstationary fashion, groups of variables may drift together (Taylor et al., 1995). If there is a tendency for some linear relationships to hold between a set of variables over long periods of time, then co-integration analysis helps us to discover it. In this study, co-integration test was

undertaken using Johansen's (1988) maximum likelihood approach. The maximum eigen value and trace statistic were employed in identifying the number of co-integrating vectors of the model.

Since the validity of Johansen's co-integration estimation technique is based on the assumption of white noise errors, the selected lag length should represent the minimum lag length for which there will not be significant autocorrelation in the estimated VAR residuals. Autocorrelation LM Test tests the multivariate serial correlation up to the specified order. The test statistic for lag order h is computed by running an auxiliary regression of the residuals u_t on the original right-hand regressors and the lagged residuals u_{t-h}, where the missing first h values of u_{t-h} are filled with zeros. Under the null hypothesis of no serial correlation of order h, the LM statistic is asymptotically distributed x^2 with k^2 degrees of freedom. The Lagrange multiplier (LM) technique was used to determine whether the residuals of the model approximate white noise.

The estimated VAR is stable if all roots have modulus less than one and lie inside the unit circle. If the VAR is not stable, certain results (such as impulse response standard errors) are not valid (Taylor et al., 1995). The stability of the VAR is worth diagnosing, therefore, so as to come up with valid inferences about impulse responses. Moreover, Pair wise Granger causality Test was employed to test whether an endogenous variable can be treated as exogenous.

4. Results and Discussions

4.1. Descriptive Results

Indeed it is hardly possible to make conclusive deductions from simple descriptive analyses. Nonetheless, since descriptive trend lines may help portray the overtime relationship of explanatory variables vis-a-vis the dependent one, the researcher has opted to present trend lines of the same and the possible explanations of peculiar spots in the scenarios that follow.

4.1.1. Trends in Money Supply, Government Expenditure and GDP

Government expenditure had been very low and virtually steady up to 1974 (imperial regime) (see Figure 1 and appendix III). This may partly be attributed to the then prevailing private command of economic activities and little hand of the government in the economy. Moreover, the imperial regime adhered to fiscal conservatism that could possibly be another reason for the low and steady government expenditure when it remained in saddle. Quite apparent, money supply remained low and portrayed little growth during the same regime. The then low level of government expenditure and thereby low budget deficit may have helped the government to maintain low level of borrowing from the banking sector that elucidates the slow growth rate of money supply during the same regime.

The military government that succeeded to power in 1974 subscribed to socialist ideology opting for establishing strong and self-reliant state economy under planned economic management. Consequently, it designed policies and programs that deliberately discouraged and stifled the private sector. In fact, the military regime was successful to create one among the largest government size in the world (Teshome, 1993). Apparently,

government expenditure to GDP ratio (Figure 1) depicted unprecedented tremendous growth since 1974 owing to soaring defense expenditure, the proliferation of stated-owned enterprises and the increased debt servicing (Zekarias, 2003). Government expenditure to GDP ratio remained very high throughout the regime. The years 1977/78, 1984/85 and 1988/1989 hold special attention, however. During these three periods government expenditure to GDP ratio picked at some unprecedented high levels. Indeed the war the country faced against Somalia in 1977/78 may explain the unprecedented upsurge in the same year whereas the intense war the government was waging against insurgents in 1988/89 could possibly be the reason for pick government expenditure to GDP ratio witnessed in the same year. The severe drought that claimed the lives of many dear fellow citizens and the concomitant conviction of the military government to perish the insurgents, whose strong hold was hard hit by the drought, explain the unprecedented apex level of government expenditure to GDP ratio in 1984/85.

Money supply to GDP ratio (M2/GDP) (Figure 1) witnessed consistently high expansion except for few intermittent swinging during the incumbency of the military regime. Given the addiction of the regime to sustained high spending, one would conjecture that the government had been resorting to borrow from domestic banking sector, thereby spurring the supply of money like anything. Zekarias (2003) argues that '... the fiscal policy has been one major destabilizing factor as in case of revenue shortfalls the government resorted to borrowing from the banks leading to monetary expansion. Hence money supply, M1 and M2, showed almost five-fold increase from 1974/75 to 1989/90.' Zekarias (2003) further argues that the command economy that the country followed

during the military regime preordained that there be direct control on money and its components.

No later than the military government was toppled in 1991 the country experienced remarkable diminish of government expenditure to GDP ratio. In the early three years of the transitional government (1991-1993), government expenditure to GDP ratio steadily declined. This could possibly be as a result of the switch to market economy principle the transitional government made: the government has been privatizing production and service enterprises that used to demand incessant expenditure from government coffers. Even though government expenditure to GDP ratio depicted a little trending up since 1993, it was only since 1997 the country embarked on steady rise of government expenditure to GDP ratio. The growing investment on health, education and infrastructure the country has been pursuing can explain the phenomenon. In fact, the unprecedented high level of government expenditure relative to GDP the country witnessed in 1998/99 could be mainly attributed to the border conflict with Eritrea. Hence increased defense expenditure possibly caused the unprecedented upsurge of public spending in the same year. Teshome (2006) elucidates the phenomenon with vigorous argument: " the relatively good start of the fiscal situation changed dramatically during the period 1998/99-1999/00 as a result of the border conflict with Eritrea in that defense expenditure increased from 3.0 percent of GDP during 1995/96-1997/98 to 13.1 percent of GDP in 1999/00.' Similarly, money supply started to reverse relative to GDP soon after the regime change in 1991. Money supply (M2) to GDP ratio remained swinging from 1991 to 1998/99 but it exhibited remarkable decline compared to the earlier regime. It witnessed steady rise since 1989/99, however. The overlap of the start of steady rise of

money supply and the commencement of Ethiopia-Eritrean border conflict is beyond just coincidence. In this regard, I would like to dare comment that the latter caused the former. Teshome (2006) upheld the same stand by arguing that 'the way the deficit was financed shows the impact of the war. Before the conflict started in 1998, the government was actually repaying the banking system. This, however, changed when government borrowing from the domestic sources increased from 3.1 percent of GDP in 1998/99 to 9.6 percent in 1999/00.' Apparently money supply witnessed remarkable decline relative to GDP since 2002 as can be inspected from the following scenario.

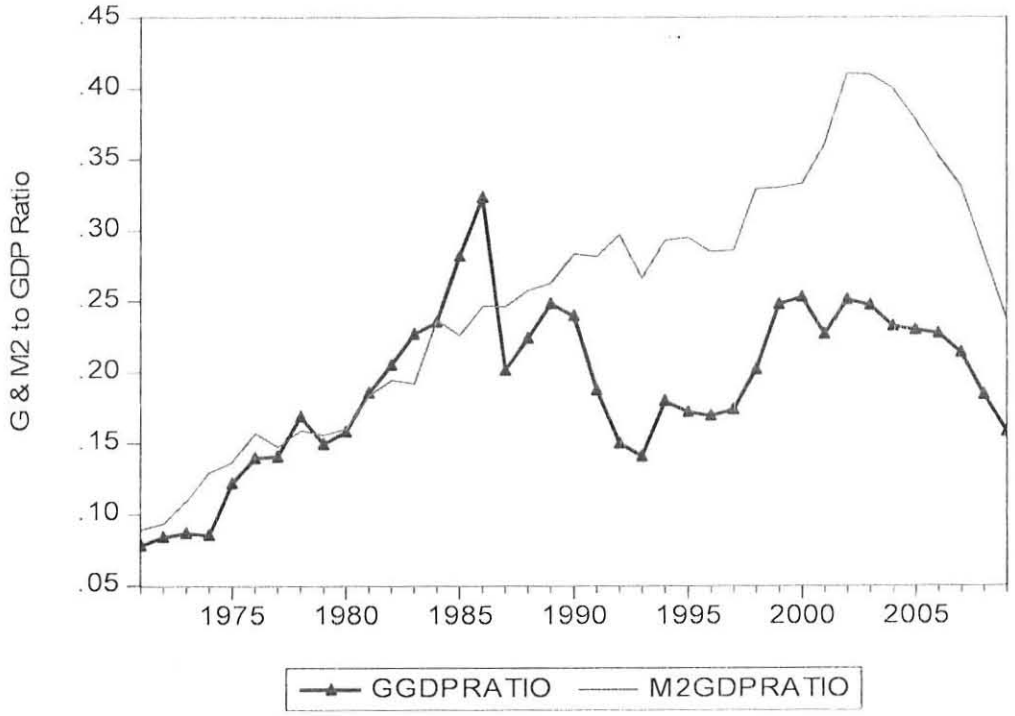


Figure 1: Trends in Government Expenditure to GDP Ratio (GGDPRATIO) and Money Supply to GDP Ratio (M2GDPRATIO)

Source: Researcher's sketching using data from MoFED andNBE

During the last days of the imperial regime, up to the demise of the emperor in 1974, the country had been registering fairly good rate of annual growth (three percent) in real GDP (Figure 2). However, this could not be sustained after the emperor was toppled and power transfer was made to the military regime. Along with the change of government shift of economic ideology took place to centrally planned and commanded economy. Of course it wouldn't sound proper not to give account to the effect of the first oil shock that took place in 1973/74 though it was a short term phenomenon. Nonetheless the overall poor performance of the economy during the military ruling is possibly attributed to the misguided public command of resources that deliberately stifled private investment. The adverse impact of inefficiency of government investment is another worth mentioning point. The government had been doing to its level best to squeeze private venture and to overtake every private investment made earlier which in fact sounds inferior option. The predominance of the economy by rain fed agriculture is, indeed, the core reason for the erratic nature of output growth. Bliss of high growth rate has been often attributed to windfall gains out of good weather where as curses of poor performance usually emanate from natural calamities. The 1984 lowest growth of real GDP, for example, coincides with the severe drought the country encountered in the same year. The military regime is to blame, however, as its policies couldn't ensure commendable rate of growth even during periods of favorable weather. Neither did the military regime pursue any successful attempt to transform the structure of the economy.

Soon after the military government was toppled in 1991, the transitional government switched to free market economy principles. Under the transitional government, limbo liberal economy, the country witnessed revival. Indeed this could be attributed to the end

of civil war pacific situation and thus the peace dividend, availability of funds for development projects. The shift of policy to one encouraging the participation of the private sector could have also partly helped the economy to revive.

The country seems to be embarked on sustainable striding on the path of growth since 2004. Double digit growth the country has been registering since 2004 could be attributed to the developmental role the government has been taking. Hard to deny, the incumbent government has been investing in infrastructure more than any other time (regime) ever in the history of the country. Indeed the leader has vowed that his government is determined to set Ethiopia off serving the poster child of poverty. The big push spending on infrastructure could have been possibly crowding in private investment. The relative peaceful situation concomitant with the military might of the government, favorable environment for private ventures, and the emergence of medium and small scale novice entrepreneurs in the country are some among the factors that could possibly explain the commendable growth rate.

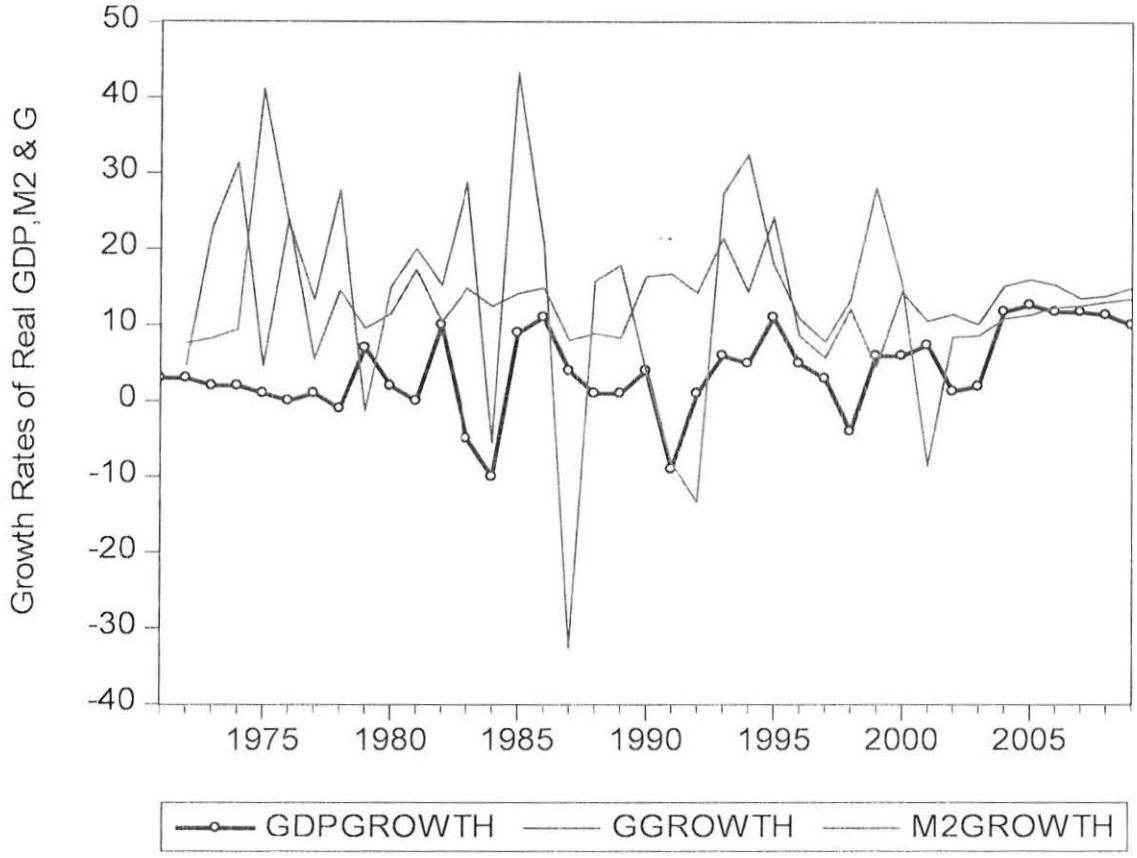


Figure 2: Trends of Growth Rate in Real GDP (GDPGROWTH), Money Supply (M2GROWTH) and Government Expenditure (GGROWTH)

Source: Researcher's sketching using data from MoFED and NBE

In conclusion, money supply (M2), government expenditure (G) and GDP have been trending up over the sample period (1971-2009) (see appendix III). In fact, one relying solely on the descriptive trend lines might opt to deliver a conclusion that monetary and fiscal policies are equally important (potent) in impacting GDP fluctuations. Even though it is too early to conclude as to which of these policy instruments have been more effective in effecting GDP growth overtime, the trend lines can guarantee one to

vigorously argue that both monetary and fiscal policies have been influencing GDP in Ethiopia. Since the trend lines furnish no means to test, which way the causation of variables trending together is, the verdict about which caused which and which influenced more are differed to the econometric testing.

4.1.2. Trends in Export and GDP

The trend line of export to GDP ratio shows (Figure 3) the extent to which the inward-looking policy the socialist military government pursued impacted on the export sector. Export value steadily dwindled relative to GDP up until the military regime was finally doomed in 1991. In fact, the unprecedented high level of export relative to GDP in the year 1976/77 coincides with international coffee price boom in the same year rendering the pick of export earning windfall. The prolonged civil war that co-saddled with the military government is another worth mentioning reason that could possibly have partly adversely affected export.

Owing to the end of the prolonged civil war and shift to outward-looking policy, export started to revive relative to GDP since 1991. Export to GDP ratio has been remarkably growing since the change of government took place in 1991 except for intermittent swinging attributed to bad weather and unfavorable international prices. Export to GDP ratio has been steadily declining since 2004, however. On the other hand, export value has been growing in the same period (see appendix III). The decline in export to GDP ratio recorded is, therefore, attributed to growth rate differential: export value could not grow at high enough rate to catch up with GDP growth given the base value differences.

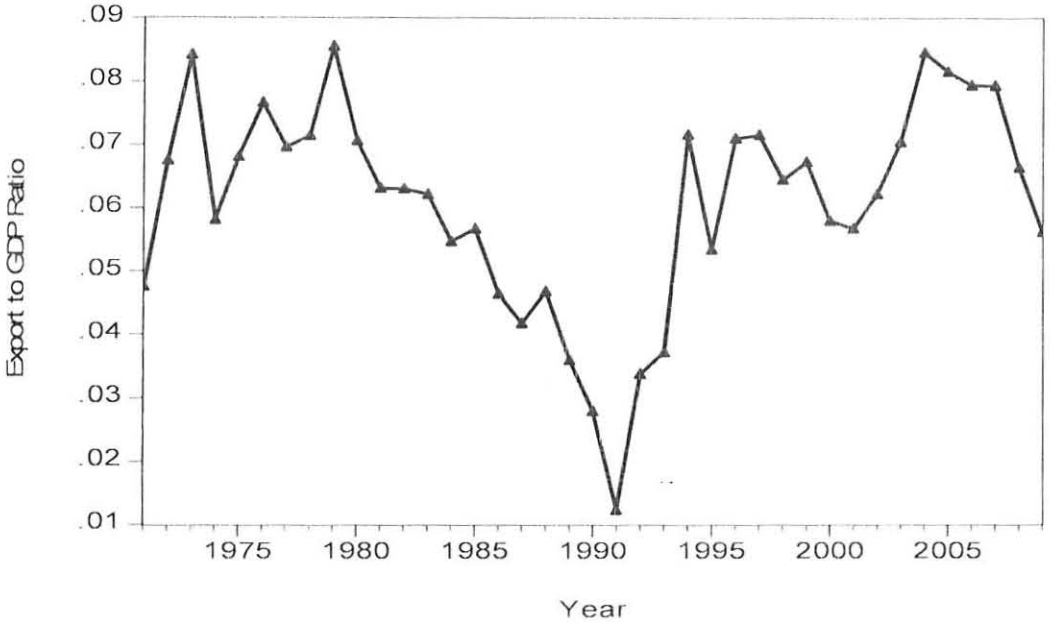


Figure 3: Trend of Export to GDP Ratio

Source: Researcher's sketching using data from Ethiopian Customs Authority

4.2. Empirical Results

4.2.1. Preliminary Data Analysis

Prior to utilizing the data in estimating VAR it is imperative to scrutinize the time series properties of each series. All the variables but interest rate are transformed to logarithmic forms with the intention of minimizing, if not getting rid of, any abnormality and nonlinearity that characterizes macroeconomic data. To begin with, a series of unit-root tests, such as Augmented Dickey-Fuller (ADF, 1981), Phillips-Perron (PP, 1988), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992), are used to determine the order of integration of each series and the summary of test results are shown in Table 1.

Table 1: Unit-Root Test Results

Variables	ADF	5% Critical value	PP	5%critical value	KPSS	5% critical value	Decision
I	-2.23	-2.941145	-2.38	-2.941145	0.13	0.463	**I(1)**
lnG	-0.16	-2.941145	-0.12	-2.941145	0.76	0.463	**I(1)**
lnGDP	-0.83	-2.941145	2.73	-2.941145	0.77	0.463	**I(1)**
lnM2	0.48	-2.941145	0.46	-2.941145	0.77	0.463	**I(1)**
lnX	0.12	-2.941145	0.19	-2.941145	0.70	0.463	**I(1)**
dI	-6.00	-2.943427	-6.00	-2.943427	0.05	0.463	**I(0)**
dlnG	-5.86	-2.943427	-5.86	-2.943427	0.11	0.463	**I(0)**
dlnGDP	-12.29	-2.943427	-3.67	-2.943427	0.42	0.463	**I(0)**
dlnM2	-6.35	-2.943427	-6.38	-2.943427	0.11	0.463	**I(0)**
dlnX	-6.25	-2.943427	-6.25	-2.943427	0.15	0.463	**I(0)**

N.B.: 1. Lag length for ADF tests are decided based on Akaike's information criterion (AIC)

2. Maximum Bandwidth for PP and KPSS tests are decided based on Newey-West (1994)

3. Prefix 'd' stands for first difference operator

4. Prefix 'ln' stands for natural logarithm of the variable

All the variables were integrated of order one (I (1)) at level: the three testing approaches yielded the same results for all the series except for interest rate (I). Whereas both ADF and PP tests proved that interest rate (I) is I(1), KPSS test failed to reject that the null hypothesis of stationarity at level.

The presence of structural breaks demand re-specifying the model of interest by incorporating dummy variables. The change of regimes the country experienced in 1974 and 1991 and the concomitant shift of economic ideologies respective governments

adhered for guarantee one to suspect the existence of structural break in the aforementioned dates. Consequently, Chow break point test is undertaken to check for structural break (Table 2). As shown in Table 2 we fail to reject the null hypothesis of no-breaks at specified break points at any plausible level of significance.

Table 2: Chow Breakpoint Test in 1974 and1991

F-statistic	0.094	Prob. F(2,35)	0.91
Log likelihood ratio	0.204	Prob. Chi-Square(2)	0.90
Wald Statistic	0.189	Prob. Chi-Square(2)	0.91

Since all the variables are found nonstationary at levels, it is compulsory to difference them before estimation. Differencing the variables removes any long-run information contained in the variables of interest, however. Resorting to error-correction mechanism, which embraces the estimation of the short-run and the long-run models, is the conventional way out to retain the long run information. The step that follows is, therefore, determining the appropriate lag length that yields white noise residuals as estimation of the long-run relationship using the Johansen's estimation technique takes white noise errors granted. Lag-length selection criteria such as sequential modified LR test statistic (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hanna-Quinn information criterion (HQ) were employed to determine the appropriate lag length. The test results of the different lag selection methods are reported in the Table 3. In fact the different selection criteria came up with different outcomes. After meticulous examination of the different lag lengths by estimating the VAR at each lag length and diagnosing the whiteness of resulting

residuals, two lag length, as recommended by sequential modified LR test statistic, was chosen.

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	45.23	NA	7.36e-08	-2.23	-2.02	-2.16
1	250.54	342.19	3.34e-12	-12.25	-10.93*	-11.79*
2	280.04	40.97*	2.83e-12	-12.50	-10.08	-11.66
3	312.77	36.36	2.32e-12*	-12.93*	-9.41	-11.70

To countercheck that the selected lag-length was appropriate, one needs to perform diagnostic tests of residuals as none white noise residuals may render inferences invalid. Autocorrelation LM test analyses residual serial correlation up to the specified order. The test statistics for lag order h is computed by running an auxiliary regression of the residuals u_t on the original right-hand side regressors and the lagged residuals u_{t-h}, where the missing first h values of u_{t-h} are filled with zeros. Under the null hypothesis of no serial correlation of order h, the LM statistic was asymptotically distributed x^2 with k^2 degrees of freedom. As shown in Table 4, we fail to reject the null hypothesis of no serial correlation at 5% level of significance for any of the lags.

Table 4: VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	52.84	0.06
2	33.15	0.13
3	29.65	0.24
4	18.57	0.82
5	22.12	0.63
6	24.73	0.48
7	20.09	0.74
8	19.91	0.75
9	15.79	0.92
10	46.46	0.06
11	21.078	0.67
12	21.67	0.65

To test normality, the Jarque-Bera residual normality test compared the third and fourth moments of the residuals to those from the normal distribution. With the null hypothesis of normal distribution the multivariate extensions of the Jarque-Bera residual normality test results were reported in Table 5. According to the test, we fail to reject at 10% level of significance the null hypothesis that residuals resulting from the specified VAR are normally distributed. This holds for all the five components individually and jointly.

Table 5: VAR Residual Normality Tests

Component	Skewness	Chi-sq	Prob.	Kurtosis	Chi-sq	Prob.	Jarque-Bera	Prob.
1	0.50	1.50	0.22	2.70	0.13	0.72	1.62	0.45
2	-0.74	3.29	0.07	3.28	0.12	0.73	3.40	0.18
3	-0.02	0.003	0.96	1.99	1.52	0.22	1.52	0.47
4	-0.10	0.06	0.80	2.35	0.64	0.42	0.70	0.70
5	-0.31	0.59	0.44	1.70	2.52	0.11	3.11	0.21
joint		5.43	0.37	0.36	4.92	0.43	10.35	0.41

Finally, White's heteroskedasticity test that is the extension of White's (1980) test to systems of equations, scrutinizes hetroskedasticity of residuals. The test regression was run by regressing each cross product of the residuals on the cross products of the regressors and testing the joint significance of the regression. Each test regression may be considered like testing the constancy of each element in the residual covariance matrix separately. Under the null hypothesis of no heteroskedasticity or (no misspecification), the non-constant regressors should not be jointly significant (Johnston and Dinardo, 1997). The joint test (Table 6), testifies that we fail to reject (at 10% level of significance) the null hypothesis of the non-constant regressors are not jointly significant thereby proving that there is no heteroskedasticity with the specified VAR.

Table 6: VAR Residual Heteroskedasticity Tests (Joint test)

Chi-sq	df	Prob
315.32	300	0.26

Neither did the test against individual components signal existence of heteroskedasticity. As can be inspected from appendix I, we fail to reject (at 10% level of significance) the null hypothesis of no heteroskedasticity for all the individual components.

Even though the residual tests indicated that the VAR was specified correctly, we need to pursue more tests to check the appropriateness of the VAR to be estimated. The inverse roots of the characteristic AR polynomial help test stability (stationarity) of VAR. The estimated VAR is stable (stationary) if all roots have modulus less than one and lie inside the unit circle (Johnston and Dinardo, 1997). The VAR stability test is indispensible for if

the VAR is not stable, certain results (such as impulse response standard errors) are not valid, rendering the resulting inferences misguiding. As portrayed in Figure 4, all the roots lie inside the unit circle, proving that the specified VAR was stable.

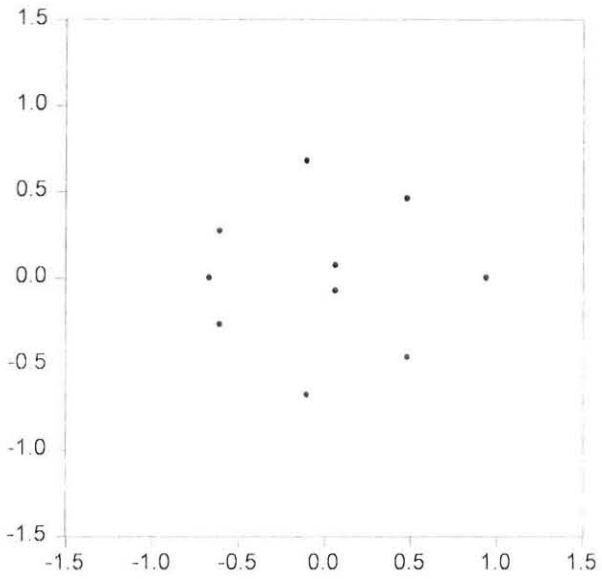


Figure 4: Inverse Roots of AR Characteristic Polynomial

Pair-wise Granger causality test tests whether an endogenous variable can be treated as exogenous. Moreover, it tests the direction of causation among the variables of interest. It was found that all the explanatory variables Granger cause GDP. The test results show that the converse holds for all explanatory variables but the interest rate. The test failed to reject the null hypothesis that GDP (in logarithm) does not Granger cause interest rate. As can be inspected from appendix II, none of the variables Granger caused the interest rate: the variables had little effect on the interest rate rendering that the variable was merely exogenous.

Moreover, tests of co-integration restrictions was undertaken to check if the restriction set by the researcher that interest is exogenous was binding, and the test result (Table 7) shows that the restriction that interest rate is exogenous in two co-integrating vectors was binding. Consequently, the researcher treated interest rate as exogenous in the long run (cointegrating) equations estimation.

Table 7: Tests of co-integration restrictions

Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability
2	296.93	10.39	2	0.006
3	309.19	NA	NA	NA
4	312.20	NA	NA	NA

Note: NA indicates restriction not binding.

4.2.2. Co-integration Tests and Results

Engle and Granger (1987) pointed out that linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be co-integrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. To determine the number of co-integrating relations, 'r', we proceeded sequentially from 'r = 0' to 'r = k-1' until we fail to reject, where k is the number of endogenous variables. The trace statistic tests the null hypothesis of 'r' co-integrating relations against the alternative of 'k' co-integrating relations, for r = 0,1, ..., k-1. The alternative of k co-integrating relations corresponds to the case where none of

the series has a unit-root and a stationary VAR may be specified in terms of the levels of the series. On the other hand, the maximum eigen value statistic tests the null hypothesis of 'r' co-integrating relations against the alternative of 'r+1' co-integrating relations.

Accordingly, both test statistics rejected the hypothesis that there exists at most one co-integrating relationship. However, both failed to reject the hypothesis that there exist at most two co-integrating relationships and the sequential testing procedure stops there. Therefore, both test statistics reveal that there are two co-integrating relationships among the series at the 5% level of significance, as summarized in Table 8.

Table 8: Unrestricted Co-integration Rank Test (Trace and Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None	0.89	155.31	88.80	79.75	38.33
At most 1	0.64	75.56	63.88	36.49	32.12
At most 2	0.51	39.08	42.92	25.56	25.82
At most 3	0.20	13.51	25.87	8.047	19.39
At most 4	0.14	5.47	12.52	5.47	12.52

Based on this, the VEC estimation was carried out following the Johansen (1998) procedure and the two long run (co-integrating) equations are as follows:

$$lnGDP(-1) = 2.81 + \underset{[0.20]}{0.22lnM2(-1)} - \underset{[0.22]}{0.12lnG(-1)} + \underset{[0.10]}{0.82lnX(-1)} \quad (1)$$

$$lnX(-1) = -3.43 - \underset{[0.41]}{0.26lnM2(-1)} + \underset{[0.28]}{0.15lnG(-1)} + \underset{[0.41]}{1.22lnGDP(-1)} \quad (2)$$

where the standard errors are in parenthesis.

Neither government expenditure nor money supply (M2) was found to be statistically significant in both long-run (co-integrating) equations. This finding conforms to economic theory that in the long run only real variables matter: policy variables do not have significant effect on real variables like GDP and Export. Similarly, an empirical study by Rahman (2005) using GDP, interest rate, M2 and government expenditure of Bangladesh in VAR analysis found no cointegration among the variables suggesting neutrality of policy variables in the long run.

The first co-integrating equation shows that export significantly affects GDP at 1% level of significance. The empirical result implies that a percentage increase in export causes 0.82% increase in GDP. Indeed, the empirical result sounds plausible as long run growth of the country may presumably depend on eventual structural transformation of the economy from rural-based semi-subsistence agriculture to urban-based industry and service as well as rural-based modern mechanized commercial agriculture. Obviously, the endeavor to successfully keep on striding on the trail to the eventual structural transformation in the long run necessarily demands imports of hefty capital goods and machinery, among others. The country can afford the huge volume of imports and ensure sustained growth only if export grows at high enough rate to generate sufficient foreign exchange earnings. Furthermore, the empirical result show that GDP has significant positive effect on export at 5% level of significance: a percentage increase in GDP helps export to increase by 1.22% in the long run as the second co-integrating equation suggests. Since export and GDP were found to push each other to a higher level in the

long run, it sounds imperative to quest for prudent policy that deliberately encourages and eventually transforms the export sector.

With the finding that fiscal and monetary policy variables are neutral in the long run we step to scrutinizing relative effectiveness of the two policy tools in the short run. Variance decompositions (VDCs) and impulse response functions (IRFs) were estimated in an attempt to get the relative effect of monetary and fiscal policy shocks on GDP growth. The estimated results of VARs in terms of VDCs and IRFs are presented in the following sub section.

4.2.3. Variance Decompositions (VDCs)

Variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR. The variance decompositions of output growth, as reported in Table 9, indicate that monetary policy shock best explains the forecast error variance of GDP growth next to GDP itself, which significantly explains more than 39% of the forecast error variances of GDP growth. The growth rate in money supply alone significantly explains more than 30% of the forecast error variances of GDP growth during all time horizons with the exception of year-1 where it explains about 29% of the forecast error variances of GDP growth. None of the other variables, such as fiscal policy, export and interest rate had any significant influence in predicting the movement of GDP growth. Therefore, this finding attests that monetary policy is more important than fiscal policy for the prediction of future output growth of Ethiopia.

Since variance decomposition based on cholesky factor may change dramatically if the ordering of the variables in the VAR is changed, an alternative estimation by interchanging the ordering of the two policy variables, government expenditure (G) and money supply (M2), was carried out to check the robustness of the results. The alternative estimation yielded the same results, however.

The outcome of the Variance Decompositions (VDCs) (Table 9) is very much in line with the predictions of the advocates of the St. Louis equation where variation in the rate of money growth causes variation in real economic activity. This finding, thus, suggest that only monetary policy is effective in altering output (GDP) of Ethiopia where fiscal policy remains broadly ineffective.

Table 9: Variance Decomposition of GDP growth

Period	Explained by Shocks in the Growth of				
	DLNM2	DLNG	DI	DLNX	DLNGDP
1	28.99 (11.85)	6.59 (6.97)	4.92 (7.13)	3.64 (4.75)	55.86 (11.24)
2	31.61 (11.99)	5.14 (5.92)	3.67 (7.08)	17.23 (10.13)	42.33 (9.99)
3	31.34 (12.76)	6.83 (6.45)	3.40 (7.45)	12.70 (7.35)	45.73 (10.68)
4	33.33 (12.94)	6.54 (6.23)	2.96 (7.83)	15.76 (8.50)	41.41 (10.76)
5	32.20 (13.53)	7.84 (7.02)	2.66 (8.72)	14.81 (8.82)	42.48 (11.83)
6	33.95 (14.10)	7.27 (6.80)	2.41 (8.85)	16.20 (9.61)	40.18 (12.20)
7	34.41 (14.77)	7.29 (6.70)	2.23 (9.12)	15.95 (10.32)	40.12 (12.76)
8	35.25 (15.01)	7.156 (6.68)	2.11 (9.23)	16.038 (10.56)	39.44 (13.07)
9	35.64 (15.45)	7.18 (6.61)	1.99 (9.29)	16.02 (11.01)	39.18 (13.49)
10	36.11 (15.59)	7.13 (6.70)	1.91 (9.34)	15.95 (11.23)	38.91 (13.77)

NB: -Monte Carlo (100) simulated standard errors are reported in parenthesis
- Cholesky ordering used is DLNM2 DLNG DI DLNX DLNGDP

4.2.4. Impulse Responses

A shock to the i^{th} variable not only directly affects the i^{th} variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VAR. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. If the innovations ε_t are contemporaneously uncorrelated, interpretation of the impulse response is

straightforward. The i^{th} innovation on $\varepsilon_{i,t}$ is simply a shock to the i^{th} endogenous variable $y_{i,t}$. Innovations, however, are usually correlated, and may be viewed as having a common component which cannot be associated with a specific variable. In order to interpret the impulses, it is common to apply a transformation to the innovations so that they become uncorrelated. In this study, the cholesky transforming approach which uses the inverse of the cholesky factor of the residual covariance matrix to orthogonalize the impulses was employed. This approach imposes an ordering of the variables in the VAR and attributes all of the effect of any common component to the variable that comes first in the VAR system. One need to bear in mind, however; that response may change dramatically if the ordering of the variables is changed. The estimated IRFs along with 95% confidence interval of output growth due to fiscal as well as monetary policy shocks are reported in Table 10. This table embraces response of output growth due to shocks in fiscal policy, monetary policy, interest rate, export and to GDP itself. The finding shows that only monetary policy shocks had significant and positive impact on output growth, which is very much in line with the outcome of VDCs. GDP growth responded positively to the monetary policy shocks at the initial period and became insignificant for rest of the period, indicating a short-run positive impact of monetary policy on GDP growth. Table 10 shows that GDP growth responds by almost 0.05 to one standard deviation innovation of money supply growth in the initial period. Besides, GDP growth responds by about 0.06 to one standard deviation innovation of GDP growth itself in the first period. The response of output growth to the fiscal policy shocks, however, was always insignificant, indicating that GDP growth does not respond to any fiscal policy shocks. In a nutshell,

the impulse response estimates of the VAR show no real impact of fiscal policy on output growth.

An attempt was also made to check the robustness of the results by changing the ordering of the variables in the VAR. However, the alternative estimate in which the position of money supply and government expenditure was interchanged could not deliver different results, suggesting that the results are robust.

Table 10: Impulse Responses of GDP Growth

	Impulses from				
Period	DLNM2	DLNG	DI	DLNX	DLNGDP
1	0.046 (0.015)	0.022 (0.015)	0.019 (0.012)	0.016 (0.011)	0.063 (0.008)
2	0.033 (0.022)	0.007 (0.019)	0.004 (0.019)	0.038 (0.019)	0.015 (0.018)
3	0.034 (0.032)	0.021 (0.023)	-0.010 (0.024)	-0.005 (0.023)	0.046 (0.021)
4	0.032 (0.033)	0.011 (0.022)	-0.003 (0.026)	0.028 (0.031)	0.019 (0.027)
5	0.022 (0.044)	0.019 (0.026)	-0.003 (0.025)	0.013 (0.034)	0.0323 (0.035)
6	0.031 (0.052)	0.006 (0.028)	-0.001 (0.029)	0.024 (0.040)	0.019 (0.039)
7	0.026 (0.068)	0.011 (0.034)	-0.002 (0.033)	0.015 (0.051)	0.026 (0.053)
8	0.026 (0.085)	0.008 (0.038)	0.001 (0.040)	0.015 (0.061)	0.020 (0.067)
9	0.024 (0.117)	0.010 (0.053)	-0.0002 (0.048)	0.015 (0.080)	0.022 (0.090)
10	0.022 (0.153)	0.008 (0.067)	-0.0003 (0.062)	0.012 (0.103)	0.019 (0.118)

NB: -Monte Carlo (100) simulated standard errors are reported in parenthesis
- Cholesky ordering used is DLNM2 DLNG DI DLNX DLNGDP

Therefore, monetary policy was found more important than fiscal policy in explaining GDP growth in Ethiopia as suggested by the variance decompositions and impulse response results. Indeed this finding complies with the findings of different authors such as Ajisaf and Folorunso (2002) who studied for Nigeria, Rahman (2005) for Bangladesh, Ali et al (2007) for South East Asian countries and Carlson (1975) for the United States of America (see Part II). All the five aforementioned authors reached the conclusion that monetary policy is more effective than fiscal policy in their respective countries.

5. Conclusions and Policy Implications

5.1. Conclusions

This study investigates whether the monetary policy or fiscal policy has greater impact on GDP growth in Ethiopia using unrestricted VARs based on St. Louis equation. Unrestricted Co-integration Rank Test (Trace and Maximum Eigen value) was undertaken to determine the number of cointegrating vectors. Two cointegrating vectors were estimated as suggested by both Trace statistic and Maximum Eigen Value statistic. Both money supply and government expenditure were found statistically insignificant in the cointegration equations supporting the finding that none of the policy variables has long run impact on real variables such as GDP and export. In the long run, output fluctuates around potential output, which is determined by factors other than policy variables. In the long term, policy variables can only control nominal variables such as inflation and the exchange rate.

The finding that GDP and export positively affect one another significantly in the long run (cointegrating equations) sounds plausible as long run growth of the country may presumably depend on eventual structural transformation of the economy from rural-based semi-subsistence agriculture to urban-based industry and service as well as rural-based modern mechanized commercial agriculture. Obviously, the endeavor to successfully keep on striding on the trail to the eventual structural transformation in the long run necessarily demands imports of hefty capital goods and machinery, among others. The country can afford the huge volume of imports and ensure sustained growth only if export grows at high enough rate to generate sufficient foreign exchange earnings.

Variance Decompositions (VDCs) and Impulse Response Functions (IRFs) of the VAR was estimated in an attempt to capture the short run effects of fiscal and monetary policies on GDP growth given the policy variables are neutral in the long run. The result from the VDCs implies that monetary policy variable explains most of the forecast error variance of GDP growth where fiscal policy remains broadly ineffective in explaining the forecast error variance of GDP growth. In line with the prediction of VDCs, the outcome of IRFs also suggests that monetary policy alone has significant impact on GDP growth in Ethiopia. Therefore, the hypothesis that monetary policy is relatively more effective than fiscal policy in influencing GDP growth in Ethiopia is not rejected.

The results of the VDCs and IRFs suggest that monetary policy should be used as a short term tool for macroeconomic stabilization in Ethiopia. The economic effects of central bank decisions depend critically upon public expectations regarding the future conduct of policy. It is therefore important for the monetary authorities to think carefully about what their current actions signal about future policy, they need to seek to develop channels through which they can also shape expectations of the public about future policy. One aspect of the expectations that monetary authorities should seek to influence is the public's expectations regarding the rate of inflation. Effective stabilization of the real economy partly depends on stable inflation expectations. While some degree of short-run variation in the rate of inflation is inevitable, it is important to maintain the public's confidence that the average rate of inflation over the medium term will be low and that this can be forecasted with reasonable precision. The National Bank of Ethiopia should therefore be mandated with public commitment through legislative definition to a quantitative inflation target, or a quantitative definition of the bank's objective of price

stability. But the mere declaration of a target is not enough to anchor expectations: it is also necessary that the public be able to see that policy is conducted in a way that should be expected to achieve the target. Hence the necessity for National Bank of Ethiopia to improve transparency and accountability by specifying and announcing an explicit inflation target for monetary policy.

5.2. Policy Implications

Export has been found to be significantly positively affecting GDP in the long run. National competitiveness promotion strategy should be among the top priority strategies of the government in order to ensure the long term growth of the nation. Though competitiveness is created at the firm level, it is partly derived from a systemic context, emerging from complex patterns of interactions between government, enterprises and other actors: national technological capability is more than a sum of capabilities of individual firms in a country. It is an innovation system, which includes the externalities and synergy generated by the learning process, ways of doing business, and the knowledge and skills residing in related institutions. Government, therefore, need to do to its level best to solve supply-side constraints, build national productive capacity and develop an efficient trading and transport infrastructure. Diversifying the export basket, sustaining higher rates of export growth over time, upgrading the technological and skill content of export activity are some among the core activities to promote national competitiveness. To diversify the export basket, beyond the multi pronged activities government is doing to scale up small and medium size enterprises, deliberate focus should be made to enhance the export competitiveness of the same enterprises through possible link-ups to international trade and investment linkages.

Money growth exerts a positive statistically significant influence on the growth of GDP. Monetary policy should be used as a short term tool for macroeconomic stabilization in Ethiopia because the results of the long run model show that the policy variables do not have statistically significant effect on GDP. Policy makers need to ascertain the liquidity needs of the economy and thereby create greater certainty in the amount of credit and money to be supplied to achieve macroeconomic objectives. Furthermore, monetary authorities should be transparent to the public about their policy objectives and should do to their level best to win credibility among the public that they truly pursue the predefined objectives. This helps to harness expectations of the public and thereby ensure macroeconomic stability. For sustained economic growth, policy makers should make sure that monetary actions do not adversely affect exports and private investment.

In fact fiscal policy's effect has been shown to be insignificant both in the short run and long run models. Despite the findings of the study, the researcher suggests that further studies on this issue are required to make concrete policy recommendations as single study based recommendation may not be appropriate.

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Appendix-I

VAR Residual Heteroskedasticity Tests (Individual components)

Dependent	R-squared	F(20,15)	Prob.	Chi-sq(20)	Prob.
res1*res1	0.630273	1.278526	0.3175	22.68984	0.3043
res2*res2	0.756325	2.327873	0.0500	27.22771	0.1290
res3*res3	0.562662	0.964919	0.5383	20.25582	0.4420
res4*res4	0.718829	1.917417	0.1012	25.87785	0.1699
res5*res5	0.208956	0.198114	0.9995	7.522412	0.9946
res2*res1	0.771158	2.527363	0.0360	27.76167	0.1152
res3*res1	0.546095	0.902329	0.5923	19.65943	0.4794
res3*res2	0.803815	3.072921	0.0154	28.93734	0.0890
res4*res1	0.689664	1.666738	0.1582	24.82791	0.2081
res4*res2	0.609755	1.171869	0.3824	21.95118	0.3432
res4*res3	0.673977	1.550451	0.1951	24.26317	0.2311
res5*res1	0.490710	0.722637	0.7548	17.66555	0.6094
res5*res2	0.629601	1.274844	0.3196	22.66564	0.3055
res5*res3	0.562626	0.964779	0.5384	20.25453	0.4421
res5*res4	0.538797	0.876182	0.6155	19.39669	0.4962

Appendix-II

Pair-wise Granger Causality Tests

Null Hypothesis	Obs	F-Statistic	Probability
LNG does not Granger Cause I		0.15	0.86
I does not Granger Cause LNG	37	0.35	0.71
LNGDP does not Granger Cause I		0.17	0.84
I does not Granger Cause LNGDP	37	3.18	0.04
LNM2 does not Granger Cause I		0.47	0.63
I does not Granger Cause LNM2	37	1.57	0.22
LNX does not Granger Cause I		0.65	0.60
I does not Granger Cause LNX	37	1.91	0.16
LNGDP does not Granger Cause LNG		3.76	0.03
LNG does not Granger Cause LNGDP	37	3.61	0.04
LNM2 does not Granger Cause LNG		3.61	0.04
LNG does not Granger Cause LNM2	37	0.96	0.39
LNX does not Granger Cause LNG		5.45	0.01
LNG does not Granger Cause LNX	37	0.79	0.46
LNM2 does not Granger Cause LNGDP		3.76	0.03
LNGDP does not Granger Cause LNM2	37	3.06	0.06
LNX does not Granger Cause LNGDP		5.44	0.01
LNGDP does not Granger Cause LNX	37	4.06	0.03
LNX does not Granger Cause LNM2		3.16	0.06
LNM2 does not Granger Cause LNX	37	2.37	0.11

Appendix-III

Trend Lines of Explanatory Variables vis-à-vis Dependent Variable

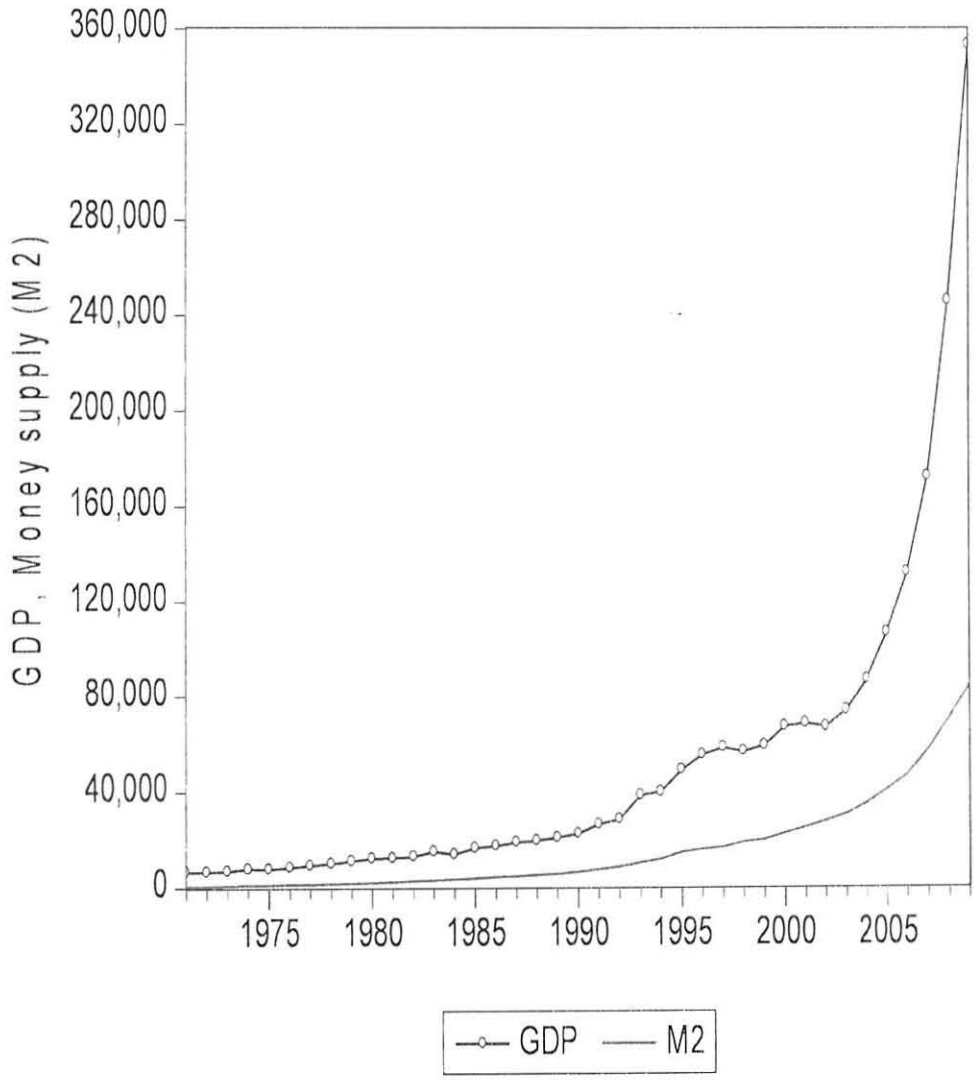


Figure A1.Trends in GDP and Money Supply (millions of birr)

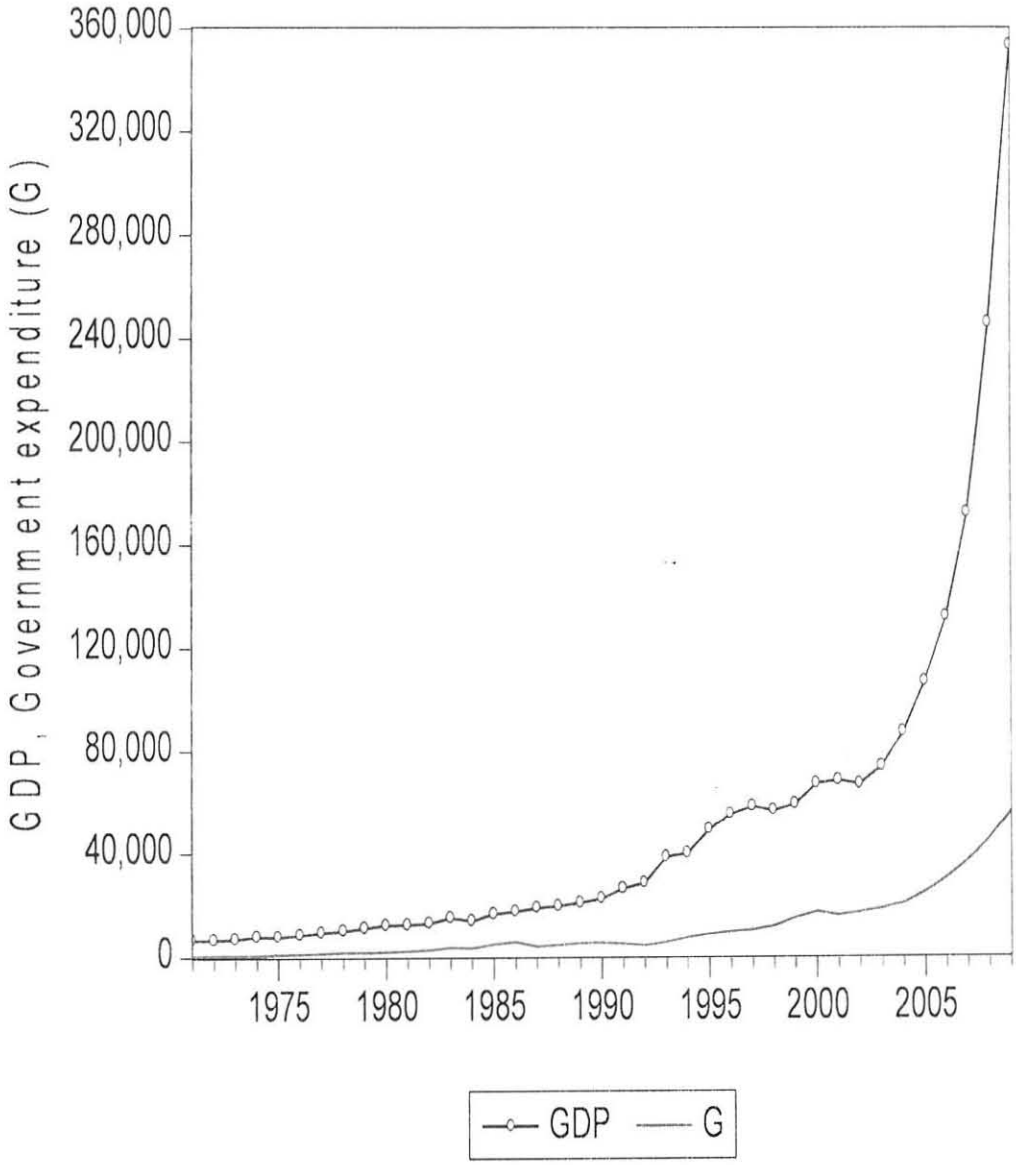


Figure A2. Trends in GDP and Government Expenditure (millions of birr)

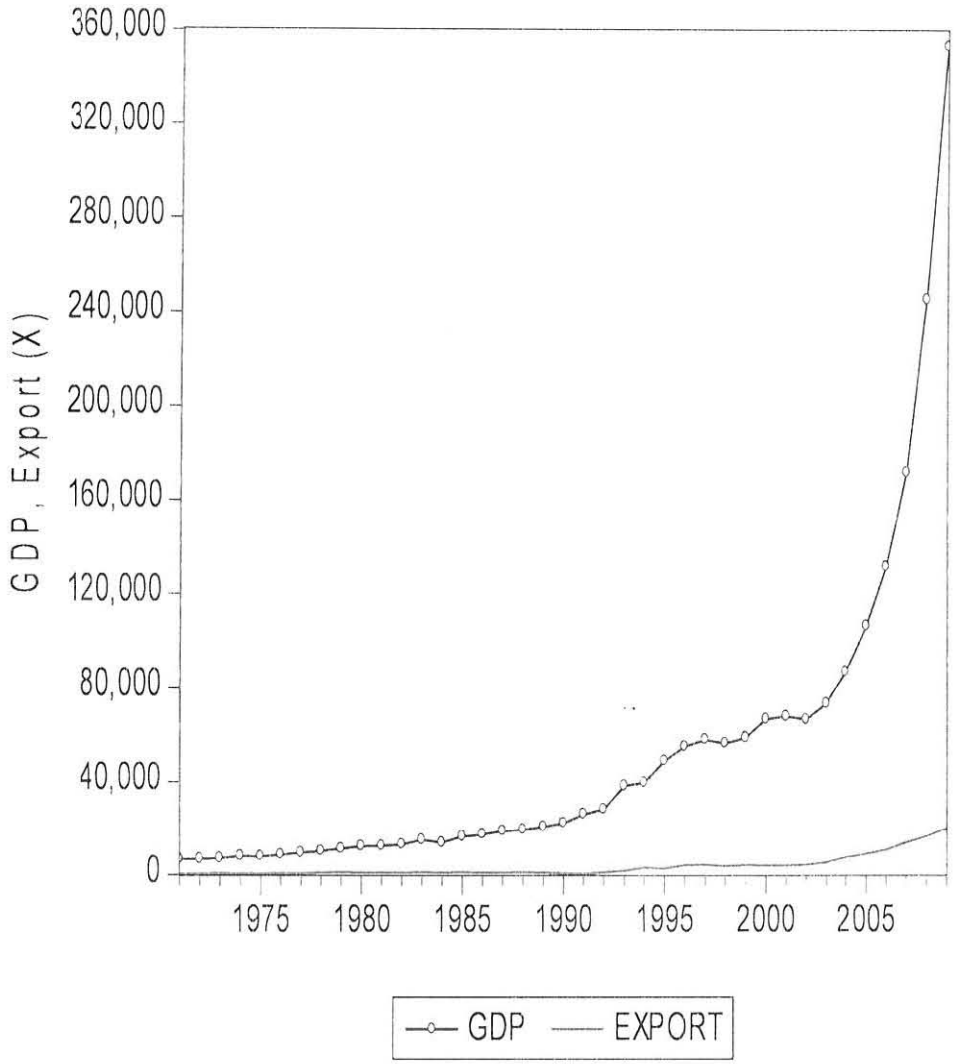


Figure A3. Trends in Export and GDP (millions of Birr)

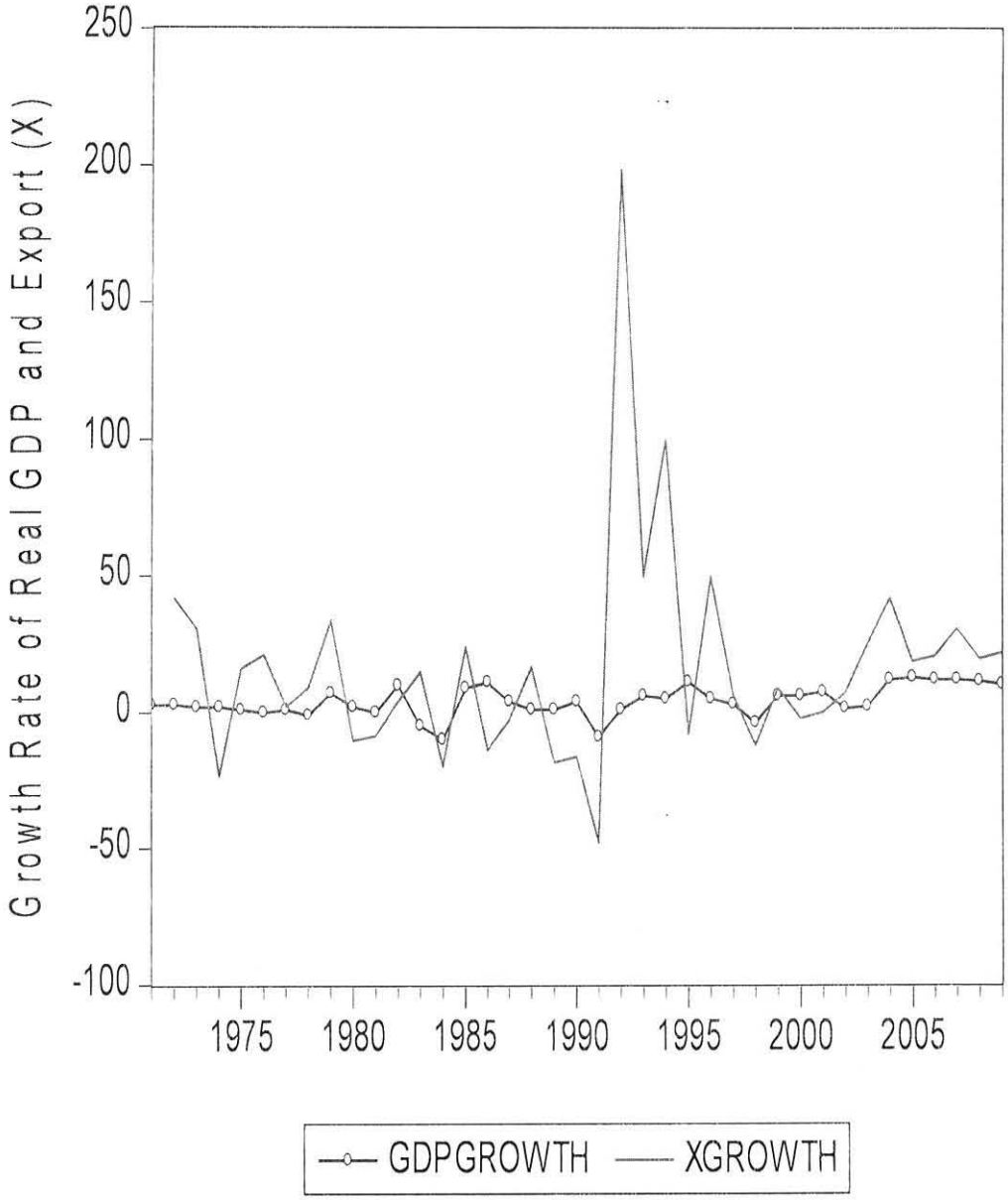


Figure A4. Trends in Growth Rate of Real GDP (GDPGROWTH) and Export (XGROWTH)

Declaration

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

The examiners' comments have been dully incorporated.

Declared by:

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Place and date of submission: _____.