How Central Bank Responds to Macroeconomic Shocks? Specification, Estimation and Analysis of Monetary Policy Reaction Function:

The case of Ethiopia (2000-2017)

A Thesis Submitted to the School of Graduate Studies of Jimma University in partial fulfillment of the Requirements for the Award of the Degree of Master of Science in Economics (Msc)

BY:

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JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

MSC PROGRAM

MAY 14, 2018

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DECLARATION

I hereby declare that this thesis entitled "How Central Bank Responds to Macroeconomic Shocks? Specification, Estimation and Analysis of Monetary Policy Reaction Function: The case of Ethiopia (2000-2017)" has been carried out by me under the guidance and supervision of Dr. Leta Sera and Mr. Sisay Tolla.

The thesis is original and has not been submitted for the award of any degree or diploma in any universities or institutions.

Researcher's name	Date	Signature
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CERTIFICATE

*This is to certify that the thesis entities "**How Central Bank Responds to Macroeconomic Shocks? Specification, Estimation and Analysis of Monetary Policy Reaction Function: The case of Ethiopia (2000-2017)**", Submitted to Jimma University for the award of the Degree of Master of science in economics (Msc) and is a record of Valuable research work carried out by Mr. Milikit Balcha, under our guidance and supervision.*

Therefore we hereby declare that no part of this thesis has been submitted to any other university or institutions for the award of any degree of diploma.

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ACRONYMS

CPI	Consumer Price Index
DC	Domestic Credit.
DCP	Domestic credit to private sectors
REER	Real effective exchange Rate
GDP	Gross Domestic Product.
Fg	Fiscal deficit or gap
NBE	National Bank of Ethiopia
BOP	Balance Of Payment
CSA	Central Statistics Authority
VECM	Vector Error Correction Method
VAR	Vector Autoregressive
ECM	Error Correction Model
MOFeED	Ministry of Finance and Economic development
MBOP	Money Balance of Payment

Abstract

This paper designed to identify both the goals and pattern of policy with the two major aims: firstly to know the way how National Bank of Ethiopia systematically responds to macroeconomic shocks and secondly to evaluate the performance monetary policy against its initial objective including assessment of gap analyses in monetary policy frame work. Hence, the model demonstrates that the National Bank of Ethiopia chooses the domestic credit as the most appropriates indicator of monetary policy with the determinants of net foreign assets, consumer price index, fiscal gap, real effective exchange rate and Gross Domestic Products to formulate the reaction function. On top of this the empirical results explain that domestic credit has strong long run & positive relation with net foreign assets & to real Gross Domestic Product. But it has short run relation with consumer price index, real effective exchange rate and real Gross Domestic Product at different lag structure. The NBE followed a combination of both accommodating and stabilization monetary policy. The Coefficients of equilibrating error terms, ECM suggest that the speed of adjustment/ feed back effect towards the long run equilibrium takes many years for full adjustment when there is a shock in the system, indicating the longer lags structure and undeveloped financial sectors resulted in obstacles for the effectiveness of monetary policy. Regarding to the evaluation of monetary policy objectives up on short run dynamics model, Both low inflation rate and reduction of monetization of fiscal deficit can be maintained while achieving the international reserve target is not fully under the control of NBE. Basically, the attempts of NBE to maintain the growth rate of money supply at the rate of nominal GDP growth has been satisfactorily met. The sterilization coefficient revealed incomplete sterilization activities while the offset coefficient tell us a highest degree of monetary control with low degree of capital mobility.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Countries have gratefully concerned about the macroeconomic stability and the growth of GDP to achieve a better living standard of their people. Macroeconomic stability has been an issue in heart of macroeconomics since the origin of economics. Both empirics and theories suggest that it is challenged by domestic and foreign shocks. Especially in the era of globalization, the unprecedented degree of economic integrations intensifies complexities and exposes domestic economy to various macroeconomic shocks (Einar, 2000). Hence, countries pay attention to the existence of sound macroeconomic policies laid a fertile ground to attract domestic and foreign investment along with the development of business confidence. The attempts are also made to consider different aspects policy implication of macro activities and to synchronize the net effects of all efforts particularly fiscal and monetary policy into a particular direction addressing the critical problem of real sector. Being each macroeconomic policy interacts, supplement, and complement each other, there should be then set out principles that policymakers can use when designing policy packages, before implementing it practically. It means that policy is likely to have a positive or negative effect on the various target variables. In effect it might have stimulating or damping effect on economy.

So as the interactions between real and monetary sectors can determine countries growth rate of GDP, One of most and foremost researchable area in macroeconomics is monetary policy. It is the nucleus part of macro policy and can attract many researchers to steer the government into a particular direction and considers international macroeconomic coordination. Hence, a monetary sector is too much sensitive to macroeconomic shocks like domestic and foreign shocks or policy and non-policy shocks. Depending on the independence of central bank, policy makers widely engaged in determining the pattern of monetary policy, and in setting the effectiveness of policy objective, policy target and policy instruments. These conditions are depending on the political and the economic condition pursed by the countries.

In the case of Ethiopia, during the Derg regime actions to centrally planned economy was nationalizing the emerging private banks and Insurance companies. Here monetarypolicy was

designed to the target of central plan. The private sectors were marginalized from getting bank loan and the bulk of investment decisions were made within the public sectors. Economic sectors lost their own autonomy and the development of financial markets and institutions was curtailed. These policy actions together with recurrent drought and intensified civil war were held responsible for the sluggish economic performance and macro economic instability, increasing BOP deficits and inflationary pressure. Extension of credit intake by central government had to do a lot with the behavior of money supply during Derge regime. Though the scarcity of foreign assets from poor foreign sectors policy had seriously hampered their impact on monetary expansion and constraint the endeavor to expand the pubic sectors. Since borrowing had also been effected for non- development purpose, the resulting external indebtedness had not been sustainable. The exchange rate was fixed, thus, at a very low level to prevent growth in the domestic cost of foreign currency due to weak foreign assets, parallel markets had a number of restriction. Despite the prevalence of negative real interest rate for the most period, deposits kept on growing because of lower demand for money in the private sectors (MoFED: 1999). Apart from increasing pressure on domestic financial resources, government's endeavor to expand the public sector was constrained by the availability of foreign exchange (as is the case for any developing countries), necessitating external borrowing and assistance. Since borrowing had also been effected for non-development (defense) purposes, the resulting external indebtedness had notbeen sustainable. The exchange rate was, thus, fixed at a very low level to prevent growth in the domestic cost of foreign currencies. This has, however, penalized the export sector, which has not developed from the beginning. To restrain effective demand for foreign exchange, government has introduced a number of restrictions on the imports of some commodities (especially consumer goods), foreign exchange rationing through licensing, introduction of high and protective tariff rates and the like.

After down fall of Derg regime and when EPDRF government came in to power in 1990/91 with the adoption of market-oriented economy up on the adjustment programs of IMF and the World Bank structural adjustments. Policy measures were taken to improve the external imbalance, liberalize trade and financial sectors, to remove fiscal and real sectors constraints. As an important of stabilization, monetary policies of the reform period has been aimed at maintaining the growth in nominal GDP so that inflation could be contained and external balance maintained at a sustainable level. In doing so government sought to ensure adequate growth of credit to meet

the requirements of the non- government productive sector. Government has introduced and uses currently open market operation, a standing central bank credit facility, reserve requirement, Setting of floor deposit interest rate, direct borrowing/lending in the inter-bank money market and introducing re-purchase agreement (repo/reverse repo operations), use of selected credit control and moral Suasion.(NBE's monetary policy framework, February 2009).

The objective of monetary policy will be to ensure domestic liquidity expansion that allows for reasonable credit growth to meet the proper needs of the productive sectors particularly the private sectors, while reducing domestic inflation and that pressure on the BOP. Attainment of this objective will require a significant cut back in credit to the central government (TGE, 1992). Even though open market operation is not in its standard way, steps are taken to lay ground by developing Treasury bill market. There are three categories of treasury bills with maturity periods of 28, 91, and 182 days on the market. Both private and public enterprises participate in this auctioning. Apart from being a non-inflationary financing instrument to the government, T-bills help avoid crowding out effects of government borrowing from the banking system and help prepare the ground for capital markets.

Economic shocks cause's macroeconomic fluctuations since they often result in sudden changes in one or more of the macroeconomic variables. In addition, the government usually responds to negative shocks by implementing policy measures to mitigate their negative effects and these measures in turn cause changes in other macroeconomic variables which adversely affect economic growth and investment. According to Agenor and Montiel (2008), supply side shocks (output fluctuations) and external shocks (terms of trade, exchange rates, interest rates, and capital flows) were found to play a more prominent role in most developing countries.

According to Hausmann and Gavin (1996), even though domestic and external economic shocks contribute to macroeconomic volatility, the economy's vulnerability to these shocks depends on its institutional structure and policy regimes, that is, the interaction of economic shocks with the prevailing institutional structure and the economic policy regime determines the severity of macroeconomic volatility. Similarly, Acemoglu et al. (2003) found that the main cause of macroeconomic volatility is not "bad" policies (such as excessive government spending, high inflation, and overvalued exchange rates), but rather the underlying institutional weaknesses.

This they explained was because weak institutions (such as political institutions that do not constrain politicians and political elites, ineffective enforcement of property rights for investors, widespread corruption, and a high degree of political instability) foster the adoption of distortionary macroeconomic policies, which in turn lead to macroeconomic volatility.

The banking sector in Ethiopia is composed of 16 private and one state owned commercial banks and one state owned development bank. There is also 17 private and one state owned insurance companies, more than 30 micro finance institutions and few emerging lease finance companies. Under supervision of the NBE, Ethiopian banking sector is rapidly growing, developing its outreach and exhibiting strong financial soundness.

1.2 Statement of the problem

The central essence of the study is going to identify the problems associated with the response of National Bank through monetary policy when there are shocks in the system. After the falling down of socialist regime and direct monetary policy instrument, monetary authority attempts to conduct basic financial liberalization program step by step including establishments of indirect or market based policy instruments, inter -banks money markets, a treasury bills auction market as a stepping stone for open market operation in financial market and then to move out to a full-fledged open market operation step by step, lifting up the ceiling and floor the interest rates through time, the entrance of private banks and all those commercial banks are allowed to set credit interest rate and the floor of deposit interest rate. Beside that the exchange rate are dramatically depreciating to alleviate the current account deficit and etc. The study can critically investigate the problems associated with monetary policy and its response to macro-economic shocks including:

- What are the problems involved in monetary policy instruments and the reaction towards macro shocks when the Bank attempts to meet its long run and short run policy objectives?

- To what extent the effectiveness of the policy depend on lag structure and the structure of the economy?

- Why some of macroeconomic variables are insensitive to monetary policy? What are the factors which insulate the monetary authority action?

1.3 Objectives of the Study

1.3.1 Main objective

The main objective of the study is to know the way in which National Bank of Ethiopia reacts to macroeconomic shocks and to evaluate its performance against its policy objectives.

1.3.2 Specific objectives

- To know the performance of monetary policy and the actions taken by NBE to tackle the problems.

- To specify and analyze a monetary policy reaction function of Ethiopia and the interactions or feedback responses for policy determinants, and to identify variables that are relatively sensitive to monetary policy.

- To suggest policy implications after critical examination of the objectives of the monetary policy whether the National Bank meet its initially designed objectives since financial liberalization adopted.

1.4 Significance of the Study

This study may place its own contributions to evaluate the policy objective and it could be a building block for future studies. It also shed light on screening out the determinants of policy, and ensure whether there systematic pattern of response or not.

1.5 Limitation of the study

Although this study was carefully prepared, I am aware of its limitations and short comings. The main limitation of this study was time and finance to conduct the study.

1.6 Scope of the Study

The scope of the study is confined to the role of NBE in responding to macro shocks, and evaluates its objectives by using specification estimation and analysis of policy reaction function. It includes the policy design, assignments, and instruments-targets relations from 2000-2017 in Ethiopia.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1 Overview of the Role of Central Bank

The central bank, which is responsible for managing a country's monetary affairs, determines the level of short-term interest rates, thereby profoundly affecting financial markets, wealth, output, employment and prices. Indeed the central bank's influents spread not only within the domestic territory of a country but even, through financial and trade linkages to virtually every corner of the globe.

The central bank's main goal is low and stable inflation. It also seeks to promote steady growth in national output, low unemployment, and orderly financial markets. If output is growing rapidly and inflation is raising the central bank is likely to raise interest rates, as this puts a brake on the economy and reduces inflationary pressures.

2.2 Theory of Money and monetary policy

It is obvious that the very nature of monetary policy is to control money supply, which is linked with the changes in economic variables (Mishken, 1998). Hence analysising the behaviors of money supply is the fertile ground and a precondition for effective monetary policy. Accordingly, as universally accepted, money can be used as a medium of exchange, a unit of account, a store of value and a means of payment. However there is unsettled debates among economist how money affects the economy. In general, each school of thought like classical, Keynesian and monetarist presented different version to the effect of money over the real sectors due to the underlined assumptions

- **The Classical Monetary theory**

The classical economists argue that monetary forces do not change real variables such as output and employment. Accordingly, money acts only as a medium of exchange and it facilities transactions, i.e. neglects money as a store of value. Unlike Hume whose theory was based on long run equilibrium and restricted metal concept of monetary system, the one, Henry Thornton proposed that a *short-term theory* and took *expansion of credit* into account. As Hume, the

expansion of money real effects in the short-term particularly in a metal-based currency economy but Thornton expressed the long-term effect unknown.

He believed that in an expanding economy, the credit system can stimulate the economy depend on the demand pattern of the economy, He also advocated monetarist to pursue a credit management system through the use of monetary instruments of interest rate to control any excessive credit expansion, which can lead to boom and then to slump. He found an indirect link between money supply and prices through the rate of interest in that the rate of interest affects money supply, which in turn affects the price level. This linkage between prices, money and interest rate was the basis for Keynes's later works on the general theory of employment, interest and money (Mankiw, 2003).

Irving Fischer developed the 'exchange or transaction equation' of earliest quantity theory of money. His theory based on that money was simply a medium of exchange such was held only to facilitate exchanges. For the aggregate economy, at equilibrium, PT=MV where T is demand for money (trade volume) and also is determined independently of the other variables in the identity, P is average price of commodity and factor, M is average quantity of money and is determined independently of any of the three other variables, V is average velocity of money and MV is supply of money is assumed to be passive and dependent where V is stable. This consideration permits the identity to be transformed in to a version of the 'quantity theory of money'. The demand for money (it depends on real factors of production) is taken as stable and outside the influence of monetary factors. Money supply (MV) and trade volume (T) determines the level of P and there is proportional relation ship between general price and money supply (Branson, 1989).

Marshall and Pigou gave another version of the quantity theory of money to be called Cambridge equation. According to cash balance approach, individuals desire to hold money because it provides certain services such that security, purchasing power, buying on favorable term, opportunity arise, convenient asset to have and the like. For the aggregate economy, at equilibrium, M=KYP where M is average money supply in a period, Y is real income, P is average general price, K is a fraction of cash balance out of real income and KY is demand for real cash balances. Here K is assumed to be constant in a fully employed economy and real

income change only a very slowly. When M increase p will continue to rise until the demand for money equates the supply of money (Mankiw, N.Gregory: 2003).

Therefore in the short run money is not neutral to the economy, but in the long run equilibrium because of prices rise with the same proportion to equate actual and desired real money balances, money is neutral. Even though the classical dichotomy has been subjected to many debates, classicalist divided the economy in to the real and the monetary sectors. In the real sector, which is associated with the short-run monetary theory, real wages, output and employment are influenced and money is not neutral to the economy. While in the monetary sectors, which is associated with long run theory, the interest rate plays no role and money is neutral to real variables but affects nominal variables.

• **Keynesian Monetary theory**

According to this thought, the changes in money supply may be transmitted to real output and employment through interest rate and investment. Money is demanded for three motives: transactions, precautionary and speculative motives. Unlike classical, the Keynesian argument incorporates both the medium of exchange and store of value as basic functions of money.

Keynesian's view of the economy can be presented in a very simplified form. Suppose that for some reason each household and firms in the economy decides that it would like to hold a little more cash. Keynes argued this happens when businessmen lose confidence and start to think of potential investments as risky, leading them to hesitate and accumulate cash instead: An individual can increase cash holding by spending less. So what happens when everyone tries to accumulate cash simultaneously? The answer is that income falls along with spending.

For Keynes, the first and most thing to do is to make it possible for the people to satisfy their demand for more cash without cutting their spending, preventing the downward spiral of shrinking spending and shrinking income. The way to do is simple to print money and somewhat get in to circulation. So the usual and basic Keynesian answer to recessions is a monetary expansion. But he worried that even sometimes not be enough if a recession become a true depression. Once the economy is deeply depressed during the depression year, 1930s, households and especially firms may be unwilling to increase spending no matter how much cash they have; they may simply add any monetary expansion to their hoarding. Such a situation, in which monetary policy has become ineffective, has come to be known as a ''liquidity trap'. In

such a case, the government has to do what the private sector will not: spend. When monetary expansion is ineffective, fiscal expansion must take its place. Such a fiscal expansion can break the vicious circle of low spending and incomes and getting the economy moving again. Therefore there were re-establish stability by drawing into use idle resources, capital and labour. However after some time unemployment, which was expected to move inversely with prices increase, began to move in a similar direction. The cheap- money policy of Keynesians could not mop up unemployment, rather created monetary instability caused by inflation (Keynes, 1936).

To the detail, in Keynes theory, an increase or a decrease in money supply is attributed to the open market purchase or sale of government instrument by the central bank depending on the prices of security. The speculative motive is a key element of his liquidity theory and distinguishes Keynes from the classical school of thought. In classical, there is no distinction between motives, and takes money as neutral to the economy in the long run (Branson, 1989 and Mankiw, 1997).

Keynes considered investment in financial assets as an alternative investment if money rose, and are replaced for money because money has nil return. The return of financial assets is the sum of the capital gain and the interest yield of the assets. So the owner make a decision based on this return the whether to buy or to hold speculative (idle balance). If at higher interest rate the wealth owner hold less idle balances is changed to bonds up on the anticipation of the rate of interest and the capital gain.

Contrasting this with the quantity theorist, a rise in money supply does not result in a direct proportionate increase in prices since part of it is held as idle balances because of different motives principle. For Keynes the general price level is determined by labour costs. But in classical, money supply determines the level of prices, wage, and employments. For Keynes those variables are determined through the rate of interest. Keynesians also differ from the classical monetary school in their view of transaction mechanism in the monetary sectors (Branson, William H: 1989). The classical school does not state a thing about the source of extra money in an economy, while Keynes identified sources such as open market operation, increased exports and deficit expenditure. Unlike classicists who believed in wage cuts to diminish unemployment, Keynes recommended an increase in prices, which he believed that it would shrink the real wage rate and increase the demand for labour (Branson,1989).

• **Monetarists Monetary theory**

Monetarists' school argues in favor of the classical theory with slight deviations. They agree that money may affect real variables in the short run but only nominal variables or magnitudes changes in the long run. Friedman has studied the demand for money and suggested not only income and interest rate, total wealth also affects the desire to hold real money balances. Monetarism, as advocates of free market, started challenging Keynes's theory in the 1970s.Milton Friedman, the founder of monetarism, attacked Keynes idea of smoothing business cycle on the ground that such active policy is not only unnecessary but actually harmful, worsening the very economic instability that is supposed to correct, and should be replaced by simple, mechanical monetary rules. This is the doctrine that came to be known as monetarism (Friedman: 1970). Friedman began with a factual claim; most recessions, including the huge slump that initiated the Great Depression, did not follow Keynes's script. I.e. they did not arise because the private sector was trying to increase its holding of *a fixed amount of money*. Rather, they occurred because of a fall in the quantity of money in circulation (Branson, 1989 and Mankiw, 2003). The policy rule under Monetarism is that if economic slumps begin when people spontaneously decide to increase their money holdings, then the monetary authority must monitor the economy and pump money in when it finds a slump is imminent. If such slumps are always created by a fall in the in the quantity of money, then the monetary authority need not monitor the economy; it need only make sure that the quantity of money doesn't slump. In other words, a straightforward rule-''keep the money supply steady''- is good enough, so that there is no need for a ''discretionary'' policy of the form, 'pump money in when your economic advisers think a recession is imminent.''

Money supply, which has been given a limited direct role in an economy, received a prominence position; their theoretical formulation is based on the old quantity, Cambridge cash balance, and the Keynesian liquidity preference theories. Similar to old quantity theorists, the monetarists believe that money plays a significant role in an economy and influence the periodic movement economic activity and particularly income and price levels. While the old quantity theorist, an increase in money supply result in a *direct* level determines the purchasing power or real money balance money is required now to purchase commodities.

The monetarist model is fundamentally a model for the demand of money and not a money supply model. Unlike Keynesian model, their model does not deal with changes in output, employment, money income or the price level. They consider money as assets With implicit yields such as convenience and safety and treated it like production factors or commodities. The demand for money depends on total wealth, the prices and yields of money assets in terms of other alternative assets, tastes and preferences. They regarded money as any other commodity in which tastes and preferences play a significant role in the decision to buy or not to buy. For this reason, their model follows the general macroeconomic demand for goods equation where the quantity of a commodity is depending on its prices, prices of other commodities and on test and preferences (Friedman, 1968).

In general monetarism postulates that variation in money supply brings disturbances to prices and hence influence resource allocation. Growth in prices occurs only as an expansion in money supply, which implies that rigid monetary policy result in a stable environment for the performance of an economy. Friedman assigns three roles for monetary policy. Namely to restrain money itself from being a central cause of economic disorder, to present a stable background for the working of the economy and, to counterbalance majors instabilities from other sources. The monetarist alleged monetary policy to provide a universal remedy to all business-cycle evils, and monetary policy was primarily to be directed to encouraging the banking system in to satisfying the monetary demands of the business commodity.

So far we have seen the role of money in macroeconomic system depends on of the thoughts of different schools. Given that money can matter the economy, How could transmitted its effects? It can transmit through the intermediate macro variables namely portfolio balance, wealth, Credit, expectation, and exchange rate (Harris, Branson and Thomas , 1967).

According to Keynesian argument, if monetary authority undertakes open market operation to increase money supply will lead to increase bond price and interest rate. Even if there is no direct relation between money and with real assets, money can affects it through bond markets where the demand and price of the bond interaction directly affect the given money supply and then the real assets of the household (Harris, 1985 and Branson, 1989).

According to Tobin approach, money stands at one end of continuous spectrum of assets with real assets at the other. An increase money supply will result in portfolio adjustment and higher expenditure in real capital asset. For instance an increase in money supply leads to excess reserves by commercial banks, and they adjust their portfolio by either more loan or by engaging in secondary government market. He strongly considers, not only bond, many financial assets in equity market with a ripple effects that transmitted monetary impact in to real assets. i.e. the effect of a change in money supply is seen as a ripple passing along the range of financial assets but diminishing in magnitude and unpredictability as it proceed further away from their initial distribution. The ripple effect will eventual reach the demand for equity pushing up their prices and pressing their yield until this demand for real physical asset that will result in high investment and their output and employment (Branson, 1989).

On the other hand, monetarist does not endorse the indirect relation, and the ripple effect as recommended by the aforementioned schools. Rather they believed that money could easily and directly affect the real sectors through the portfolios balance approach. Besides that money is like any other assets and the term interest rate refers not only to the rate of return of the final assets but also to the rate return that the flow of services from any real assets represents the cost of assets. However the rate of return are implicit and unobservable. Thus the monetarist "money" is a substitute for not only financial assets but for all assets that comprise wealth portfolio (Friedman, 1970).

On top these intermediate variables, textbook expositions of the monetary transmission mechanism typically assume a financial structure in which banks coexist with well-developed and liquid markets for securities in the form bonds and equities. However the development of financial markets and macroeconomic policy in Sub-Saharan Africa characterized by weak security markets and bank dominated structure.

As central banks bear an increasing share of responsibility for short-term macroeconomic management, effects on the monetary transmission mechanism and on conduct of monetary policy are particularly important. The transmission mechanism is strongly influenced by the state of domestic financial development, and financial structure may also constrain the ways in which monetary policy is conducted (AERC, 2003).

Under financial repression, the monetary authority can make use of a wide array of policy instruments, but the influence of these instruments on aggregate demand and real sectors is likely to be extremely complex and to be influenced by a variety of factors that can be expected to vary across time and place. While in liberalized 'bank-only' environment, monetary policy instruments consist of reserve requirements and central bank lending to commercial banks. Transmission is through the 'credit channel' (the cost or availability of bank credit) and the 'asset channel' (the price of durable goods, which exerts wealth effects on aggregate demand). The relative importance of the availability versus the cost of credits, as well as the strength of the asset channel, is likely to vary with financial development.In a 'bank-com-securities' world, the process of financial development will influence the relative roles of channels of transmission associated with the 'traditional ' view of monetary (interest rate effect that influence aggregate demand through real long-term interest rates, assets value and real exchange rates) and those associated with the 'lending view' (the credit channel and balance sheet channel). By increasing the scope for bank borrowers to access other sources of finance, as well as banks themselves to sustain lending in the face of reduction of reserves, financial development is initially likely to strengthen the former and weaken the latter.

As financial development proceeds in a bank-cum-securities setting, however, the growth of 'nearmonies' will tend to weaken the traditional channels of transmission operating through the effects of open market operations on markets interest rate, essentially by increasing the interest elasticity of the demand for money. This does not mean that central Bank will lose control over interest rates, but that larger changes in reserve may be required to achieve a given interest tare effects. With respect to the conduct of monetary policy, the increased role of the asset channel associated with financial development, coupled with the role of expectations in determining assets value is likely to increase the uncertainty associated monetary policy effects, not least because of the possible effects thatmonetary policy may have in creating or collapsing asset-price bubbles. The implication is the financial development increases the premium on predictability in the conduct of monetary policy (AERC, 2003).

2.3 Monetary policy framework and operating procedures

In the face of real world's complexities, policymakers need guiding principles to aid them in their work. It is important to examine the theory of economic policy against multiple objectives of the countries. This government objective is not only confined to economic sphere but it bring us to the concept of multiple and hierarchical objectives.

Tin Bergen (1955-1967) developed a mathematical model of policy formulation that conclude a government must use at least as many policy instruments as the numbers of its target variables. It serves as a warning against trying to use just one or a few policy measures to achieve a multiplicity of objectives.

The pursuit of multiple objectives bring with the potential for conflicts among them. This brings in the idea of tradeoffs, when progress towards one objective can be achieved only at the cost of a retreat from another objective. Trades off are pervasive and further complicate the policy problem.

In principle, central bank can resolve choices between conflicting objectives according to their place in the hierarchy, or according to the weight that government places up on each of them. There is also danger while each policy decision may be carefully considered; this individual consideration may divert attention from the overall design and coherence of policies when taken together.

Taking all complexity in to account, the monetary authority draw monetary policy framework and operating procedures in the context of countries' existing condition to have achieving certain goals or objectives. Macroeconomic goals may have included items such as highest possible long-term economic growth or lowest unemployment, moderate inflation rate (*price stability*), balancing foreign trade (*stability in foreign exchange market*), *interest rates stability, stability in financial markets*. In recent years, however, responding to new insights from macroeconomic theory, mandates have increasingly focused on price stability. In some cases this goes as far as setting explicit numerical targets for inflation to be attained over specific time horizons: inflation targeting (Mishkin, 1998).

In more general terms, the pursuit of final goals of monetary policy rests on a series of choices regarding the information set used as a basis for short-term and longer-term policy adjustments, including the weights and specific roles attached to various economic variables. This subsumes such as the choice of exchange rate regime, intermediate target variables, forecasting, and indices of the thrust of monetary policy or overall conditions in the monetary sphere. The variables playing a role at the strategic level are generally not under the close control of the authorities and the corresponding policy decisions usually pertain to longer horizons. Hence, monetary policy strategy specifies both intermediate targets.

Monetary policy strategy

Intermediate targets	**……**	**Final Goals**
*Monetary/credit aggregates		* Price stability
*Exchange rate		* Unemployment
*Long-term interest rates		* Economic growth

Regarding to monetary policy tactics, operating procedures relate to what might be called the tactical level of policy implementation. They cover the choice of instruments and of operating targets.

Monetary policy instruments are official interest rates (discount window), market operation (repo tenders), reserve requirements, and direct control (ceilings on bank credit growth and deposits).

Operating targets are variables which, being more proximate to the policy instruments in the causal chain, can be influenced quite closely by the authorities. They include money market interest rates (Overnight or call rate), and bank reserves (commercials banks' deposits with the central banks plus vault cash). Monetary - policy indicator is needed to measure correctly the intensity of policy actions, so that by looking at it we can know how much of a change in the target variable already chosen (money supply as argued above) is due to policy actions. This should help evaluate, guide, and readjust policy actions quickly.

Currently, all central banks implement monetary policy through market-oriented instrument or direct instrument geared to influencing operating targets and do so largely by determining the conditions that equilibrate supply and demand in the market for bank reserves to influence economic activities.

In conclusion, in view of the complexity of instruments-targets interrelationships and the interconnectedness of different policies, we have urged the adoption of "a system approach", with policies viewed as a consistent, mutually supporting package (Tin Bergen: 1967).

This urges us to the determinant and behaviors of policy reaction function that states how central bank adjust their operating targets (and instrument) to information, such as an increase in expected or lagged inflation rates, high economic growth, depreciating exchange rate, excessive money growth and provides a link between short-horizon operating procedure and long-horizon strategy objectives.

2.4 The three Instruments of Monetary Policy

Open Market Operations are the purchases and sales of government bonds by the central bank. When the central bank buys bonds from the public the birr it pays for the bonds increase the monetary base and thereby increase the money supply. When central bank sells bonds to the public, the birr it receives reduce the monetary base and thus decrease the money supply. Open market operations are the policy instrument that the central bank uses most often.

Reserve Requirements: - are the central bank regulations that impose on banks a minimum reserve deposit ratio. An increase in reserve requirements raises the reserve deposit ratio and thus lowers the money multiplier and money supply.

The Discount rate: - is the interest rate that the central bank changes when it makes loans to banks. Banks borrow from the central bank when they find themselves with too few reserves to meet reserve requirements. The lower the discount rate, the cheaper are borrowed reserves, and the more banks borrow at the central bank's discount window. Hence, a reduction in the discount rate raises the money base and the money supply.

2.5 Determinants of Monetary policy & their co-ordination

The monetary policy of central banks in developing countries has been the subject of numerous studies, which seek to identify the determinants of these policies. The policies of central banks of developing nations, however, have not received the same degree of scrutiny. This difference has been due, in part, to a belief that monetary agencies in the developing economies do not have the latitude to engage in discretionary activities.

As central bank attempts to control money supply and bring macroeconomic stability, the policy makers have to critically consider all the determinants of their policy decision. Broadly speaking, factors that affect the magnitude and the direction monetary authority action are the monetary implication of government deficits, the interactions with the external sectors, and the targets of the authority and its specified objectives (Joyce , 1991).

2.5.1. Monetization of budget deficit and inflation

In the absence of broad and active financial markets in developing countries, the primary obligation of the monetary authorities is to finance the government budget. Under these circumstances, monetary growth depends primarily up on fiscal policy .The government can pay deficit in three ways. *It can borrow from the public* through issue bonds to the public, *it can print money*, i.e. borrow from the central bank or *it can run down foreign-exchange reserve*.

A government that has borrowed a lot in the past has already accumulated a heavy debt, and it will have difficulties borrowing further, either domestically or from abroad, because of doubts about its capacity to service its debts. Typically, such a government has also exhausted its stock of foreign exchange reserves after prolonged period of large budget deficits. For these reasons, a government with chronically large budget deficits is likely to find itself eventually compelled to pay for those deficits by printing money. The growth rate of money supply is largely dominated by the growth rate of credit from central bank.

Assuming that fixed exchange rate**,** quantity theory of money and that velocity of money is an increasing function of the interest rate and perfect capital mobility, under international arbitrage, any attempt by the government to borrow from the central bank simply leads to an increase of money that, in turn, causes a loss of reserves and a subsequent reversal of the money supply increase. The government will indirectly be financing the deficit out of international reserves losses (Sylvanus, 2004).

What does all this tell us about inflation? As long as foreign reserves continue to be available, the country can avoid inflation. The exchange rate remains fixed at its pegged level, and the external price level is given. If the fiscal deficits persist, however, the government eventually runs out of reserves. At that point, when domestic residents attempt to exchange their home money for foreign currency, the government cannot continue to intervene in the market. The central bank has no option but to allow the exchange rate to depreciate. The collapse of a pegged exchange rate system, when the central bank run out of reserves, is called BOP crisis.
To the subsequent, assuming fiscal deficits under floating exchange rates, the government cannot borrow and it no longer has foreign exchange reserves and the only way to finance the deficit is through money creation, seigniorage (Sylvanus, 2004).

In general under floating exchange rates, the deficits result in inflation. Each deficit leads to a given rate of inflation. One way to describe the fiscal deficits is being financed through an inflation tax on real money balances. The tax rate is the inflation rate while the tax base is the level of real money balances. The real goods and services that the government purchases with the money that it prints each period is the measure of the tax revenue collected by the government as result of the inflationary policy.

2.5.2. Monetary Effect of Balance of payments

According to Monetary view, surpluses (deficits) in the money account measure the rate at which money balances are being accumulated (reduced) money balances are adjusted to their desired levels. There fore a balance of payment is the one mechanism by doing actual money balances are adjusted to their desired levels. The monetary approach to the balance of payment prescribe a solution to an external imbalance lies in the reduction in domestic absorption, more specifically the government budget deficit (Thomas and John , 1980).

The monetary view of the BOP maintains that the transactions recorded in the balance of payments are essentially a reflection of monetary phenomena. As such, it places emphasis on the direct influence of an excess demand for and supply of money on the BOP. The crucial concept is that which captures all transactions reflection the adjustment of actual money balances to the desired levels. i.e. the only transactions considered below the line are those, which have an

influence on domestic and foreign monetary bases and thus on domestic and foreign money supplies.

The MBOP is a theory of an automatic adjustment process. According to this theory, any BOP disequilibria or exchange rate movement reflects a disparity between actual and desired money balances and will automatically correct itself. While the adjustment process is different under different exchange rate regimes, the implication is that the process is automatic and that its effects cannot be neutralized in the long run. Any BOP imbalance or exchange rate change is a phase in the automatic adjustment process and attempts to counter these processes merely increase the forces which give rise to the adjustment ultimately required for a return to equilibrium (Thomas and John , 1980).

It is concerned primarily with the long run. The approach recognizes that short run analysis is often complicated by the fact that postulated adjustment behavior is incomplete in the short run. For example the adjustment of actual money balances to their desired levels does not occur instantaneously, but rather requires the passage of time. However, the government cannot follow such policies in the long run. This seems reasonable because, in the long run success in neutralizing the effects of international reserves flows implies that the government of some countries (surplus) is willing to trade investment and consumption goods for foreign currency balances. The accumulation of these balances by surplus country governments represents a nonmarket induced transfer of wealth away from domestic to foreign consumers. For whatever reason, it is unrealistic to suppose that government would pursue such policies in the long run (Warren and Khatkhate, 1976).

2.5.3. Monetary Base and Authority targets

The major determinants of broad money supply namely the *net foreign assets* and *net domestic credit* and the components of Broad money narrow money and quasi-money are important macroeconomic variables that reflect the combined effects of fiscal, monetary and exchange rate policy. The level of fiscal deficit and its mode of financing, credit policies, interest rate management, and the flexibility of the foreign exchange regime directly affect the level of aggregate demand and their overall impact is being felt through monetary aggregates. Along with supply side responses, such policies ultimately influence the rate of inflation and the overall macroeconomic environment. There fore, annual change in monetary aggregates, rather than

their absolute magnitudes, is crucial indicators of overall macroeconomic stability and considered for monetary policy analysis (MOFeED: 1998/99).

Considering all these components, monetary authority also responds to macroeconomic shocks depending on Authority target: targeting monetary aggregates or targeting inflation in order to attain its monetary objectives. Where *monetary policy targeting monetary aggregates*, assuming the quantity theory of money, the government can determine the long run rate of inflation by determining the long run rate of growth of money the supply of money. Thus in the long run, Pe=P and according to the quantity theory of money P=M, so the government can choose P by determining the rate of growth of M. However there are difficulties like what measure of money supply (M1, M2, M3) will be most relevant for controlling inflation (Warren and Khatkhate,1976).

Where the *monetary policy targeting inflation*, in the view of the difficulties encountered by monetary authorities in the control of monetary aggregates as a prelude to fighting inflation, many countries have moved on to target inflation directly rather than its proxy. Countries choose inflation targeting over alternative policy frameworks because of achieving price stability is the major contribution that monetary policy can make to economic growth, and short-term manipulation of monetary policy to achieve other goals may conflict with price stability. In theory, central bank can determine monetary policy adjustments based on the difference between forecast and the target, with announcement of explicit inflation targets would provide a clear monetary policy framework. Other policy goals are excluded or given minimum attention, and there may be conflicts with other objectives (Sylvanus , 2004).

2.5.4. Foreign Exchange rate

The foreign exchange rate is one of the most important prices in an open economy. It links the domestic economy with the rest f the world through both the goods and assets markets. There are two broad approaches to the conduct of exchange rate policy in developing countries: the real targets approach and the nominal anchor approach. Such approaches are their own implication on monetary policy effectiveness (Sylvanus , 2004).

In the *real targets approach nominal exchange rate* is a policy instrument distinct from domestic monetary and fiscal policies. This instrument can be varied to attain real objectives along the lines suggested by the internal-external balance model. This approach based on assumption of

nominal wage and prices of non-tradable are sluggish, which cause a reduction in real wages in terms of tradable after nominal devaluation and herby causes a real devaluation, real devaluation have significant real effects and the economy is subject to real shocks, originating domestically or externally, which differ from the shocks faced by its trading partners. When a country faces a current account deficit, the real exchange rate needs depreciating, along with an appropriate reduction in absorption, to correct it. In effect, the price of domestic goods in terms of foreign goodsfall and this improves the competitiveness of the domestic economy (Warren and Khatkhate, 1976).

2.6 Monetary Developments and Policy

Ethiopia's monetary policy continued to be geared towards keeping inflation rate at single digit. Accordingly, the National Bank of Ethiopia has been closely monitoring monetary development throughout the fiscal year so as to sustain the single digit inflation and manage inflation expectations. By end June 2015,annual headline inflation reached 10.4 percent slightly above the single digit target.

2.6.1 Developments in Monetary Aggregates

At the end of 2014/15, domestic liquidity, as measured by broad money supply (M2), reached Birr 371.2 billion reflecting a 24.7 percent annual growth mainly due to a 31.3 percent surge in domestic credit. The high growth of domestic credit was attributed to a 32.8 percent increase in credit to the noncentral government and 14.1 percent growth in credit to central government. (Table 3.2)

Component-wise, narrow money expanded by 15.3 percent due to the rise in demand deposits and currency outside banks reflecting the growth in economic activities and improvements in money demand for transaction purposes. Similarly, quasimoney, that comprises savings and time deposits, went up by 32.3 percent and reached Birr 216.6 billion in line with the increased capacity of banks in deposit mobilization with the opening of 485 new branches and stability of domestic prices.(Table 3.1)

(In millions of Birr, where applicable)

Table 2.1 Components of Broad Money

(In millions of Birr, where applicable)

Particulars	Year Ended June 30					Annual percentage change			
	2010/11	2011/12	2012/13	2013/14	2014/15	2011/12	2012/13	2013/14	2014/15
Narrow Money Supply	76,171	94,849.90	114,745.70	134,063.80	154,584.80	24.5	21	16.80	15.13
Currency Outside banks	32,574.90	38,537.10	45,671	53,176	60,496.30	18.3	18.5	16.4	13.80
Demand deposits(net)	43,596.10	56,312.70	69,074.70	80,887.80	94,088.50	29.20	22.70	17.10	16.30
Quasi-Money	69,206.0	94,548.9	120,567.9	163,682.8	216,567.6	36.6	27.5	35.8	32.3
Saving Deposits	64,539.6	82,487.8	106,276.2	136,334.0	174,699.1	27.8	28.8	28.3	28.1
Time Deposits	4,666.4	12,061.1	14,291.7	27,348.8	41,868.5	158.5	18.5	91.4	53.1
Broad Money Supply	145,377.0	189,398.8	235,313.6	297,746.6	371,152.4	30.3	24.2	26.5	24.7

Source: National Bank of Ethiopia (NBE)

Table 2.2 Factors Affecting broad Money

(In millions of Birr, where applicable)

Particulars	Year Ended June 30					Annual percentage change			
	2010/11	2011/12	2012/13	2013/14	2014/15	2011/12	2012/13	2013/14	2014/15
External Assets (net)	76,171	94,849.90	114,745.70	134,063.80	154,584.80	24.5	21	16.80	15.13
Domestic Credit	32,574.90	38,537.10	45,671	53,176	60,496.30	18.3	18.5	16.4	13.80
Claims on Central Gov't (net)	43,596.10	56,312.70	69,074.70	80,887.80	94,088.50	29.20	22.70	17.10	16.30
Claims on Non-Central Gov't	69,206.0	94,548.9	120,567.9	163,682.8	216,567.6	36.6	27.5	35.8	32.3
Other Items (net)	64,539.6	82,487.8	106,276.2	136,334.0	174,699.1	27.8	28.8	28.3	28.1
Broad Money (M2)	145,377.0	189,398.8	235,313.6	297,746.6	371,152.4	30.3	24.2	26.5	24.7

Source: National Bank of Ethiopia (NBE)

Broad Money can be determined by net foreign assets, domestic credit and net other items where domestic credit consists of claims on central government and non-central governments (other financial institutions). All the determinants are increased overtime in the review period. The

significant share of claims on central government over on other financial institutions accentuated the remarkable role of domestic credit in the determination of Broad money comparing with net foreign assets. Through the period, within domestic credit, claims on government and non-government sectors went up. This signifies a revival in the private sectors' appetite for bank credit comparing with the preceding year. The significant growth in net foreign assets also was partly attributed to improved performance in export, and foreign aid.

2.6.2. Developments in Reserve Money and Monetary Ratios

Reserve money or base money reached Birr 102.5 billion in 2014/15 reflecting a 14.7 percent annual expansion but showing a 3.3 percentage points slowdown compared with the annual target of 18.0 percent. The growth in reserve money was attributed to 16.9 percent rise in currency in circulation and 9.1 percent in deposits of banks at NBE Excess reserves of commercial banks reached Birr 9.3 billion at the end of June 2014/15 lower than Birr 10.0 billion a year ago. The ratio of M2 to GDP, an indicator of financial deepening, went up to 0.29 points from 0.28 points in 2013/14 partly indicating the prudent monetary policy measures undertaken to mitigate the inflationary pressures. Compared to last year same period, the money multiplier defined as narrow money to reserve money, showed no change at 1.5 whereas the ratio of broad money to reserve money slightly increased to 3.6 from 3.3 last year the same period, reflecting improvements in deposit mobilization by commercial banks (Table 2.3).

Table 2.3 Reserve and monetary ratios

(In Millions of Birr, where applicable)

Particulars	Year Ended June 30					Annual percentage change			
	2010/11	2011/12	2012/13	2013/14	2014/15	2011/12	2012/13	2013/14	2014/15
Reserve Requirement (CB's	20,495.2	18,080.6	11,708.8	14,479.4	18,240.5	-11.8	-35.2	23.7	26.0
Actual Reserve (CB's)	27,757.3	21,791.8	21,160.9	24,493.3	27,513.5	-21.5	-2.9	15.7	12.3
Excess Reserve (CB's)	7,262.1	3,711.3	9,452.1	10,013.9	9,273.1	-48.9	154.7	5.9	-7.4
Reserve Money	69,043.1	65,972.6	74,942.3	89,322.5	102,467.8	-4.4	13.6	19.2	14.7
Currency in Circulation	39,100.6	45,785.2	54,917.7	64,355.0	75,240.7	17.1	19.9	17.2	16.9
Bank Deposits	29,942.5	20,187.4	20,024.6	24,967.5	27,227.1	-32.6	-0.8	24.7	9.1
Money Multiplier (Ratio):									
Narrow Money to Reserve Money	1.1	1.4	1.5	1.5	1.5	30.3	6.5	-2.0	0.2
Broad Money to Reserve Money	2.1	2.9	3.1	3.3	3.6	36.3	9.4	6.2	8.7
Other Monetary Ratios (%):									
Currency to Narrow Money	42.8	40.6	39.8	39.7	39.1	-5.0	-2.0	-0.3	-1.3
Currency to Broad Money	22.4	20.3	19.4	17.9	16.3	-9.2	-4.6	-8.0	-8.7
Narrow Money to Broad Money	52.4	50.1	48.8	45.0	41.6	-4.4	-2.6	-7.7	-7.5
Quasi Money to Broad Money	47.6	49.9	51.2	55.0	58.4	4.9	2.6	7.3	6.1
M2/GDP Ratio*	0.28	0.26	0.28	0.28	0.29	-9.8	7.6	3.0	2.9

Source: NBE

* M2/GDP ratio was calculated on the basis of new GDP series and the value of GDP in 2014/ 15 is an estimate **(to be updated)**.

Monetary base (reserve money or high powered money) is the sum of currency in circulation and banks' reserve holdings with in the central bank. Under the review period, it has been highly increased overtime with the same fashion as actual and excess reserve trended. The actual and excess reserve amount through the review period was always higher than the required level of reserve. These might have an implication on monetary policy effectiveness using indirect policy instruments.

2.7 Developments in Interest Rate

National Bank revised interest rate structure through time depending the objective of monetary policy.

In 2014/15, both minimum and maximum deposit interest rates remained unchanged at 5.0 and 5.75 percent, respectively. With average interest rate on savings deposit staying at 5.38 percent while weighted annual average interest rates on time deposit rose to 5.77 percent from 5.66 percent a year earlier. Interest rate on demand deposits also tended to rise. Similarly, average lending rate stood at 11.88 percent. Yet, real rate of interest, except the lending rate, were negative given a surge in the inflation rate from 8.5 to 10.4 percent in 2014/15 (Table 3.4).

Table 2.4: Interest Rate Structure of Commercial Banks

Rates	2007/08	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
1.Deposit rate							
1.1 savings deposit(simple average)	4.08	4.50	5.38	5.38	5.38	5.38	5.38
Minimum	4.00	4.00	5.00	5.00	5.00	5.00	5.00
Maximum	4.15	5.00	5.75	5.75	5.75	5.75	5.75
2.Time deposit(weighted average)	5.16	4.79	5.49	5.55	5.66	5.66	5.77
Up to one year	4.67	4.56	5.37	5.48	5.57	5.55	5.71
One year to two year	5.23	4.80	5.51	5.57	5.68	5.68	5.81
Above two year	5.59	5.01	5.60	5.61	5.74	5.74	5.81
1.3 Demand deposit(weighted average)	0.04	0.06	0.06	0.02	0.03	0.03	0.04
2.Lending rate(average)	11.50	12.35	11.88	11.88	11.88	11.88	11.88
Minimum	8.00	8.00	7.50	7.50	7.50	7.50	7.50
Maximum	15.00	16.50	16.25	16.25	16.25	16.25	16.25
3.T-Bills(nominal)	0.67	0.89	1.31	1.25	1.86	1.59	1.43
4.head line inflation(year on year)	7.8	7.9	8.8	9.1	8.7	8.5	10.4
5.Real rate of interest on:							
5.1 saving deposit(1.1-4)	-3.74	-3.37	-3.39	-3.75	-3.33	-3.09	-5.07
5.2 Time deposit(1.2-4)	-2.65	-3.07	-3.27	-3.57	-3.04	-2.81	-4.68
5.3 Lending(2-4)	6.39	4.38	3.11	2.75	3.17	3.41	1.43

Source: NBE

2.8 Developments in Financial Sector

Banks, insurance companies and microfinance institutions are the major financial institutions operating in Ethiopia. The number of banks stood at 19 of which 16 were private and the remaining three state-owned. Banks opened 485 new branches in 2014/15 (of which 359 were private) raising the total branch network in the country to reach 2693 from 2208 last year. As a result, bank branch to population ratio declined from 1:39,833.84 people to 1:33,448.25 in 2014/15. The significant branch expansion was undertaken by Commercial Bank of Ethiopia

(CBE) with 127 branches, followed by Awash International Bank (55 branches), Oromia International Bank (43 branches), Cooperative Bank of Oromiya (36 branches), United Bank (29 branches), Bank of Abyssinia (27 branches), and Loin International Bank (26 branches). Despite aggressive branch expansion by public banks, their share in total branches slightly went down to 41.9 percent from 45.4 percent last year . About 35.5 percent of bank branches were in Addis Ababa, during the review fiscal year. The total capital of the banking industry increased by 19.0 percent and reached Birr 31.5 billion by the end of June 2015 as a number of banks injected more capital. As a result, the share of private banks in total capital marginally increased to 56.5 percent from 55.4 percent last year, while that of CBE remained at 34.0 percent. In the meantime, the number of insurance companies remained at 17 with their branches rising to 377 following the opening of 45 additional branches. About 52.8 percent of insurance branches were located in Addis Ababa. Ownership wise, 82.5 percent of the total branches were private which slightly increased from 81.3 percent a year ago. Mean while, the total capital of insurance companies increased by 40.8 percent to Birr 2.8 billion from Birr 2.0 billion last year. Private insurance companies accounted for 77.6 percent of the total capital while the share of the lone public insurance company was 22.4 percent.

2.9 Empirical Literature on monetary policy response

Domestic resource mobilization is often seen as an essential buffer against the financial shocks that threaten developing countries. On a household level, microfinance institutions that offer savings and insurance (as well as credits) allow families to maintain consumption in the face of shocks, without their having to sell livestock or other productive assets. Providing microfinance through commercial institutions provides a model for financial services to the poor that is sustainable and less subject to swings in ODA or government finance (Robinson, 1998, p. 391). In South Africa, the Government has played a leadership role in encouraging the private sector to supply a range of services to the poor. The South African Government developed a "financial sector charter" that provides a blueprint for inclusion "desacralizing" the financial sector in terms of ownership, employment and procurement practices and setting specific targets for improvement in financial access). The charter was signed in October 2003 by the Government, representatives of financial services, such as banks and insurers, and representatives of the labor movement and other parts of civil society. Banks and insurers made a commitment to provide certain products and services to the poor by 2008. In a first step, the major banks and the

Postbank created a new entry-level bank account, drawing in 1.3 million new customers in the first nine months. Participants in the South African arrangement are now encouraging other African countries to develop a strategy for creating an inclusive financial sector and to embed commitment to this strategy by all stakeholders in a formal financial access charter (Napier, 2005, pp. 8-9).

In a case of Turkey, central bank develops reaction function by using the interaction between domestic credit and net foreign assets. In such a way that it can determine the offset and sterilization coefficients of the central bank, which could be useful in terms of measuring the scope and the stance of the monetary policy. Additionally it is important to know the degree of relation between the central bank's reaction function and the macro variables. The offset and sterilization coefficients, together with monetary policy reaction to inflation itself, measure the extent to which, monetary policy is accommodating or used systematically for monetary control (Olcay and Almila, 2000).

When come to monetary policy reaction function for Taiwan, it based on an extended Taylor rule including the exchange rate, the stock's price, and the lagged interest rate. Two major monetary policy instruments like the discount rate and the collateral loan rate are considered. Its reaction function result shows that the discount rate or the collateral loan rate responds positively to a shock to the inflation gap and the stock price gap but does not react significantly to a shock to the output gap or the exchange-rate gap. Furthermore, except for the lagged interest rate, the inflation gap is more influential in explaining the variance of the interest rates than other endogenous variables, suggesting that the major focus of the monetary policy in Taiwan to contain inflation (Chang: 2000).

Monetary authorities in Malawi employ hybrid operating procedures and pursue both price stability and high growth and employment objectives. Two operating targets of monetary policy are identified, viz., bank rate and reserve money, and it is demonstrated that the former is a more effective measure of monetary policy than the latter.

Finally, in the case of Bank of Ghana, it has succeeded in reducing the gap between official and parallel exchange rates and partially succeeded in correcting the over/under valuation of nominal exchange rate by implementing various exchange rate regimes. The major instruments of monetary policy in Ghana have been the open market operation and liquidity ratios, credit ceiling and reserve requirement and bank rate. The growth rate in the money supply can be traced to rapid growth net domestic and foreign assets. Hence the bank had tried to follow a consistent lending policy in accordance with the exchange rate intervention policy and follow a consistent sterilization through an open market operations' policy with respect to nominal exchange (Vijay, 2003).

CHAPTER TREE

RESEARCH METHODOLOGY

3.1 Data and Methodology

The study investigate the response of National bank to macroeconomic shocks including for both domestic and foreign shocks. And evaluates the monetary policy objectives employing data over the period 2000-2017.The data all are obtained from National bank of Ethiopia, Ministry of Finance and Economic Development, and International Finance Statistics of the IMF.

Accordingly analyzing how central bank manages those policy instruments in order to meet its own policy objectives seeks to know the interaction between monetary policy and macroeconomic shocks. To make things simple and taking the prevailing condition, here in the model, no need of restriction on the variable as exogenous and endogenous. Thus, the study blends Johansson (1988) procedure for vector autoregressive model specification with co-integration and error correction techniques to estimate long- and short run coefficients.

3.2 Model Specification

There are different ways of specifying the monetary policy reaction function in theories, which try to explain how a central bank responds to macroeconomic shocks. Commonly, the monetary models that are applicable in developed countries may not have full satisfactory outcomes when they are applied in developing countries. This is because of the monetary agencies in developing countries do not have the latitude to engage in discretionary activities, and characterized absence of broad and active financial markets.

For our case we are basing ourselves initially on the rule-based monetary policy that means operating policy according to a predetermined rule, largely irrespective of prevailing economic circumstances. An example of monetary policy rule policy is the Friedman's rule, which suggests that money supply should go the same rate of growth of nominal GDP. This is evidenced that the NBE pursued maintaining the growth rate of monetary base in line with the growth rate of nominal GDP, which helped contain inflationary tendencies while maintaining external balances during the reform period.

This is the best known to be the **demand standard rule** advocates expanding money supply at same rate with the growth rate of GDP. The rationale for this rule is derived simply from the Irving Fischer 'exchange or transaction equation' of earliest quantity theory of money, MV=PY. So we have

Mt Vt =Pt Yt……..…….……. (1)

Making each variable one period lags and we obtain

Mt-1 Vt-1 =Pt-1 Yt-1…….…….…….…..…… (2)

Deducting equation (2) from equation (1) and dividing by Mt Vt and Pt Yt

Mt Vt - Mt-1 Vt-1 = Pt Yt - Pt-1 Yt-1…….……..……..…...…..…. (3)

* Sources: (Chang, International Journal OF Applied Econ. 2(1), March 2000.PP.50-61), World development Journal, vol.19, No.6,

PP709-709, 1991), and Quarterly Journal of Business and economics, vol.25, pp16-37: Joyce, Joseph.

Assuming that V (velocity of money) and P (the price level) is constant over time, then

Mt - Mt-1 = Yt - Yt-1. ..……..…… (4)

If it is desired to stabilize the price level, then growth in money supply must equal to growth in output. The rule is concerned primarily with the long run rather than the short run. It recognizes that V is not in fact a constant, having short runs seasonal and cyclical fluctuations, but in the long run is a highly stable phenomenon.

However regarding to how NBE determines money supply at same rate with nominal GDP growth rate, the **Accounting Framework (Flow of Fund) model** suggests that money supply mainly consists of domestic credit and net foreign assets. By chatting each other at desired magnitude with different direction, Central Bank can put change in money supply zero or positive or negative depending on the growth rate of GDP. Besides this, the Central bank considers factors that influence money supply and its policy. So in order to abide with demand standard rule, How Central Bank works and responds macroeconomic variables?

An interesting rule is **Taylor rule**, which is the foundation of our model. It prescribes setting for the bank rate i.e. the variable controls in ordered to influence the evolution of macroeconomic conditions. A policy induced increase in interest rates is generally representing a move towards more restrictive policy posture, one that tends to reduce aggregate demand. Accordingly, the Taylor rule calls for a higher setting of the bank rate when inflation is expected to be high and / or output is high relative to capacity. Specifically, the Taylor rule can be written as follows:

$it-\pi t=rt + \beta 1 (\pi t-\pi^*) + \beta 2 (yt-y^*)$…….. (5)

Where r is the bank rate setting for period t that prevails when ($\pi t = \pi^*$) and ($yt=y^*$), π^* is target rate of inflation, and y is output at the capacity while y* is the target rate of output. It shows that central bank responds to departures of inflation and output from their target values through interest rate.

However interest rates in developing countries are often set by the government, but are not adjusted in a discretionary manner like in developed countries. Other aggregates, such as the money supply, are subject to outside influences, particularly under fixed exchange rate. Therefore we have to extend the Taylor Rule along with the existing condition of NBE: **Extended and Modified Taylor Rule** can be applied here (Chang, International Journal OF Applied Economics, 2(1), March 2000.PP.50-61).

There are two major determinants of broad money supply namely domestic credit and net foreign assets. Of which managing net foreign assets is outside the National Bank of Ethiopia. Hence money supply management can be done only through controlling domestic assets to achieve both stabilization and balance of payment objective. Domestic credit consists of claims on government and claims on non-central bank. So, the change in the central bank's holdings of domestic credit assets was chosen as the most appropriate indicator of monetary policy (Joyce Joseph, 1991, World development Journal).

$DC=\beta 0 + \beta 1 (\pi\tau-\pi*) + \beta 2 (yt-y^*)$…….. (6)

Once the indicator of monetary policy set, we have to identify the macroeconomic variables to be responded and the central bank considered to control them. Like equation (6), the goals of the monetary authorities will determine which variables affect monetary policy. Hence Gross

Domestic Product and inflation rate are the objectives of central bank in long run and short run respectively.

But it is in level form rather than in deviation from the target, and taking CPI in place of π**G**t. This is because of for simplification & to maintain uniformity among considered variables and to obtain inflation rate in the short run analysis by first differencing of CPI. Therefore equation (6) can be written as below.

DC=β0+β1 (CPIt) +β2 (GDPt)……...……..……..…….. (7)

Goals are not the only variables to be considered in specifying the determinants of monetary policy.

Moreover the domestic factor that monetary growth depends primarily up on fiscal policy in developing countries (World development Journal vol.19, No.6, PP709-709, 1991). As monetization of the fiscal gap (Fg), equation (7) will be extended below.

DC=β0+β1 (CPIt) + β2 (GDPt) + β3 (Fgt) ……...……..…….. (8)

Along with domestic sectors, the openness of the economy will determine which variables affect monetary policy. The authorities would act to offset, or sterilize, the monetary impact of foreign reserves: NFA (net foreign assets) flows in order to maintain their autonomy. They would also respond to exchange rate changes by adjusting credit in order to accommodate resulting changes in the current account and output or they would adjust their domestic credit holdings to offset the impact of exchange rate changes upon output and to strengthen the international position in competition. So, we can take real effective exchange rate (REER) considering the competitiveness of the country.

The model to be estimated is:

DC= ß0 + ß 1 (CPIt) + ß 2 (GDPt) + ß 3 (Fgt) + ß 4 (NFAt) + ß 5 (REERt)…… (9)

Where DCt = Domestic credit

NFAt = Net foreign assets (Foreign Reserve)

CPIt = Consumer price index

GDPt = Real gross domestic product

REERt = Real effective exchange rate

Fgt = Fiscal gap

There are two basic types of policy, which can guide their responses to these variables: Accommodating and Stabilizing. Accordingly under a policy directed toward accommodation, the coefficients take the following signs: $\beta 1 > 0$, $\beta 2 > 0$, $\beta 3 > 0$, $\beta 4 < 0$ and $\beta 5 > 0$ while strict stabilization policy would place the following constraints on the coefficients: $\beta 1 < 0$, $\beta 2 < 0$, $\beta 3 < 0$, $\beta 4 > 0$, $\beta 5 < 0$. One-way estimating this model is using simultaneous equations approach, but with lags in all the variables. Such a model is called **a dynamic simultaneous equations model**. However rather than formulating using classifying variables endogenous and exogenous as well as imposing some constraints on the parameters to achieve identification, Sims argues that both these steps involve many arbitrary decisions and suggests as an alternative, **the vector autoregression approach**. Besides that in most literature single policy reaction function [equation] framework can be employed to estimate determinants of monetary policy. This approach is troublesome in the sense that it does not account for non-stationary and endgeneity problem. Rather this paper employs a simple co integrated VAR model combing co integration analysis and vector Auto regressive time series.

Use of co integrated VAR model helps account for spurious correlations, and exogeneity bias as it is designed for non-stationary time series and requires no endo-exogeneous division of variables.

Further vector error correction model embodied in co integrated VAR technique distinguishes clearly between long- and short-run impacts and responses, providing a suitable tool for policy analysis. The VAR model where case n>2 and k>1,that is **a general VAR model** containing n variables and k lags is

$$Zt = A0\Delta t + A1Zt\text{-}1 + A2Zt\text{-}2 + A3Zt\text{-}3 + \ldots\ldots + AnZt\text{-}n + \varepsilon t \quad \text{(10)}$$

Where Zt is an n.1 vector that containing n variables in the system. Namely: - DC, CPIt, GDPt, Fgt,NFAt, REERt Where $\Delta\tau$ is a vector holding deterministic terms like trend, intercept, Dummies.$\varepsilon\tau$ is an n dimensional vector of multivariate random errors with zero mean and covariance matrix S, i.e. ($\varepsilon 1\tau$, $\varepsilon 2\tau$)=0 that is innovation term and A1,A2,A3…An are n.n matrices of constants to be estimated.

An important issue in econometrics is the need to integrate short-run dynamics with long-run equilibria. The analysis of short-run dynamics is often done by eliminating trends in the variables, usually by differencing. This procedure, however, throws away potential valuable information about long-run relationships about which economic theories have a lot to say. The theory of co-integrated developed in Granger and elaborated in Engle and Granger addresses this issue of integrated shortrun dynamics with long-run equilibria. Hence rather than the paper employs a simple vector Auto regressive time series, the model incorporates co- integrating regression with VAR model. After some mathematical manipulations, the **Error correction model (ECM) for VAR model** can be derived and become

$\Delta Zt = \Psi\Delta t + \Pi Zt\text{-}1 + \Gamma 1\Delta Zt\text{-}1 + \Gamma 2\Delta Zt\text{-}2 + \Gamma 3\Delta Zt\text{-}3 + \ldots\ldots + \Gamma k\text{-}1\,\Delta Zt\text{-}k+1 + Vt$……..(11)

Generally, the ECM relates the change in the dependent variable to the change in independent variable(s) and the long-run relationship lagged say here one period. If variables are co-integrated is I (o), all terms in the ECM are stationary. This equation shows how long run impacts and responses the elements of Zt are incorporated in the short-term dynamics. Where Π=-I+A1+A2+A3+…+AK and Γ1= -(A1+A2+A3…+AK), Γ2= - (A2+A3+…+AK), and Γ k-1= - AK .If Zt is I(1), then ΔZt is I(0),

3.3 Sources of the Data

Here in the model there are only six macro variables namely net domestic credit, net foreign assets (Foreign Reserve), consumer price index, Gross domestic products, real effective exchange rate, and Government deficit.

Monetary data net foreign assets and domestic credit, and the fiscal date namely fiscal gap are taken from National Bank Ethiopia Annual reports of the years in the review period. Domestic credit consists of both claims on non-central government, and net claims on government which in turn composed of claims from National Bank and commercial banks while net foreign assets contains assets from national bank and commercial banks. The government deficit on annual

basis purely considered the difference between total expenditure and total revenue excluding grants. This implies that to know the distinct interaction between deficit and foreign assets. Quarterly data for consumer price index is generated on the basis of smoothing the different way calculation through review period, which is obtained from International Finance Statistics and NBE. In order to make quantitative assessment of the competitiveness of the Ethiopian export with the rest of the world, it is important to construct the real effective exchange rate index, which is the measure of the price of the country's goods to the price of its trading partner countries, both expressed in domestic currency (NBE annual report 2014/15). The index is calculated by taking quarterly data on wholesale price index, which is used as a proxy for the world price of tradable while the consumer price index of the home country was used as a proxy for the domestic price of non-tradable. And exchange rate applying weighted trade index to the base year of 2006, which seems normal in that there was no war and drought in the country. Individually, Trading partner countries were selected by employing a one percent threshold in which countries having a trade share of more than 1% for inclusion in the construction of REER. Jointly countries have a share of 80% in total trade of Ethiopia. Hence all variables are computed and organized from the quarterly Bulletin of NBE. Not that an increase in REERI and NEERI indicates appreciation. The real exchange rate can be computed either on a bilateral or multilateral basis.Since a country trades and competes with anumber of other countries in the international markets, real effective exchange rate (REER)is constructed as a multilateral or effectiveRER for which economists and policy makers are more interested in analyzing competitive stance of a country. To convert a set of bilateral RER indices into a multilateral real exchange rate (REER), a weighted average of the bilateral RER indices needs to be taken. Thus, the REER is the average of bilateral RERs between a country and each of its trading partners, weighted by the respective trade shares of each partner.

3.4 Estimation technique

Multivariate time series models enable one to estimate the dynamic effects of the explanatory variables on the dependent variable. However, to undertake estimation or testing procedures it is important to make sure that the variables are stationary. This is because regressing a non-stationary dependent variable on non-stationary independent variables results in spurious regression from which estimates and test statistics obtained would be misleading. However, there is an exception to this problem where if non stationary series happen to have a

linear relationship that is stationary they are destined to have a long run relationship to which there is an error correction mechanism that leads the variables to their long run equilibrium. (Verbeek, 2004).

In this study, the regression results of long run relationship and short run error correction adjustments will be discussed. The first thing to do before running any of the regression is to check for the stationary of the variables under study. After checking whether the variables are stationary or not, we will proceed to the regression of the variables and test for the existence of the co integration among the variables which indicates for the long run relationship among the variables. If there is found to be a long run relationship an error correction model will be regressed to check how much of the fluctuations is adjusted to equilibrium per period.

CHAPTER FOUR

4. ECONOMETRIC RESULTS AND ANALYSIS

4.1 Unit root and Co-Integration analysis

In the work of time series regression, one often obtains a very high R^2 even though there is no meaningful relation among variables. It resulted spurious regression estimation and the classical t and F tests cannot work well. Hence there are two concepts to be analyzed to have non- spurious estimation outcome. Hence both unit roots test and co-integration analysis are the basic components of time series characteristics.

4.1.1 Unit root test

A test of stationarity (or non stationarity) that has become widely popular over past several years is the unit root test.

The formal test for the existence of stationary is to find out if a time series contains a unit root using Dickey-Fuller and augmented Dickey-Fuller test. The issue of whether a time series is trend stationary (TS) or difference stationary (DS) time series has both economic and statistical implications. Therefore testing unit root is not questionable and its testing procedure with three possibilities presented below.

Let yt become a *random walk without drift*, which is a non-stationary stochastic process. $yt=\rho y_{t-1}+ et$ and subtract $yt-1$ from both side of equation to get $\Delta yt =\delta yt-1+ et$. Where $\delta=(\rho -1)$ and Δ is the first difference operator. A case where yt is *a random walk with drift:* $\Delta yt =\beta1 +\delta yt-1+ et$ (it is stationary with a nonzero mean equal to $=\beta1/(1- \rho)$ and a case *where random walk with drift around a stochastic trend:* that is, $\Delta yt =\beta1 +\beta2t + \delta yt-1+ et$ (it is stationary around a deterministic trend). Formulate Hypothesis testing: $H0: \delta=0$ or $\rho=1$. If it is zero, yt is non-stationary but it is negative, we conclude that yt is stationary. Dickey and Fuller have shown that under the null hypothesis, the estimated value of the coefficient that follow the t (tau) statistic, which is called **Dickey and Fuller (DF) test.**

Dickey and Fuller, Said and Dickey (1984), Phillips (1987) and Perrson (1988) and other developed modifications of the DF test when the error term, **et** is not white noise. These tests, called the Augmented Dickey-Fuller test (ADF).

Table 4.1 Summary of unit root test using ADF

	Without drift and trend		With drift		With drift and trend	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
LDC	0.2730995	-2.6646**	-4.2883**	3.469455	-8.513599	-4.2993**
LRDGP	0.1799443	-19.177**	-2.178523	-19.597**	-15.731**	-19.434**
LNFA	-0.0158811	-7.6136**	-6.4286**	-8.2689**	-6.0156**	-8.8599**
LCPI	0.1005779	-6.9607**	5.21524	-7.6812**	-4.4635**	-7.5449**
LREER	0.0097971	-6.1579**	49.23699	-6.2317**	54.38818	-6.4538**
LFG	-3.5956**	-9.1218**	-3.7114**	-9.0777**	-4.2410**	-9.0064**

We transformed the variables in natural logarithms to make the interpretation of coefficient in elasticity concept. As presented above, the variable LFg is stationary in level and first difference form in all the three option but LDC and LREER are stationary if and only if they are in first difference. In general all are stationary when they are differenced once but a mixture of I(1) and I(0) in level form. Hence Johansen procedure can treat a mixture of them occurred at a time.

4.1.2 Co-integration Analysis

The theory of co-integration considers both short-run dynamics and long-run equilibria. The Johansen procedure in this regard is preferable, and considers maximum likelihood estimation that helps to relax the assumption of one Co integrating vector and avoids the use of two-step estimation of Engle and Granger two-stage test. The analysis of short-run dynamics is often done by first eliminating trends in the variables, usually by differencing. This procedure however throws away potential valuable information about long-run relationships about which economic theories have a lot to say. Hence the theory of co-integration addresses this issue on integrated short-run dynamics with long-run equilibria.

Engle and Granger two-stage test for co-integration in single equation is different from a VAR models. It assumes a predetermined one-way relationship between variables. i.e., it assumes only one co integrating vectors which indicates only one equilibrium relationship in general, it has no systematic procedure for a separate estimation of multiple co integrating vectors. Moreover Engle and Granger procedure uses a two steps estimator: the error induced in first step directly used for the second step.

Johansen procedure: His maximum likelihood estimation can help us considering relax assumption of one co integrating vector and avoids the use of two-step estimation. Co integration relation ship is tested using VECM and it avoids arbitrary selection of dependent and independent variable. It is a multivariate generalization of DF test for the unrestricted VAR model with K lags (Harris and Johansen). Unlike a single equation using Engle and Granger procedure, For instance, under the two equations system of VAR there are three possibilities: the two series are not co integrated if the two roots $\lambda 1$ and $\lambda 2$ are both equal to one (that is non stationary), the series are co integrated if one root is unity, and the third possibility is that the series are stationary (neither integrated nor co integrated) if neither of the roots is unity.

Π=-I+A1+A2+A3+…+AK and $\Gamma 1$= -(A1+A2+A3…+AK), $\Gamma 2$= - (A2+A3+…+AK),this equation contains information of both short run and long run adjustment to changes in Zt through P and Gi. The rank of P denoted by p, which determine the number of co-integrating vectors. If p is zero, no stationary linear combination can be identified and hence the variables in Z are not co integrated. If p has full rank, Equal to the number of variable in the regression, the variables are stationary in levels.

If some linear combinations of Zt are stationary, that is there is some co integrating relationships among the variables in Zt, then the matrix Π should have a rank p<n. Also this Π matrix can be decomposed and written as **long run matrix** Π=CB'. Where C and B are n·p matrices. After normalization can be interpreted as long –run parameter, the rows of B' are the p distinct co integrating vectors. In the case where there are (n-p) unit roots and p co integrating vectors, there exist p long run stationary relationships between the variables in Zt. In general, B-matrix designating the long run coefficient of p distinct co-integrating vector that makes the linear combination B'Z, stationary, even if Zt is non-stationary, while the C-matrix represents the coefficient of speed of adjustment to the disequilibria (Harris 1995). In co integrating analysis matrix B gives the co integrating vectors, Matrix c in the decomposition of the Π (Π=CB') gives the speed of adjustment of particular variables with respect to a disturbance in the equilibrium relation. The matrix C is called the **adjustment matrix** or **feedback matrix**. The number of co-integrating vector is identified based on λ trace: λ Trace statistics = $-T\sum(1-\lambda\hat{}i)$ and λ Max statistics=$-T \ln (1-\lambda\hat{}\, r+1)$. Trace (A) or trace Π is $\sum \lambda 1+\lambda\iota+.....+\lambda n$.

Where λ^I is the estimated value of the characteristics roots and T is the number of observations. The null hypothesis under λ Trace is that the number of distinct co integrating vector is less than or equal to r against the general alternative, while λ max tests the null hypothesis that there are r co integrating vectors against the alternative of r+1 and λ max is a more powerful test than λ trace (enders.1995).

- **Test for the number of co integrating vector for DC**

The VAR system of equations is estimated over the period 2000 first quarter and 2017 fourth quarter using variables: domestic credit, net foreign assets, consumer price index, real effective exchange rate, real gross domestic product, and fiscal gap. Determining the element of deterministic components: AoDt and ΨDt is an important issue in VAR analysis results (including diagnostic tests) depend on whether constant and/or trends are existed in VAR and VECM (A.Badawi, 2004).Accordingly the study follows Doornik and Hendry that state equation (10) is estimated by restricting the trend to enter co-integrating space while equation (11) with constant & with out a linear trend because existence of linear trend in difference series come from the quadratic trend in level, unusual in Macro time series.

On top of this, determination of the lag length 4 is decided on the basis of general to specific procedure for favorable diagnostic tests: to the best approximation for auto correlation process in our series. Having specified VAR model we need to test for co-integration using statistical hypothesis: rank (II)<=p, and report both lambda-max test and trace statistics presented below.

Table 4.2 Co integration analysis and testing for co integration rank r

H0: p< =	Eigen value	λ trace. Stat. T\Sum log (.)	95%	λ Max. Stat. – Tlog (1-\mu)	95%
P< =0	0.65796	156.2** [0.000]	114.9	62.22**	44.0
P< =1	0.500356	94.01* [0.018]	87.3	40.24*	37.5
P< =2	0.327553	53.76 [0.265]	63.0	23.02	31.5
P< =3	0.214529	30.75 [0.464]	42.4	14.01	25.5
P< =4	0.176613	16.74 [0.445]	25.3	11.27	19.0
P< =5	0.090028	5.472 [0.539]	12.3	5.472	12.3

***** Indicates Statistical Significance at 5% and ** at 1%, if any. The test is done using PC GIVE and PCFMIL.

Diagnostic Test:

Vector portmanteau 7 lags= 234.5

Vector AR 1-4 F (144, 25) = 1.288 [0.2339]

Vector normality Chi^2(12)= 62.183 [0.0000] **

Vector hetero test: Chi^2(546)= 541.77 [0.5431]

The results indicate that there are two co-integrating vectors in the system as both statistics report on respective magnitudes greater than critical values at 1% and 5%. Regarding to diagnostic tests, there is no problem of auto correlation and heteroscedasticity, but it indicates vector normality problems. However econometrics theory states that the existence of normality problem does not affect and distort the estimators' BLUE and consistency property, because the main purpose of normality tests is for testing hypothesis about the population parameter using confidence interval (Enders, 1995).

Therefore the in-existence of vector normality in our model doesn't affect the coefficients and t values. If the sample size gets larger and larger, we can easily remove the normality problem & the distribution approaches normal.

The existence of two co-integrating vectors implies that there is two long run relations/equilibrium points in the system, which can be directly added into the short run equation after netting out the exogeneity problem (Badawi, 2004 and Doornik and Hendry, 2001).

- **Unrestricted Long Run Elasticties and Loading Coefficient**

Once rank of long run matrix identified, which is P=2, we obtain the two co integrating vectors as the first two row of the Eigen vector, ß matrix (long run coefficient) and the first two column of the a matrix (speed of adjustment matrix). But, to have unique co-integration relations, we remove the trend from the first co- integrating vector and ß2t from the second co-integrating vectors in II matrix (Doornik & Hendry, 2001 and A.Badawi, 2004). The co- integrating space is now just identified Note that the restricted variables are ß11=1, ß17=0, ß21=0, ß22=1 in ß's matrix. Therefore the unique co-integrating vector ß's and α's results are reported below.

Unrestricted variables: [0] = Constant, Restricted variables:[0] = Trend Number of lags used in theanalysis: 4,Linear co integration restrictions:&12=1; &18=0; &19=0; &20=1;

Table 4.3 Unrestricted standardized Eigenvectors β'

	LDC	LNFA	LCPI	LREER	LGDP	LFg	Trend
β'1	1.0 (res.)	0.0217 (1.20)	0.325 (1.65)	0.287 (2.54)	-1.411 (-7.42)	-0.3045 (-5.35)	0.000 (res.)
β'2	0.0 (res.)	1.0 (res.)	-5.067 (-4.04)	1.745 (4.83)	3.765 (2.64)	1.700 (9.09)	-0.104 (-6.25)

t-value presented in the parentheses.β's shows long run elasticties as they are in logarithms form.

Table 4.3 present us the unrestricted model, the two row of the Eigen vector of ß matrix (long run coefficient) in long run matrix Π=CB' are the basic determinants of broad money supply namely domestic credit and net foreign assets and can be explained by other aforementioned macro variables.

Table 4.4 Unrestricted standardized adjustment coefficient α

	α1	α2
LDC	0.0066 (1.72)	-0.0047 (-1.23)
LNFA	0.4897 (1.68)	0.0509 (1.58)
LCPI	0.1170 (2.41)	0.0432 (2.86)
LREER	-1.1307 (-3.53)	-0.1570 (-2.08)
LRGDP	-0.3924 (-2.69)	-0.0772 (-2.75)
LFG	-0.5886 (0.32)	-1.4327 (-3.10)

Regarding to a matrix, there are two column, of which our interest is the first column of the (speed of adjustment matrix) in long run matrix Π=CB' in unrestricted model characterized by dominant long run feed back effect from those variables whose coefficients are relatively higher: LREER, LFg, LNFA, LCPI, LGDP and LDC in descending order with very lower statistically insignificant of LFg.

- **Test for Long Run Weak Exogeneity**

The values of adjustment coefficients with their respective t value give some information about weak exogeneity to domestic credit vector. Taking both adjustment coefficients and t-value in to account simultaneously, we suspect that LFg would surely be exogenous to LDC due to its very

low t-value. But, the formal test whether there is weak exogeneity or not, can be conducted using likelihood ratios chi^2 and to identify endogenous and exogenous variables in the model.

Table 4.5 Tests for Long-Run Weak Exogeneity

(H0: Variables is exogenous to domestic credit vector)

Variables	Chi^2	F-probability	Decision over H0	Inference
LNFA	1.6772	[0.0195]**	Rejection	Not Exogenous
LCPI	3.8446	[0.0499]**	Rejection	Not Exogenous
LREER	7.9688	[0.0048]**	Rejection	Not Exogenous
LGDP	8.6526	[0.0033]**	Rejection	Not Exogenous
LFg	0.62678	[0.4285]	Acceptance	Exogenous

Associated likelihood ratios, which the report indicates that only LFg is weakly exogenous to the domestic credit vector while others rejected the null hypothesis that states variable is exogenous. This implies that fiscal gap is exogenous to the domestic credit vector.

- **Restricted long-Run Elasticties and Loading Coefficients**

Using information about weak exogeneity of LFg and preserving the rank of 2, the VAR system putting restriction on α's of LFg equal to zero. This is very important to netting out the adjustment coefficient of LFg due to its exogenous nature to the domestic credit, LDC. And the compare the result of unrestricted and restricted models (A.Badawi, 2004). Results of restricted model reported below.

Table 4.6 Restricted standardized Eigenvectors β'

	LDC	LNFA	LCPI	LREER	LGDP	LFg	TREND
β'1	1.0 (res.)	-0.3507 (-9.72)	1.520 (1.83)	0.0012 (-0.0048)	-1.360 (-2.36)	-0.246 (-1.81)	0.0000 (res.)
β'2	0.0 (res.)	1.0 (res.)	-3.880 (-2.9)	1.143 (2.89)	1.246 (5.63)	0.518 (2.31)	-0.037 (-5.28)

Table 4.7 Restricted standardized adjustment coefficient α

	α1	α2
LDC	0.02072 (1.78)	0.01714 (-1.93)
LNFA	0.45895 (1.65)	0.11133 (1.61)
LCPI	0.15795 (2.95)	0.13353 (3.57)
LREER	-1.1043 (-3.92)	-0.16206 (-3.35)
LGDP	-0.33726 (-3.02)	-0.16206 (-2.79)
LFg	0.000000 (res.)	0.000000(res.)

Diagnostic Test:

Vector Portmanteau (7): 225.379

Vector Normality test: Chi^2(12)= 84.463 [0.0000]**

Vector hetero test: Chi^2(1050)= 1066.4 [0.3552

Comparing results of restricted from unrestricted models, the magnitude of β1 for LNFA, LCPI, LREER & LFg have changed significantly, with no change in respective signs except LNFA. These relations indicate that the exogeneity of LFg is great importance for relation b/n LDC and LNFA, LCPI, LREER. But LGDP remains to be significant in explaining long run LDC in both restricted & unrestricted models. This suggests that all variables are expected signs as the central bank follows a mixture of both stabilization and accommodates policy. Both LNFA and LGDP have significant long run relation with positive effect. LREER is completely statistically insignificant to explain the long run relation with LDC.

As the National Bank of Ethiopia reacts to, α1(=0.02072) for LDC indicates that the speed of adjustment of feed back effects towards the long run equilibrium is 2.072 percent per quarter and 8.288 percent per annum. On this pace the adjustment towards long run equilibrium takes many years for full adjustment.

4.2. Vector Error Correction Model & Stability Test

- **Vector Error Correction Model**

As we know, determination of the coefficient of short-run dynamics is conducted by estimation of parsimonious VECM after the determination of long-run relationships. It is very important to specify how short run adjustment of macroeconomic variables is took place, and a fertile ground for policies analysis & implementation (Harris, 1995).

From table 4.6 we can derive the error correction terms lagged one period in order to analyze the short term dynamic. Thus, the two co-integrating vectors β'1 and β'2 are domestic credit and net foreign assets and can be defined in error correction term as follows: -

CIa = LDC -0.36 * LNFA +1.53 * LCPI +0.0013 * LREER -1.37* LGDP -0.25* LFg

CIb = (LNFA-0.038 * trend) -3.89* LCPI +1.14 * LREER +1.25 * LGDP +0.52 * LFg

There are two equations in the form two-error corrections terms and contain restricted long-run stationary relationship. Taking both lagged one period as explanatory variables in the system; we can produce the short-term dynamics, which consists of six equations of changes in LDC, LNFA, LFg, LREER, LGDP and LCPI.

Our interest is to know National Bank of Ethiopia reacts to macroeconomic shocks using domestic credit as monetary policy variable. So the equations as whole system can be estimated by unrestricted OLS, 2SLS, and FIML. The results are similar. Out of that equation our interest of LDC reported as below. The VECM in equation is estimated with three lags: (to have same formation, the lags could be t-k in equation (10) and t-k+1 in equation (11) as presented by Badawi, 2005 and Hendry 2001).

Table 4.8 Short-Run Dynamics

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
DLDC_1	-0.106	0.204	-0.52	0.605	0.0077
DLDC_2	0.214	0.199	1.08	0.289	0.0321
DLDC_3	0.114	0.180	0.63	0.529	0.0114
Constant	0.076	0.723	0.10	0.916	0.0003
DLNFA_1	-0.044	0.042	-1.04	0.306	0.0300
DLNFA_2	-0.001	0.043	-0.01	0.995	0.0000
DLNFA_3	-0.013	0.033	-0.41	0.680	0.0049
DLCPI_1	0.361	0.237	1.52	0.137	0.0621
DLCPI_2	0.088	0.236	0.37	0.710	0.0040
DLCPI_3	0.136	0.218	0.62	0.534	0.0111
DLREER_1	-0.081	0.079	-1.02	0.313	0.0290
DLREER_2	0.043	0.078	0.54	0.586	0.0086
DLREER_3	0.020	0.065	0.31	0.754	0.0028
DLGDP_1	-0.001	0.097	0.00	0.992	0.0000
DLGDP_2	0.020	0.077	0.27	0.788	0.0021
DLGDP_3	0.100	0.079	1.26	0.217	0.0432
DLFg_1	0.005	0.010	0.54	0.589	0.0084
DLFg_2	0.005	0.009	0.58	0.561	0.0098
DLFg_3	0.004	0.008	0.51	0.613	0.0074
CIa_1	-0.003	0.116	-0.03	0.973	0.0000
CIb_1	-0.006	0.074	-0.08	0.930	0.0002

Sigma=0.0396673, RSS=0.055072405, R^2= 0.349386, F (20, 35) = 0.9398 [0.547], Log-likelihood 114.424, DW=2.02, No.of observations=56, no. Of parameters=21, mean (DLDC) =0.0283409 var (DLDC) 0.00151155.

Diagnostic Tests:
AR 1-4 test: F (4, 31) = 0.72290 [0.5829]
ARCH 1-4 test: F (4, 27) = 0.30387 [0.8728]
Normality test: Chi^2(2) = 1.7534 [0.4162]
Hetero test: Chi^2(40) = 33.833 [0.7431]
RESET test: F (1, 34) = 0.62931 [0.4331]

But we cannot take this model due to its statistically insignificance coefficient for the aforementioned all explanatory variables. In general and theoretically there are reasons why we cannot take the model as it is: statistically insignificant coefficient (small t value), the lack of meaningful relation, and the inexistence constancy of parameter or taking variable as exogenous in the system where it is endogenous (Doornik and Hendry, 2001). So, we have to follow general-to specific modeling specification by deleting statistically insignificant regressors to obtain a parsimonious model (leaving from over parameterized equation) and check the validity of the model through tests (Doornik and Hendry, 2001).

Therefore let's set the lag length at eight (over parameterized equation) and follow the general–to specific procedure to the most parsimonious dynamic LDC equation considering t-value and other criteria. Finally it yields the following parsimonious short run dynamics of monetary variable, LDC. (Please see annex four that states the short run dynamics for the system as a whole following general to specific procedure of LDC).

Finally, regarding to diagnostic tests, there is no autocorrelation and heteroskedasticity problem among residuals. On top this, the normality condition is satisfied and RESET test also depicted that there is no model specification problem in the system. (Note that variables at specified lags are included in the model to maintain the best of diagnostic tests as reported and very important for evaluation of monetary policy objectives against theory).

- **Stability tests**

The intuition behind stability test is to check the monetary policy reaction function stability and predictability for policy analysis in responding to macroeconomics shocks. To test the stability of parameter, the study conducted the *recursive least square graphic test* which can overcome the limitation of *chow test* (it does not indicate the source of instability whether from the intercept or the coefficient up on dividing the sample in to two groups). The recursive method uses by increasing the sub-sample size and then estimate the parameters continuous until the total sample data is completed. So finally plot the paths of the estimates overtime. In recursive plots, there are two standard errors band around the selected coefficients. As the sample size increase and significant variation occurs within the bands, then the coefficient is stable over the entire period and indicates the constancy of the variance of the estimated model. Therefore up on this theory, the recursive graphs that plot 1-step ahead residuals, break point chow tests and 1-step ahead chow-test for the LDC and other variables in the system.

Granger Causality Tests: - Interaction between NFA and DC

In short broad money supply basically consists of net foreign assets and domestic assets, and we know that the National Bank of Ethiopia needs to equalize the growth rate of money supply at the growth rate of GDP using considerable management both determinants.

In addition, the monetary approach to the balance of payment states that the movement of net foreign assets (NFA) can be influenced by the domestic credit (DC) expansion. Their relation extended to determine the internal and external imbalance of the economy, but Killick (1990) gave reasons for reverse causality between NFA and NDCG. During a decrease in NFA before NDCG is cut, the crowding out effect of the government credit cut DCP and secondly the decrease in NFA leads to lower the reserve base (the summation of currency in circulation and Bank deposit in National Bank), which has effected on commercial banks' lending. But their lending is not as such responsive to reserve base due to the already existing excess reserve above the requirement.

Following both variables are assumed to be stationary at first difference level and the errors terms entering the causality test are uncorrelated, the Granger causality test of net foreign assets and domestic credit up on quarterly periods of 2000-2017 can be presented below depending on the number of lagged terms.

Table 4.9 Granger causality test

Null Hypothesis	Lag	F-Statistic	Probability	Decision
NFA does not Granger Cause DC	2	5.38887	0.00729	Reject
DC does not Granger Cause NFA	2	1.46674	0.23956	Accept
NFA does not Granger Cause DC	1	4.19365	0.04511	Reject
DC does not Granger Cause NFA	1	0.14983	0.70012	Accept

4.3. Interpretation of the Results

Up on the results presented above, we can now interpret both long run and short run dynamic analysis. This empirical discussion summarized the response of National Bank of Ethiopia to macroeconomic shocks.

Since the exogeneity nature of fiscal gap (LFg), Domestic credit has positive long run effect to net foreign assets and gross domestic product while it has very low elasticity to the real effective exchange. This implies that the Bank took action using domestic credit on the basis of net foreign assets, as both are the determinants of money supply. In turn both are needed to be changed at the same growth rate of GDP. But monetary policy of domestic credit plays insignificant long run role to enhance the international position of the country in competition with the rest of the world, because the major determinants of international position of Ethiopia are the very nature of developing countries like backward technology, poor quality products, structural problem, and instability and so on.

Regarding to consumer price index, the policy variable had loose elasticity to the change in CPI in the long run, which implies that inflation happened not only from the monetary effect but also from aggregate supply shortage evidenced by drought with inflation in the country. Due to the consequence of the coffee export booming and the substantial increment in credit expansion to the private sector, there was a significant change in the growth of GDP.

Regarding to fiscal gap, domestic credit has positive long run effect to fiscal gap if we take fiscal deficit as endogenous variable (but became weak effect when we treat it as exogenous variable for the system). This is also directly consistent to theories for the case of developing countries. In the absence of broad and active financial market the primary obligation of monetary authorities is to finance the government deficit. Under such circumstance monetary growth primarily depends on fiscal policy (Joseph, 1991).

Even though the National Bank does not have full control over it, net foreign assets have positive long run relation with LCPI and trend while it has negative relation with LREER, LGDP and LFg similar output done by (Haile, 2001) in the study of BOP and policy. On top this all explanatory variables are statistically significant and LNFA has strong relation with them: that is why national bank articulates policies using domestic credit on the condition of status of net foreign assets as both are the determinants of money supply to set the rate at GDP growth rate.

Restricted standardized adjustment coefficient,α_1=0.02072 tells us that the speed of adjustment or feedback effects towards the long run equilibrium is 2.072 percent per quarter when there is macroeconomic shock in the system, which is very weak took 8.288 percent per annum. In general it took many years for full adjustment. This is a rationale for the longer lags structure and undeveloped financial sectors resulted in obstacles for the effectiveness of monetary policies, and disable its ability to govern macroeconomic shocks within short period. It is obviously noted that one of the efficiency measurement criteria for monetary policy is the time taken for adjustment and the controllability of macro variables under central bank.

Bearing the long run dynamic analysis in mind, we can interpret the short run empirical outcomes for policy prescription from table 4.9. Both domestic credit and GDP have positive and negative short run impacts respectively, and are statistically significant at lag five indicating monetary policy variable, DLDC responded after a year when both were changed, and the growth rate of money supply set at the growth rate of annual nominal GDP. However DLNFA is a loose significant & negative short run impact indicating that variations in LDC were not much more explained by a change in LNFA in short run period, and also DLFg could not explain the change in DLDC. Both error correction terms are statistically significant with negative short-term impacts on DLDC, which is consistent with the two co integrating vectors. It means that the coefficient is CIa-1 and CIb-1 indicate the speed and direction to correct equilibrium errors towards the long run relation are 15.12% and 6.49% per quarter where there is a shock in the short run dynamics implying that inconsistent with the long run dynamic analysis.

In equation of DLDC, the coefficient of DLNFA is known as sterilization coefficient, which measures how much change in the net foreign assets deriving from the interventions in the exchange rate market is sterilized by the monetary authority. In general it is an indicator of the degree of sterilization of net foreign assets. The coefficient ranges from zero to minus one. If it is negative one, the sterilization is complete; while it is greater than one, the degree of sterilization is less than full (Olcay Yucel, Almila Karasoy and Kursat, 2000). Therefore from table 4.8, the coefficient of – 0.0452 tells us incomplete sterilization activities done by National bank.

In equation of DLNFA the coefficient of DLDC is known as the offset coefficient, which gives the amount of capital outflow per domestic currency of expansion of domestic credit. It closes to –1 if domestic and foreign assets are close substitutes indicating a higher degree of capital mobility and a low degree of control over the money stock. If it closes to zero, a higher degree of

monetary control and a low degree of capital mobility are available (Olcay, Almila and Kursat, 2000). Accordingly the coefficient of model under investigation 0.29 is that it is closer to zero even though its t-value is statistically insignificant. Therefore the National bank of Ethiopia adopted a higher degree of monetary control with a low degree of capital mobility in practices.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Along with the policy adopted, the National Bank of Ethiopia reacts to macroeconomic shocks by specifying its monetary policy reaction function that might be needed to make the broad money supply growth rate at the rate of nominal GDP. To make proper responses to macroeconomic shocks of policy & non-policy shocks or foreign & domestic shocks, and to maintain its monetary policy objectives, the bank attempts to consider the monetary growth rate as determined by domestic credit and net foreign assets, the extent of monetization towards fiscal deficits, the movement of consumer price index, and the position of Ethiopia in world market using real effective exchange rate. Such determinants of monetary policy claims the National Bank to adjust its operating and instruments targets to new information mostly using quarterly and annual frequency in the sense that to create a link between short term and longer horizon monetary objectives.

Therefore as identifying the proper monetary policy indicator prior to reaction function specification, the domestic credit assets (monetary policy indicator) have strong long run and positive relation with net foreign assets and real GDP. But it has short-run relation with the change in domestic credit & real GDP at lag five, and with the change in both CPI & REER at lag one. Besides that the equilibrating error terms derived from both LDC and LNFA in the long run have strong negative relation with LDC in the short run. Eventually, the result justifies that National Bank of Ethiopia follows a combination of both accommodating and stabilizing policies.

In conclusion the Bank can strongly meet the objectives of reducing the monetization of budget deficits and the effort of setting the monetary growth rate at the growth rate of nominal GDP as the empirical results reported in the table. In addition, the objective of stabilizing the price level and achieving the international reserve target can strongly be satisfied in the short- and long run period respectively. The longer the speed of adjustment and correcting the errors, the longer lags structure and undeveloped financial sectors which manifested the poor effectiveness of monetary policies as evidenced by the efficiency measurement criteria for monetary policy.

5.2 Policy Implication

As the NBE specifies its monetary policy reaction function using domestic credit as policy indicator, the policy implication of the empirical result tells us that the net foreign assets, inflation, real effective exchange rate and real GDP should be considered in conducting & analyzing monetary policy. Accordingly, the bank should also pay attention to part of the broad money determinants, net foreign assets to respond macroeconomic shocks, and more emphasis should be continued to the objective of price stability and achieving international reserve target. In addition the effort to reduce deficit monetization has been successfully satisfied in short & long run in to control inflationary condition in the country. The low long run adjustment coefficient indicates the inadequacy of the financial market and weak financial development, which in turn implies that the indirect monetary policy instruments might not be effective as expected. Therefore the following policy implications are suggested.

- The effectiveness of monetary policy including the controllability of National Bank over macro variables depends on the demand pattern of the economy, which is activated by performance of investment. Thus, the government should conduct policies that improve structural bottleneck in the real sectors. These enable the commercial banks to extend credits (short term and long term) to private sectors and minimize their over-liquid cash position. In effect, the National Bank will have an access to grant loans for these banks, when they are in shortage of liquidity and control the money supply using the interest rate.
- Therefore the monetary authority have to made investigation and pursue policies that enable commercial banks to utilize their over-liquid assets and need credit from National Bank, In effect the discount window faculty will be activated.
- National Bank has to continue to pursue policies of reducing budget deficits monetization to control inflation rate where there is monetary implication of inflation.
- But, as we have seen in restricted long-run model, the domestic credit does not have significant elasticity and relation with consumer price index in the long run indicating that NBE controlled inflation only to some extent due to the non-monetary nature.

However the bank controlled consumer price index in the short run. Therefore the government should pay attention for policies that improve aggregate supply bottleneck then after monetary policy, domestic credit, might have long run relation with and controlled consumer price index.

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APPENDIX

Appendix one

Modeling of D LDC by OLS

Parsimonious-dynamic-LDC-equation

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
DLDC_2	0.2348	0.137	1.71	0.095	0.0663
DLDC_5	0.3908	0.139	2.80	0.008	0.1607
DLNFA_1	-0.0452	0.024	-1.86	0.127	0.0560
DLCPI_1	0.4107	0.166	2.47	0.018	0.1292
LREER_1	-0.0941	0.046	-2.03	0.048	0.0917
DLGDP_5	-0.1692	0 .045	-3.73	0.001	0.2538
DLFDD_5	-0.0050	0.003	-1.69	0.240	0.0335
CIa_1	-0.1512	0.066	-2.28	0.028	0.1126
CIb_1	-0.0649	0.032	-2.01	0.051	0.0894
Constant	0.7028	0.329	2.13	0.039	0.0997

Sigma = 0.0342166, RSS=0.048001793, R^2=0.428059, Log-likelihood: 107.897, -T/2log|Omega| 181.681776, No. Of observations: 52, no. Of parameters=11, Mean (DLDC) 0.02777, Var (DLDC)= 0.001614, Sigma = 0.0342166, DW = 1.88

Diagnostic Tests:
AR 1-4 test: F (4,37) = 0.35190 [0.8410]
ARCH 1-4 test: F (4,33) = 0.71613 [0.5869]
Normality test: Chi^2(2) = 0.16248 [0.9220]
Hetero test: F (20,20) = 0.79611 [0.6925]
RESET test: F (1,40) = 2.1383 [0.1515

Appendix two: - Short run dynamics for the DLNFA

(Up on general to Specific procedure for a single equation)

Modeling DLNFA by OLS

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
DLDC_5	0.29	0.13	2.15	0.037	0.0992
Constant	0.40	0.30	1.30	0.200	0.0388
DLNFA_4	-0.05	0.02	-2.19	0.034	0.1028
DLCPI_1	0.38	0.16	2.41	0.021	0.1212
DLCPI_5	0.32	0.17	1.89	0.066	0.0781
DLREER_1	-0.06	0.03	-1.77	0.084	0.0694
DLGDP_3	0.11	0.03	3.20	0.003	0.1962
DLFDD_2	-0.004	0.004	-1.10	0.276	0.0282
CIa_1	-0.08	0.06	-1.45	0.155	0.0476
CIb_1	-0.03	0.03	-1.17	0.249	0.0315

Sigma= 0.0343824 RSS= 0.0496502832

R^2 = 0.408418 F (9,42) = 3.222 [0.015]

Log-likelihood = 107.019 DW = 2.02

No. Of observations= 52 No. Of parameters=10

Mean (DLDC)=0.0277731 var (DLDC) =0.001614

AR 1-4 test: F (4,38) = 1.2102 [0.3225]

ARCH 1-4 test: F (4,34) = 0.43727 [0.7807]

Normality test: Chi^2(2) = 0.26310 [0.8767]

Hetero test: F (18,23) = 0.44293 [0.9589]

Not enough observations for hetero-X test

RESET test: F (1,41) = 1.3021 [0.2604]

Appendix three

How NBE generate real effective exchange rate

REER is the index is computed by taking quarterly data on wholesale price index & exchange rate of 19 major trading partners (Belgium, Kenya, Italy, France, Germany, Us,Uk, S.Arabia, nether land, south Korea, Sweden, Japan, India. are selected by their weight of import plus expire to total hade of Eth and accounted 80% of total trade jointly) & applying weighted trade index to the base yean of 2006 which seem to be normal in the country.

$$NEER = \sum_{1}^{n} Wji.\ Eji$$ Where Wji is trade weight of country J at time I

Eji is nominal exchange rate defined as domestic currency per a unit of foreign currency

$$REER = \sum_{1}^{n} Wji.\ Eji\ (Pi/p*i)$$ Where n= Number of partners

1 P*i= Wholesale price index of partner countries P_i =Consumer price index of Ethio

Annex four: Short run dynamics for the System As a whole

(Up on general to specific procedure for DLDC)

Short Run Dynamics For the System As A whole						
Explanatory	**DLDC**	**DLNFA**	**DLCPI**	**DLREER**	**DLGDP**	**DLFG**
DLDC-2	0.234[1.71]	0.480[-1.66]	0.019[0.18]	0.204[-0.90]	0.198[-0.04]	1.954[-.59]
DLDC-5	0.390[2.80]	0.276[-0.37]	0.082[-0.79]	0.031[0.13]	0.523[1.22]	3.240[0.97]
DLNFA-1	0.045[-1.56]	0.180[1.16]	0.007[-0.34]	0.015[-0.31]	0.070[-0.79]	1.738[2.53]
DLCPI-1	0.410[2.47]	0.150[0.16]	0.414[3.35]	0.020[0.07]	0.865[1.72]	2.324[0.58]
DLCPI-5	0.169[1.01]	0.695[0.78]	0.334[-2.73]	0.084[1.11]	1.366[2.73]	5.692[-1.45]
DLREER-1	0.094[-2.03]	0.397[1.69]	0.0012[0.03]	0.024[0.31]	0.038[-0.27]	3.502[3.19]
DLGDP-5	0.169[-3.73]	0.210[0.868]	0.090[-2.68]	0.084[1.121]	0.419[3.02]	5.007[-4.66]
DLFG-5	0.005[-1.19]	0.043[1.67]	0.002[-0.80]	0.012[1.52]	0.019[1.34]	0.087[-0.760]
Cia-1	0.151[-2.28]	0.312[0.88]	0.057[1.18]	0.084[-0.76]	1.135[5.59]	5.612[-3.57]
Cib-1	0.064[-2.01]	0.088[0.51]	0.045[1.88]	0.046[-0.86]	0.612[6.17]	4.281[-5.58]
Constant	0.702[2.13]	1.010[-0.57]	0.418[-1.71]	0.476[0.86]	6.210[-6.14]	40.712[5.21]
F test	3.069[0.005]	1.103[0.38]	3.59	1.02	1.3	8.9
Log-Likelihood	107.897	20.6899	123.37	81.1343	49.6431	-56.7478
Tlog/Omega (-)	181.681	164.2654	197.155	154.9191	123.42	17.036
Sigma	0.034	0.183	0.025	0.057	0.1048	0.8115
RSS	0.048	1.373	0.026	0.134	0.4511	27.003
R^2	0.428	0.211	0.567	0.218	0.7631	0.6888
Mean	0.027	0.047	0.008	-0.0018	0.0142	0.0101
Var	0.001	0.033	0.0011	0.003	0.036	1.665
DW	1.888	2.05	1.97	1.99	2.07	2.35

System Diagnostic Test
System Diagnostic Test

log-likelihood=339.208601,-T/2log|Omega|=781.917424,|Omega|=8.69235791e-014,Log|Y'Y/T|=-25.8814

R^2(LR)=0.984888, R^2(LM) = 0.426652,No. Of observations = 52, No. Of parameters = 66

DLDC: AR 1-4 test: F(4,37) = 0.35190 [0.8410]

DLNFA : AR 1-4 test: F(4,37) = 0.86157 [0.4960]

DLCPI: AR 1-4 test: F(4,37) = 0.85732 [0.4985

DLFDD: AR 1-4 test: F(4,37) = 0.23366 [0.9176]

DLDC: Normality test: Chi^2(2) = 0.16248 [0.9220]

DLNFA: Normality test: Chi^2(2) = 26.076 [0.0000]**

DLCPI: Normality test: Chi^2(2) = 0.90522 [0.6360]

DLREER: Normality test: Chi^2(2) = 2.4208 [0.2981]

DLGDP :Normality test: Chi^2(2) = 1.0902 [0.5798]

DLFDD: Normality test: Chi^2(2) = 1.8089 [0.4048]

DLDC:ARCH 1-4 test: F(4,33) = 0.71613 [0.5869]

DLNFA: ARCH 1-4 test: F(4,33) = 0.25144 [0.9067]

DLCPI: ARCH 1-4 test: F(4,33) = 0.70140 [0.5966]

DLREER: ARCH 1-4 test: F(4,33) = 0.76777 [0.5539]

DLGDP:ARCH 1-4 test: F(4,33) = 0.059327 [0.9932]

DLFDD: ARCH 1-4 test: F(4,33) = 0.31532 [0.8657]

DLDC: hetero test: F(20,20) = 0.79611 [0.6925]

DLNFA: hetero test: F(20,20) = 0.92522 [0.5681]

DLCPI: hetero test: F(20,20) = 0.27590 [0.9971]

DLREER: hetero test: F(20,20) = 0.72123 [0.7643]

DLGDP: hetero test: F(20,20) = 0.57098 [0.8906]

DLFDD: hetero test: F(20,20) = 0.67828 [0.8036]

Vector Portmanteau (6): 203.356
Vector AR 1-4 test: F (144,78)= 1.2544 [0.1348]
Vector Normality test: Chi^2(12)= 36.598 [0.0003]**
Vector hetero test: F (420,66)= 0.22312 [1.0000]