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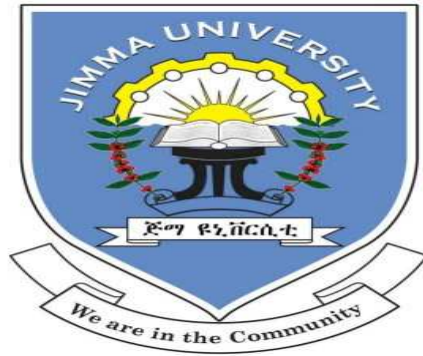
**THE RELATIONSHIP BETWEEN INFLATION,
MONEY SUPPLY AND ECONOMIC GROWTH IN
ETHIOPIA: COINTEGRATION AND CAUSALITY
ANALYSIS**

BY:

FITSUM SHAREW

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**A Thesis Submitted to the School of Graduate Studies of Jimma
University in Partial Fulfillment of the Requirements for the Degree of
Masters of Science in Economics (Economic Policy Analysis)**

MAY 2013

JIMMA

DECLARATION

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

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ACRONYMS and ABBREVIATIONS

ADB	African Development Bank
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
ARDL	Auto Regressive Distributed Lag
ARMA	Auto Regressive Moving Average
CPI	Consumer Price Index
CUSUM	Cumulative Sum of Recursive Residual
DF	Dickey-Fuller
ECT	Error Correction Term
ECM	Error Correction Mechanism
EPRDF	Ethiopian People Revolutionary Democratic Front
FDI	Foreign Direct Investment
FMOLS	Fully Modified Ordinary Least Square
FPE	Final Prediction Error
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
HQ	Hannan-Quinn Information Criterion
IMF	International Monetary Fund
IRF	Impulse Response Function
LDC	Least Developed Country
LR	Sequential Modified Likelihood Ratio
MA	Vector Moving Average
MB	Monetary Base

MoFED	Ministry of Finance and Economic Development
MoARD	Ministry of Agriculture and Rural Development
NAIRU	Non-Accelerating Inflation Rate of Unemployment
NBE	National Bank of Ethiopia
ODA	Official Development Assistance
PCGDP	Per Capita Gross Domestic Product
PP	Phillips-Perron
PPI	Producer Price Index
QTM	Quantity Theory of Money
RGDP	Real Gross Domestic Product
SSA	Sub-Saharan Africa
SC	Schwarz Information Criteria
SD	Standard Deviation
UNFPA	United Nation Fund for Population Activities
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
WB	World Bank

ABSTRACT

The Ethiopian Economy has the feature of low and stable inflation before the period 2002/03. However, in the post 2002/03 period continues rise in the prices level along with sustained and rapid economic growth has been emerged. On the basis of this situation, this study has examined the existing causal relationship between inflation and money supply and between inflation and economic growth in Ethiopia for the period 1970/71-2010/11. The study used tri-variate Granger causality with VECM methodology along with impulse response function analysis. Stationarity tests, selection of optimal lag length and cointegration tests are under taken before estimation of the model. The test of stationarity revealed that CPI, money supply and RGDP are non-stationary in level and they become stationary at first difference. The Johansen cointegration test indicates the presence of one cointegrating vector and the VECM demonstrates the existence of long run bi-directional causality between inflation and money supply and uni-directional causality from economic growth to inflation. In the short run one way causality were found from money supply and economic growth to inflation. Furthermore, the impulse response function shows the response of inflation in money supply and economic growth shocks. Therefore, the key findings of the study are inflation is a monetary phenomenon in Ethiopia and inflation is negatively and significantly affected by economic growth. Thus, based on the results of the study, monetary policy should be planned to maintain price stability by controlling the growth of money supply and combined effort should be made by policy maker to increase the level of output by improving productivity and supply so as to reduce the prices of goods and services (inflation) and boost the growth of the economy.

Key words: *Inflation, Money supply, Economic growth, Cointegration, Granger Causality.*

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

With a population of about 84 million in 2011, Ethiopia is the second most populous country in Africa (WB, 2012). Its history as a political entity extends back to ancient time, and almost uniquely within Sub-Saharan Africa, it has never been colonized (Alemayehu, 2007). Despite its rich and varied endowment of natural resource base, historic and cultural heritages, the country remains poor and widely associated with poverty and famine.

The main feature of Ethiopian economy is its dependence on rain fed agriculture. Overall economic performance is largely related to what happens in the agriculture sector, which is in turn tremendously dependent on the amount and the timing of rainfall (Alemayehu, 2005). More than 80 percent of the population engaged directly or indirectly on agriculture. Besides, agriculture has a lion's share to GDP (i.e., 43% of GDP in 2010) and is the most important export item both by volume and value, 90% of total exports originate from this sector (MoARD, 2010).

The Ethiopian economy during the sample periods of 1970/71-2010/11 was experienced three different growth episodes. These three different growth episodes are characterized the two regimes past and the current government in the country. Between the years 1970/71-1973/74 which is in the imperial regime, the economy recorded promising growth rate. But, during the military regime of 1974/75-1990/91 the economic performance was poor and the growth is averaging 1.7 percent and – 1.1 percent per capita growth (MoFED, 2010/11). The factors underlying this poor trend include draught, civil war, high population growth rate, low investment levels, poor infrastructure, and volatile terms of trade, debt burden and so on. Moreover, heavy state intervention and a command economic system crippled the country's economy during these periods (Ergete, 1998).

After the downfall of the military government in 1990/91, the current government of Ethiopia implemented stabilization and structural adjustment program with the help of the IMF and the World Bank. The aim of the program was to abolish price distortions, improve market related incentives, encourage private enterprises and exports, and liberalize the economy and to reduce the role of the public sector in the economy. Then a private led competitive economy operating under a free market and prudent fiscal and monetary policy environments was expected to emerge from this program (Minale, 2002). With this stabilization and structural adjustment program, inflation remained low for most of the periods following the adjustment program as the inflation level of the past.

Following the expansionary economic policies (such as increased public expenditure and money supply) followed by the government and National Bank of Ethiopia (NBE), resulted in improvements in various macroeconomic indicators including high economic growth (Alemayehu and Kibrom, 2008). Between the periods 2003/04-2010/11, the annual average real GDP growth rate was 11.5 percent (NBE, 2012). At the same time, sharp and persistence rise in the general price level in the economy has emerged as an important macroeconomic problem all over the country in the post 2002/3 period.

In economic theories the sources of inflation can be classified in different type but the main categories are: demand-pull and cost-push inflation. The demand-pull inflation occurs when aggregate demand in an economy is higher than aggregate supply due to the higher demand for goods and services, this may happen due to expansionary fiscal and monetary policy (Makochekanwa, 2007). While the cost-push inflation arises, when there is an increase in the cost of production of goods and services. The main sources of cost-push inflation may be decrease in aggregate supply that may be due to high cost of factors of production, higher import price and rising taxes. The price rise to increasing cost of the factors of production caused either by trade unions' bargaining power or by the pricing policies of oligopolistic and monopolistic firms with market power (Ibid). However, Chhibber and Shafik, (1990) argued that, this theoretical view rarely holds in developing countries largely because wages constitute only a small part of national income and strong trade unions hardly exists. Yet, the Keynesian theory attributes the inflationary gap to the difference between aggregate demand and potential level of output

at full employment. Another version of Keynesian approach to price determination emphasized the importance of wage and salary costs in influencing the price level.

Based on Quantity Theory of Money, on the other hand monetarists argued that inflation is purely a monetary phenomenon. They asserted that continuous increase of aggregate prices in an economy is caused by the excessive rate of expansion of the supply of money. Milton Friedman in 1963 thought that 'inflation is always and everywhere a monetary phenomenon'. He postulates that the source of all inflation episodes is a high growth rate of the money supply (Mishkin, 2004). This is supported by the evidence that, every country that has experienced a sustained, high inflation has also experienced a high rate of money growth. In recent years Kesavarajah and Amirthalingam, (2012); Bakare, (2011); Ghazali, et al., (2008); Quayyum, (2006); and others have found that changes in nominal quantity of money and price level are closely related.

When we look at the developments in the monetary aggregate of Ethiopia, the broad money supply has been increased from 34.7 billion in 2002/03 to 145.4 billion in 2010/11 with annual average growth rate of around 22 percent. The share of broad money as a percentage of GDP has shown a marked increase from 42.7 percent in 2002/03 to 56.7 percent in 2006/07 and latter on declined to 29.1 percent in 2010/11 (NBE, 2012). In the fiscal front both the government revenue and expenditure has increased from birr 15.7 billion and 20.5 billion in 2002/03 and reached 85.6 billion and 93.8 billion birr respectively in 2010/11 (MoFED, NBE, 2012). As we observe here, there has been a huge increase in government expenditure and the money supply as well.

In order to understand the causal relationship between inflation, money supply and economic growth researchers spent amount of time in investigation. However, the existing empirical literature is far from reaching conclusive agreement on the precise relationship between inflation and money supply and between inflation and economic growth. For instance, different studies found no conclusive empirical support either a positive or negative association between inflation and economic growth. Studies like (Fisher, 1993; Barro, 1996; Singh and Kalirajan, 2003; Chuan-Yeh, 2012) and others regard inflation as pernicious issue and recommend government and policy makers to combat it. While empirical literatures like (Bruno and Easterly, 1995; Sarel, 1995; Ibarra

and Trupkin, 2011) and others also maintain the view that inflation below a certain threshold level could be beneficial and facilitate economic growth than retard it. In other words, they suggest that macroeconomic stability, specifically explained as low inflation is positively related to economic growth.

Similarly, there is also controversy on the direction of causality between money supply and inflation despite the strong positive correlation between them. The studies of Darrat, (1986); Amin, (2011); and Chimobi and Uche, (2010) indicated that unidirectional causality running from money supply to inflation. While, Anderson, et al., (1988) found evidence in favour of one way causality from inflation to money growth and others like Jones, (1989); Lahiri, (1991); and Choudhry (1995) found bi-directional causality between inflation and money supply.

The above discussion indicates that empirical evidence regarding causal relationship between inflation and the other two variables, money supply and economic growth, remains inconclusive. The purpose of this study is therefore to examine the causal relationship between inflation and money supply and between inflation and economic growth with regard to Ethiopia's data.

1.2 Statement of the Problem

Ethiopian economy has the feature of low and stable inflation for the periods before 2002/03. According to the NBE, (2007) this was achieved due to prudent monetary and fiscal policies (1970/71-1973/74), general price control (1974/75-1990/91) and implementation of economic reform and stabilization programs (1991/92-2002/03). The annual average inflation was only 6.3 percent in 1970/71-2002/03, and major inflationary episodes have occurred during a regime shift, conflict and drought periods. For instance, inflation reached a record of 11 percent in 1973/74 during the end of the imperial regime and the coming of the Military Junta, 18.55 percent in 1977/78 during a war with Somalia, 16.4 due to the severe droughts of 1984/85 and again 20 percent in 1990/91 at the peak of the Civil war.

However in the post 2002/03 periods, the country has been experiencing continues rise in prices of goods and services along with sustained and rapid economic growth. For instance, from 2003/04-2010/11 onwards, output on average grew by 10.8 percent per

annum while during the same period; prices have grown by 15.3 percent annually. Particularly, in 2008/09 the general prices rose by more than 36 percent on average and food price jumped by about 44 percent. The picture is relatively less pronounced for non-food prices during the same period with average prices rose by about 24 percent. Although the general price level slowed down to 2.8 percent annual growth during the 2009/10, the figures remained at the high level in 2010/11 steadily increasing to reach 38.1 percent in June 2011 back from 5.7 percent in July 2010. This shows that the general price rise has remained to be the most important macroeconomic problem of the Ethiopian economy despite the government effort to maintain the inflation rate to a low level during this period.

Empirical studies on the possible sources of the inflationary situation in the country indicated that, the fast increase in broad money supply, the widening of public budget deficit and the mechanism of financing it, the rise in price of oil and food items and other as the causes of the price surge (ADB, 2011; Jema and Fekadu, 2012; Desta, 2009; Alemayehu and Kibrom, 2008). While the government on the other hand argues that structural factors that is, the hoarding of goods by traders (piling up stocks), rapid economic growth, the rise in oil and food prices are the possible sources of inflation in the country (Jema and Fekadu, 2012). In sum, there is no consensus on why Ethiopia is currently facing varying food and non food inflation while the economy is registering rapid growth.

Therefore, in this situation it is interesting to understand the causal relationship between inflation and money supply on one hand and inflation and economic growth on the other hand. However, in the context of Ethiopia, the relationship between inflation and money supply as well as the repercussion of inflation on economic growth or vice versa is not well studied. To the best of the researcher knowledge, there have been little empirical studies done on the causal relationship between inflation, money supply and economic growth in the country. Wolde-Rufael, (2008) tried to investigate the causal link among inflation, money and budget deficits for the period 1964 to 2003 using the bounds test approach to cointegration and a modified version of the Granger causality test. While, Fekadu, (2012) analyzed the relationship between inflation and economic growth for the period 1980-2011 using Vector Autoregression (VAR) model. Unlike these studies, in

this paper the causal relationship between inflation and money supply and between inflation and economic growth is examined by using tri-variate Vector Error Correction Model (VECM) for the period 1970/71-2010/11.

1.3 Objectives of the Study

The main objective of the study is to empirically analyze the causal relationship between inflation and money supply and between inflation and economic growth in Ethiopia for the period 1970/71-2010/11.

The specific objectives are:

- ❖ To empirically examine whether there is a long run relationship between inflation, money supply and economic growth.
- ❖ To empirically examine whether money supply and economic growth causes inflation.
- ❖ To empirically examine whether inflation causes money supply and economic growth.

1.4 Hypothesis of the Study

The null and the alternative hypotheses of the study will be specified as follows:

H₀: There is no Granger Causality between inflation and money supply.

H₁: There is Granger Causality between inflation and money supply.

H₀: There is no Granger Causality between inflation and economic growth.

H₁: There is Granger Causality between inflation and economic growth.

1.5 Significance of the Study

The sources and impacts of inflation on economic growth in Ethiopia has been a debatable agenda. Some argues that inflation is the indicator of high economic growth while others say it is the sign of wrong economic policy in the country (Teshome, 2011). Still others maintain the view that rapid expansion of money supply as the prime cause of inflation in the country. Thus, this study will provide two main purposes. First, it identifies the causal relationship between inflation and money supply and between inflation and economic growth. This may help policy maker for appropriate ways of

intervention to go for proper policy set up to contain inflation and maintain the economic growth. Second, this study may serve as a spring board as well as reference material for researchers interested in further investigation of the topic.

1.6 Scope and Limitation of the Study

The scope of the study is restricted to the analysis of the causal relationship between inflation and money supply and between inflation and economic growth in Ethiopia. It is also designed to cover the periods between the years 1970/71 to 2010/11 and this period is selected based on the availability of data.

Despite the fact that this study shed some light on the causal relationship between inflation, money supply and economic growth in Ethiopia, it suffers from some limitations. One of the limitation is, the robustness of the study result is delimited by the inter play of macro-economic factors such as interest rate, rate of saving, rate of investment, budget deficit, exchange rate, export and import. Here, in this study, the pure causal relationship between inflation, money supply and economic growth is analyzed without including any controlling variables. Hence, the scope for further empirical research may be to include more variables in the study.

The other limitation of the study arises from inconsistency of data. For example there is a discrepancy of data reported by governmental organization and international organization. This may arise due to the use of different methods and assumptions in the preparation of data. In addition to this, different sources of data use different calendar. Some sources of data use Gregorian calendar others use Ethiopian fiscal calendar. In this study governmental sources of data such as National Bank of Ethiopia (NBE) and Ministry of Finance and Economic Development (MoFED) are used in order to reduce the variation as the raw data mainly prepared in these offices.

1.7 Organization of the Study

The study is organized in the following chapter. The first chapter discusses the introductory part, in which the back ground, statement of problem, objectives, hypothesis, significance, scope and limitation as well as organization of the study is involved. Chapter two briefly reviews the theoretical and empirical literatures on the relationship

between inflation, money supply and economic growth. Chapter three looks at the research methodology of the study which includes model specification and methodology adopted for the study. Chapter four briefly presents the trend analysis of economic growth, inflation and money supply in Ethiopia. In chapter five empirical results are presented and finally, chapter six provides the conclusions and policy implications of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Review of Theoretical Literature

2.1.1 Definition and Concepts of Inflation

Different scholars of economics define the word inflation in various ways. But all the definition can be summarized to the same point. Inflation is a continuous upward movement (increase) in the general price level. Alternatively it is a state in which the value of money is falling i.e., the prices are rising. There are important points to be considered about this definition. In the first place, it refers to the movement in the general prices level. This does not indicate changes in one price relative to other prices. This type of changes is common even when some level of prices is stable. The other point is the rise in the price level must be somewhat substantial and continue over a period longer (Makinen, 2003).

Based on the degree of price rise, inflation has been classified as creeping, walking, running and galloping or high inflation. Creeping inflation is the modest form and is conducive to economic progress and growth. In this type, the prices rise slightly over a long period. In fact some economists have agree strongly for the existence of creeping inflation in the form of secular rise in prices to save the economy from secular stagnation. However, other economists against the above idea, which is creeping type of inflation, can discourage the overall economic stability. When creeping inflation gets help from some other factors and price rise become more marked, the situation is known as that of walking inflation. If price rise becomes more rapid and the price rise by fits and starts, the situation is that of running inflation. In hyperinflation the prices rise every moment, in fact limitlessly. This phenomenon occurs when there is excessive money supply or when the fiscal and monetary policies are not compatible. Hyper inflation begins when prices start rising at the rate of more than 50 percent a month (Hajela, 1998).

There are different methods to measure inflation. The most common are: Inflation rate measured as the percentage change in the price index (consumer price index (CPI), producer price index (PPI) etc) and the GDP deflator. The consumer price index (CPI), for instance, measures the price of a representative basket of goods and services purchased by the average consumer and calculated on the basis of periodic survey of consumer prices. Owing to the different weights the basket, movements in the price of some goods and services have effect on measured inflation with varying degrees. CPI reflects the reality of the evolution of purchasing power and the consumption pattern of average consumer in a country. There are many disadvantages of the CPI as a measure of price level. First, it does not show goods and services purchased by firms and/or government, like machinery. Second, it does not show the change in the quality of goods which might have occurred through time. Thirdly, changes in the price of substitutable goods are not measured. Finally, CPI basket usually does not change often. In the same way PPI includes only the change in the price of raw materials that are used by the producers (Essien, 2005). On the other side, GDP deflator takes only locally produced goods and services (Teshome, 2011). Despite the limitations, the CPI is still the most widely used measurement of the general price level.

A downward movement in the real demand for money is, one way for the price level to increase. For instance, a permanent downward shift in the production function would reduce aggregate output, and there by the real quantity of money demand decreases. However, it should be known, that a single shock of this type creates a onetime increase in the price level rather than continues increase in price level (Barro, 1997).

According to Barro, (1997) for inflation to happen there should be a permanent downward movement to the production function. A negative technology shocks, downward shift in labor supply, upwardly skewed relative cost shocks, and other factors that change aggregate supply curve to the left cause inflation; the same is true of increases in the money stock, downward shifts in money demand, increase in government purchases, and other factors that shift the aggregate demand curve to the right. But there is no evidence that these force can account for inflation in the sense of constant rises in prices.

Although there are many factors that can increase aggregate demand, most of them are restricted in scope. For instance, since there are practical limits on government purchases and reductions in tax there cannot be continuous large increase in aggregate demand coming from these variables. We never observe government purchases that are more than total output, or total taxes that are negative. In contrast, the money supply can increase at almost any rate, and it is common to observe huge variations in money growth from large and negative during some deflations to huge and positive during hyperinflation. A large increase of the money supply, either over several years in a moderate inflation or over a few days at the height of a hyperinflation is common (Romer, 1996).

Commonly inflation can also be classified by their sources such as demand pull inflation, cost push inflation, pricing power of inflation and sectoral inflation. Under the cost-push inflation, prices rise due to increasing cost of the factors of production. This type of inflation maintains that prices of goods and services rise due to trade unions' bargaining power, and/or the pricing policies of firms with market power such as oligopolistic and monopolistic firms (Makochekanwa, 2007). Labor market rigidities and changes in the cost of labor are considered as major cause of inflation in developed countries, but it is not a major cause of inflation in most developing countries due to the fact that wages constitutes only a small part of national income and strong trade union rarely exists (Chhibber and Shafik, 1990). A rise in imported raw material prices and other goods and services costs caused by external shocks which lead to increased foreign prices of imports or domestic currency depreciation is another potential cost-push source of inflation. In the case of rising import prices and exchange rate depreciation, the major explanation for including these variables is that they determine the export competitiveness of the nation. However, in an open and import dependent country, where domestic inflation is largely explained by foreign prices and nominal exchange rate depreciation, the initial development of export competitiveness resulting from depreciation may eventually be offset by the consequent increase in prices (Dlamini *et al.*, 2001).

The demand pull inflation postulates that inflationary pressures arise because of excess demand for goods and services resulting from expansionary monetary and fiscal policies (Makochekanwa, 2007). According to the demand-pull theory, despite the ongoing debate as to whether inflation is a consequence of the upward push of costs, or upward

pull of demand it is essential to recommend the correct anti-inflationary policy. The importance of the debate originates largely from the difference between the recommendations for anti-inflationary policy to which the two views of the cause of inflation. The demand-pull explanation recommends restrictive monetary and fiscal policies whilst the cost-push explanation indicates policies directed at the process of price formation and wage determination (Dlamini *et al.*, 2001).

The pricing power inflation also known as administered price inflation occurs whenever businesses in general decide to boost their process to increase their profit margins. This occur when the economy is booming and sales are strong but doesn't in recessions (slumps). It also known as oligopolistic inflation, since it is oligopolies that have the power to set prices and increase them when they decide the time is ripe. An oligopolistic firm realizes that if it raises its price, the other major firms in the industry will likely see that as a good time to widen their profit margins too without suffering much from price competition from the few other firms in the industry. The last type of inflation is sectoral inflation. The term used whenever any of the other three factors affects a basic industry causing inflation, for example agriculture, steel, oil (Ibid).

2.1.2 The Costs of Inflation

Although most economists agree that inflation is bad, there is no consensus exists over how bad it is or what should be done about it. Some believe that inflation is a major evil and argue that monetary policy or monetary reform should be geared toward its outright elimination. Many others argues that eliminating inflation would reduce output and employment, and the loss output and employment would more than offset the gains from establishing price stability, still others argue that the cost of inflation are small anyway, and could be dealt by other means like indexing the fiscal system (Dornbusch, *et al.*, 1996).

There is no direct loss of output from inflation, as there is unemployment. The relevant distinction is between inflation that is perfectly anticipated and taken in to account in economic transactions, and imperfectly anticipated, or unexpected, inflation (Ibid).

A. Perfectly Anticipated Inflation

Suppose that an economy has been facing a 5 percent of inflation for a long time, and that everyone accurately anticipates that the rate of inflation will continue to be 5 percent. In such an economy, all contracts would build in the expected 5 percent. Borrowers and lenders would know and agree that the dollars in which a loan is repaid will be worth less than the dollar give up by the lender when making the loan. Nominal interest rates would be raised by 5 percent to compensate for the inflation. Long term labor contract would increase wages at 5 percent per year to take account of the inflation, and then build in whatever changes in real wages are agreed to. Long term leases would take account the inflation. In brief, any contracts in which the passage of time involved take the 5 percent inflation in to account. In that category we include the tax laws, which we are assuming would be indexed. The tax brackets themselves would be increased at the 5 percent per year¹ (Dornbusch and Fischer, 1994).

In such an economy, inflation has no real cost except for two qualifications. The first qualification inflation constitutes a tax on holdings of currency, and it imposes welfare costs as agents alter their behavior in response. At their most basic, these take the form of ‘shoe leather’ costs; people will make more frequent trips to the bank to withdraw currency (if bank deposits pay interest or provide depositors with other services) and attempt to synchronize cash expenditures with the receipt of cash income. If there was deflation at a rate sufficient to drive the nominal interest rate on interest-bearing and riskless substitutes for cash down to zero, these welfare costs would vanish; then people would then no longer need to economize on their holdings of cash (Briault, 1995).

The second cost is the ‘menu-cost’ of inflation. These occur from the fact that with inflation – as contrasting to price stability- people have to devote real resources to marking up prices and changing pay telephones and vending machines as well cash registers (Dornbusch and Fischer, 1994).

The existence of tax systems that are not fully indexed and of contracts set in nominal terms (as, for example, for most mortgage borrowing) leads to further distortions from

¹ The taxation of interest would have to be on the real (after inflation) return on assets for the tax system to be properly indexed.

perfectly anticipated inflation. The cost of inflation arise in this respect is the cost of adapting the tax system or financial contracts so that they are fully indexed, if that is possible, rather than the costs arising from a combination of inflation and non-indexation; but if non-indexation continues then inflation could be enormously damaging to an economy (Briault, 1995).

B. Imperfectly Anticipated Inflation

According to Hughes, (1982), costs of anticipated inflation are significant but most of them can be reduced by adjusting tax laws, regulations, and other institutional arrangements. However, this is not possible for costs of unanticipated inflation. Unanticipated inflation occur when firms and household unable to predict a portion of inflation. Unanticipated inflation leads to arbitrary redistribution of income and wealth: specifically from creditors to debtors, whenever contracts are not fully indexed and from those with fixed nominal incomes to those who pay them. This type of redistributions may be very costly for certain individuals and sectors of the economy. They may also damage confidence in property rights. The complexity of measuring the overall welfare costs here - not least because for every immediate loser there is an immediate gainer - should not obscure their importance (Briault, 1995).

There are a number of ways that uncertainty about future price levels is likely to alter the allocation of resources. First, in the absence of index-linked assets, high uncertainty may increase the attractiveness of real (in contrast to nominal) assets because they give a hedge against inflation. Second, in the presences of uncertainty agents are likely to discourage from entering into long-term monetary contracts, thereby removing the assurance provided by longer-term contracts. This is likely to restrain investments where the return is a long time ahead, and thus companies' investment rates decreases and lead to investment in shorter-lived assets (which may represent a less efficient form of investment). Third, increases the real cost of funds for borrowers due to savers and lenders respond to uncertainty by demanding a risk premium. Fourth, capital will be misallocated if savers and investors form different expectations of inflation and thus different views of the ex-ante real rate of interest. Uncertain and highly variable inflation also reduces the efficiency of the price system and thus reduces the efficiency with which

the economy allocates factors of production; and this could affect the level of output (Ibid).

2.1.3 Money Supply

In the literature of monetary theory, economists have used the term 'money supply', 'stock of money' and 'quantity of money' as synonyms. Money supply refers to the total quantity of money available with the public for spending. Individuals and business firms operating in the economy are included in the term public. Thus the governments, the central bank and commercial bank are not public and the cash balances held by them are not included in the money supply. Money supply is a stock concept when viewed with reference to a particular point of time. It is a flow concept when viewed over a period of time. As a stock, it is aggregate of demand deposits held by the public, the total currency notes and coins. Since money supply can be used and spent several times during a period of time it becomes a flow. The number of times a unit of money changes hands during a given period of time is its velocity of circulation. Thus, for a given period of time, the flow of money supply can be known by multiplying the given stock of money by its velocity of circulation (Hajela, 1998).

For economists who argue that growth in money supply will only lead to inflation, the money supply is considered an important instrument for controlling inflation when money demand is stable. The changes in amount of money supply can either be inflationary or deflationary and these two economic terms are responses to policy of central bank. When central bank expands the amount of money in circulation, inflation occurs and when it reduces the amount of money in circulation deflation is certain. An expansion of the money supply will bring about proportionate increase in the output of goods and services (assuming there are no changes in the velocity of money in circulation) and the general price level will remain unchanged (Okhiria and Salius, 2008).

The supply of money can be divided into different types of money based on how much of an effect monetary policy can have on that type of money. The type of money which is more easily affected by monetary policy is known as Narrow money whereas the type of money that is more difficult to affect through monetary policy is known as Broad money. The former one exists in smaller quantities while the latter type of money exists in much

larger quantities. Each type of money can be categorized by placing it along a range between narrow (easily affected) and broad money (difficult to affect). The different categories of money are typically classified as M's. The categories of M's usually range from M0 (most narrow) to M3 (broadest) but which M's are actually used depends on the system. The usual layout for each of the M's is as follows (Ibid):

- **M0:** Physical currency. M0 (M-zero) is the most liquid measure of the money supply; which combines any liquid or cash assets held within a central bank and the amount of physical currency circulating in the economy. Cash or assets that could be quickly converted into currency are only included. Since, it is the smallest measure of the money supply; this measure is also known as narrow money.
- **M1:** M0 + demand deposits, which are checking accounts and it is used by economists to quantify the amount of money in circulation. It is used as a measurement for economists trying to quantify the amount of money in circulation. The M1 is the most liquid measure of the money supply, as it includes cash and assets that can quickly be converted to currency.
- **M2:** M1 + small time deposits (less than \$100,000) in the case of US, savings deposits, and non-institutional money-market funds. It is a broader classification of money than M1. M2 is used by economists to quantify the amount of money in circulation and trying to explain different economic and monetary conditions. It is a key economic indicator used to forecast inflation.
- **M3:** M2 + all large time deposits, short-term repurchase agreements, institutional money-market funds, along with other larger liquid assets. M3 is the broadest measure of money; it is used by economists to estimate the entire supply of money within an economy.

2.1.4 Determinates of Money Supply

It is generally believed that the money supply is created, regulated and controlled by the monetary authority. But this is not correct. According to Hajela, (1998) money supply, in any country is determined by all the player of the game, viz. the central bank, the

commercial banks, the government and the public. The recent trend also, to include financial intermediaries, other than commercial banks, as a source of money supply. Changes in money supply, therefore, are brought about by the actions of all these players. The central bank determines the amount of high powered money or monetary base, that is currency plus reserves, that it will supply, the commercial banks determine the volume of loans and other assets that they will acquire and the quantity of reserves they will hold as excess reserves; and the public determines how to allocate their holdings of monetary wealth among currency, demand, time and saving deposits, intermediary claims and other financial assets (Fand, 1970).

The required reserve ratio or the minimum cash reserve ratio is an important determinate of the money supply. When it increases the supply of money with commercial banks will reduce and a decrease in it increases the money supply. Commercial bank reserves includes reserve on deposit with the central bank and currency in their vaults and it is another important determinate of money supply. The central bank sates the legal minimum required reserve to hold by all commercial banks from checkable deposits. If the central bank raises the reserve ratio, then the money supply will reduce and vice versa. The other determinates of money supply is the desire of people to hold currency; if people holds less cash and more in deposit with commercial banks, the money supply will be large; and if people prefer to hold money in cash, credit creation by bank will be low and, the money supply will be less (Lodha, *et al.*, 2013).

According to Mishkin, (2004) in deriving a model of the money supply process, a simple definition of money (currency plus checkable deposits) is used, which corresponds to M1. Using the M1 definition for the analysis is important because it is less complicated and yet provides a basic understanding of the money supply process despite the broader definitions of money—mostly, M2—are frequently used in policymaking. Moreover, all analyses and results using the M1 definition used equally well to the M2 definition.

We normally assume that people want to hold some proportion of their assets in the form of cash and some in the form of deposits at the bank. We also assume that the desired amount of currency they wish to hold is proportional to their deposits: $C = c.D$ and

commercial banks want to hold some proportion of the deposits in the form of reserves at the central bank: $R = r.D$.

The stock of high powered money or monetary base (MB) was defined as the sum of stock of currency (C), and the reserves (R), held by commercial banks at the central bank: $MB = C + R$ and the relationship between the stock of money and the monetary base is given by: $M = m*MB$, the variable m is the money multiplier, which indicates us how much the money supply changes for a given change in the MB. Rearranging the equation of stock of money, $m = M/MB$ and then dividing equation of m both sides by D:

$$m = [(C/D) + (D/D)] / [(C/D) + (R/D)] \text{ ----- (2.1)}$$

and substituting from the behavioral relationships, $m = [C + 1] / [C + r]$, now we have

$$M = [C + 1] / [C + r] * MB \text{ ----- (2.2)}$$

In equation 2.2 the supply of money is linked to the behavior of the public that determines the amount of cash relative to deposits they wish to hold – probably as a function of their confidence in the banking system and how much they are paid in interest on their deposits; and of the commercial banks which choose how much of their deposits they wish to hold as reserves in case there are people who want to take their money out – probably as a function of how good the investment opportunities are in the economy and how much they have to pay to acquire deposits. What we can see is that, an increase in monetary base (MB) causes the money stock to increase; and increase in reserves (r) causes the money stock to decrease, and an increase in the amount of currency people wish to hold (c) also causes the money stock to decrease (Jha, 2000).

2.1.5 Economic Growth

Kuznets, (1936) defined Economic Growth as, ‘a long term rise in the capacity of a country to supply increasing and diverse economic goods to its population; this growing capacity being based on advancing technology and institutional and ideological adjustments that it demands’ (cited in Taylor, 1991). Simply, it can be equivalently explained as growth in the national income of a given nation. According to Thirlwall, (1995) Growth in national income is usually measured by a percentage change in the real gross domestic product which considers change in price levels in to account.

2.1.6 Theories of Economic Growth, Inflation and Money Supply

2.1.6.1 Keynesian Theory

John Maynard Keynes wrote the book 'The General Theory of Employment, Interest and Money' in 1936, which establishes the foundation for Keynesianism (Vroey and Malgrange, 2011). Keynesian theory assumes that supply will not meet its demand only resting upon market mechanism. Instead it asserted that the economic system is unable to generate sufficient demand to fully employ labor and other resources when constraints to expansion arises, such as in adequate saving and investment (Yergin and Stanislaw, 1998). Therefore, the Keynesian advocates the government to intervene in economy through expansionary economic policies to increase investment and demand to reach full employment output level (Birol, 2005). The increased demand before potential output level is known as effective demand which maximize the employment of limited resources, while, the demand above potential output is known as excess demand.

The Keynesian used the AD (Aggregate Demand) and AS (Aggregate Supply) curves to show the relationship between output, employment and inflation. When resources are not fully employed, government intervention to enhance effective demand will improve output and employment without causing inflation until output reaches its full production level. However if demand increases further, output will not increase as full production has been reached and consequently, the price will rise, and then the inflation phenomenon will appear (Parker, 2010).

For Keynesian another factor than money supply could not generate high inflation. The Keynesian analysis allows for other factor besides changes in money supply (such as fiscal policy and supply shocks) to affect the aggregate demand and supply curve. The fiscal policy of increased government expenditure changes aggregate demand but that only causes a one shoot increase in price level (inflation) since there is a limit to total amount of possible government expenditure: the government can't spend more than 100% of GDP. In fact, well before reaching this limit, the increases in government spending would be stopped by the political process. Therefore, the Keynesian analysis indicates that high inflation cannot be driven by fiscal policy alone (Mishkin, 2004).

Similarly, the supply side phenomena by themselves could not create sustainable inflation. Suppose that a negative supply shock for example the rise in oil price due to supply shock (employees could have successfully pushed up their wage). This negative supply shock reduce the output level, which is below the full employment level and prices will be higher, if the money supply remain unchanged, leaving the aggregate demand curve at initial level. Since the unemployment is above the natural rate, the aggregate supply curve will now shifts back and then the economy slides down².

A onetime supply shock can't bring a permanent shift in aggregate supply curve, the equilibrium we return to full employment at the initial price level, and there is no continuing inflation. Therefore, the supply side phenomena cannot be the source of high inflation. In general the Keynesian believes that high inflation can occur only with a high rate of money growth (Ibid).

2.1.6.2 Monetarism Theory

Monetarism refers to the follower of Milton Friedman, who coined the term 'Monetarism'. Monetarists emphasized several key long-run properties of the economy, including the Quantity Theory of Money (QTM) and the Neutrality of Money (Gokal and Hanif, 2004). The quantity theory of money states that the general price level is mainly determined by the money supply.

According to Gokal and Hanif, (2004) Friedman disagreed on the concepts of Phillips curve. He argued that when the cost of everything doubles in an economy, individuals wage also double, consequently, they don't worried to pay twice as much for goods and services. In this situation neutrality of money holds when individuals forecast future inflation and behave accordingly. Therefore, output and employment will not be affected. When the equilibrium values of real variables, such as the level of GDP are independent of the level of the money supply in the long-run, the concept of neutrality holds; and super neutrality holds if the real variable, such as the rate of growth of GDP are independent of the rate of growth in the money supply in the long-run. In general, Monetarist argued that in the long-run, prices are mainly influenced by the growth rate in

² see Mishkin, 2004 pp. 637

money, but having no real effect on growth. When the growth in the money supply is greater than the economic growth rate, inflation will happen. Therefore, the Monetarists suggest that a predetermined growth in money supply along with nominal output growth (Birol, 2005).

2.1.6.3 Neo-classical Theory

The neoclassical framework for long-run growth is the Solow model. The model consists of production function and capital accumulation. The production function exhibit constant returns to scale, if all inputs are double output will also doubled (Chamberlin and Yueh, 2006). In the Solow model the saving rate, the growth rate of population and technological progress are defined to be exogenous. The capital level will change to and stabilize at the steady state on which output will keep constant at given exogenous variables. Once this balance is broken by change of exogenous variables, new steady state will be achieved (Xiao, 2009).

Mundell, (1963) and Tobin, (1965) articulated the mechanism by which inflation affects economic growth under neoclassical growth theory. According to them the increased in nominal interest rate due to inflation makes people to choose investment than consumption. The increased in capital accumulation due to increased investment will stimulate economic growth. This is known as Mundell–Tobin effect. For Mundell–Tobin model the relationship between inflation and economic growth is positive.

Sidrauski, (1967) proposed a new model by combining the assumption of supernutrality of money with neoclassical growth model. He tries to test the effect of change in growth rate of money supply in the model. The model however, doesn't give a distinct path how the new steady state is achieved up on the change of growth rate of money supply. The result of Sidrauski's model indicates that an increase in the inflation rate doesn't affect the steady state capital stock, i.e., neither output nor economic growth is affected.

Stockman, (1981) developed a long-run equilibrium growth model with assumption of cash-in-advance constraint on both consumption and capital purchases. In Stockman's model, money is a complement to capital, accounting for inverse relationship between the steady-state level of output and the inflation rate. The inflation will reduce both real money balances and investment; and then inflation will negatively influence on growth.

2.1.6.4 Endogenous Growth Theory

Endogenous growth also termed as new age growth theory and explains economic growth which is generated by endogenous factors, such as; increasing returns or induced technological change, economies of scale; in contrast to external (exogenous) factors such as the increases in population (Cesaratto, 1999). According Gillman *et al.*, (2002) in endogenous growth theory, the growth rate is dependent on the rate of return on capital and variables, like inflation, which reduce that rate of return, which in turn diminishes capital accumulation and decreases the growth rate.

Under the framework of monetary economy, the relationship between inflation and return rate on capital in the new growth model will depend on the relationship between real money balances and investment (Xiao, 2009). As neo-classical discussed above, if real money balances substitute investment, the inflation will reduce the return on real money balances but the return on investment will rise; and shows a positive relationship between inflation and economic growth. But inflation will have a negative effect on growth if real money balances complement investment.

According to Chen and Guo, (2009) the growth impact of money/inflation within endogenous growth model shows that; the sign for the relationship between money/inflation and output growth is governed by (i) whether the liquidity-constrained ratio of consumption to investment is higher or lower than a threshold level; and (ii) how the utility value of physical capital responds to a change in the monetary growth rate, which is determined by the relative strength of two opposing forces dubbed as the portfolio substitution effect and the inter-temporal substitution effect.

2.2 Review of Empirical Literature

2.2.1 Empirical Studies on Inflation, Money supply and Economic

Growth in Developing Countries

For monetarists inflation is purely a monetary phenomenon. They argued that a sustained increase of aggregate prices in an economy is caused by the excessive rate of expansion of the supply of money. According to this argument the direction of causality should run

from money supply to aggregate prices. On the other hand, other school of thought like structuralists' school challenged "inflation is purely a monetary phenomenon" and argued that the excessive money supply is a consequence rather than cause of inflation particularly in developing countries, i.e., the direction of causality runs from inflation to money supply (Tang, 2008). Similarly, there is also a debate on the relationship between inflation and economic growth. No conclusive theoretical argument for either a positive or a negative association and directional causal link between inflation and economic growth. To solve these controversies different research was conducted but there is no much empirical consensus on the relationships between inflation – money supply and inflation – economic growth.

Kesavarajah and Amirthalingam, (2012) examined the nexus between money supply and inflation in Sri Lanka over the period 1978 to 2010. They employed Johanson and Juselius multivariate cointegration test and Granger causality test to estimate the long run equilibrium relationship among the variables. The result indicates the presence of long run relationship among the variables and the Granger causality test indicates there was a significant causality from money supply to inflation in Sri Lanka. While, Gunasinghe, (2007) analyzed the causal relationship between inflation and economic growth in this country using Granger causality test and Impulse response function analysis and the result reveals that causality runs from inflation to economic growth for the period 1960-2005. Mallik and Chowdhury, (2001) analyzed the short-run and long-run dynamics of the link between inflation and economic growth for four South Asian economies: Bangladesh, India, Pakistan, and Sri Lanka by applying cointegration and error correction models by using annual data. The result revealed that, there is positive and statistically significant relationship between inflation and economic growth for all four countries and the sensitivity of growth to changes in inflation rates is lower than that of inflation to changes in growth rates. According to the researchers, these results have important policy implications, that is, although moderate inflation promotes economic growth, faster economic growth absorbs into inflation by overheating the economy, and these four countries are on the turning point of inflation-economic growth relationship.

Amin, (2011) studied "Quantity Theory of Money and its Applicability" in the case of Bangladesh using Johansen cointegration method; the empirical findings indicate the

existence of long run cointegrating relationship between money supply and inflation. The Granger causality test, revealed a unidirectional causal relationship running from money supply to inflation which provides evidence in support for quantity theorist's view. Ahmed and Mortaza, (2005) empirically investigated the relationship between inflation and economic growth in this country, using annual data set on real GDP and CPI for the period of 1980 to 2005, and the co-integration and error correction models. The empirical evidence indicates that there exists a statistically significant long-run negative relationship between inflation and economic growth for the country as indicated by a statistically significant long-run negative relationship between CPI and real GDP.

Abbas and Husain, (2006) examined the causal relationship between money and income and between money and prices in Pakistan. They used annual data from 1959/60-2003/04 and employed cointegration and error correction model as well as Granger causality analysis to investigate the bi-variate and tri-variate causal relationships. The cointegration analysis indicated long run relationship among money, income and prices. The causal relationship between money and prices indicated a bi-directional causality that money expansion increases price level and inflation in turn increases the money supply in Pakistan. Mubarik, (2005) estimated the threshold level of inflation for this country using an annual data set from the period between 1973 and 2000. He used the Granger Causality test as an application of the threshold model. The estimated threshold model suggests that an inflation rate beyond 9-percent is detrimental for the economic growth of Pakistan and this in turn, suggests that inflation rate below the estimated level of 9-percent is positive for the economic growth. Furthermore, the sensitivity analysis performed for the robustness of the threshold model also confirms the same level of threshold inflation rate.

Lahiri, (1991) studied the causality between money supply and inflation in Yugoslavia and found that, a bidirectional causal relationship between money supply and inflation. Chuan-Yeh, (2012) investigated the causal relationship between inflation and economic growth using a broad cross-country data from 140 countries over the period 1970-2005. The results indicated that, inflation retards growth, whereas the effect from growth to inflation is beneficial. Moreover, he divided the cross national dataset in to low income, developing, and high income countries, and the results revealed that, the negative impact

of inflation on growth in low income countries is greater than in developing and high income countries. On the other hand, he exploited the difference in effect of growth on inflation in different income level countries. Higher economic growth cannot results in improvement of inflation in high and low income countries. On the contrary, rapid economic growth induces higher inflation in low income sample countries.

In Africa, Chimobi and Uche, (2010) studied the relationship between Output, Money and Inflation in Nigeria by employing Cointegration and Granger-causality test analysis. Their findings revealed non-existence of a cointegrating vector in the series used. Money supply was found granger cause both output and inflation. The result imply that monetary stability can contribute towards price stability in the Nigerian economy since the variation in price level is mainly caused by money supply and also they conclude that inflation in Nigeria is too much extent a monetary phenomenon. Umaru and Abdulrahan, (2012) investigated the impact of inflation on economic growth and development in Nigeria between 1970-2010 through Granger causality test of causation between GDP and inflation. The results of Causality suggest that GDP causes inflation and not inflation causing GDP and it also revealed that inflation possessed a positive impact on economic growth through encouraging productivity and output level and on evolution of total factor productivity. A good performance of a nation in terms of per capita growth may therefore be attributed to the rate of inflation in the country. Salami and Kelikume, (2010) estimated the inflation threshold for Nigeria and found 8 percent over the period 1980-2008, beyond this optimum point inflation becomes unfavorable to growth.

Tabi and Ondo, (2011) analyzed the relationship between economic growth, inflation and money in circulation in Cameroon using a VAR model for the period 1960-2007. They found that increase in money supply increases growth and that growth causes inflation; however, an increase in money supply does not necessarily increase inflation.

In Tanzania Ailkaeli, (2007) studied Money and Inflation Dynamics in Tanzania. He used GARCH model on seasonally adjusted monthly data for the period 1994-2006 and the results of the study shows that, a current change in money supply would have impact on inflation rate significantly in the seventh month ahead. Additionally the effect of money supply on inflation is not a sort of one-time strike on inflation but a kind of persistent

shock. The main policy implication according to this study is that, in order to influence inflation in a certain future month, policy action should be taken seven months before the targeted period. On the other side, if someone wants to evaluate the effectiveness of a monetary policy action taken in any previous month, he has to assess it in the seventh month ahead. Similarly Odhiambo, (2011) analyzed the short-run and long-run causal relationship between Economic growth, investment and inflation in Tanzania using the ARDL-bounds testing approach. The findings of the study indicate unidirectional causal flow from inflation to economic growth without any feedback response.

2.2.2 Empirical Studies on Inflation, Money supply and Economic

Growth in Ethiopia

Literature regarding inflation, money supply and economic growth in Ethiopia is not many. Most of the studies focus on the sources and impacts of the current inflation level in the country. The methodologies of some of the studies are theoretical description and individual argumentations.

Teshome, (2011) studied the source of inflation and economic growth in Ethiopia using statistical analysis. According to him, between the year 2004 and 2008 the higher desires to spend and higher import price with slow growth of aggregate supply contributed to inflation in the country. He states that, inflation in Ethiopia is not a monetary phenomenon, and to him controlling money supply to reduce inflation will hinder growth of the economy. In addition to this, stopping the injection of money to the economy can't stop inflation due to high velocity of money caused by growth of financial institution and economic transaction in the economy. In part II of the study he mentioned that, it is difficult to specify the exact relationship between inflation and growth and one must study the structure of government spending and the nature of economic growth. By comparing the rate of inflation and economic growth of Ethiopia with Sub Saharan Africa (SSA), he explains how inflation affects economic growth over time. Based on the statistical data of the rate of inflation and economic growth from 2004 to 2010, inflation affects economic growth nonlinearly in the country. Between 2004-2006 inflation and economic growth has positive relationship while from 2006-2008 they have negative

relationship. In spite of the variation in the magnitude between 2008 and 2010, he mentioned that inflation and economic growth has positive relationship in Ethiopia.

Desta, (2009) stated that, there was an increase in broad money supply in Ethiopia and bank credit has been increased and the expansion was facilitated by the substantial negative real interest rate and commercial banks excess reserves. From 2002 to 2006, Ethiopia's real GDP increased by 6.8 percent. Rather than adjusting the money stock with the change of GDP, the country's money supply grown by about 18 percent, contributing to an average 12 percent increase in the rate of inflation. He also argues that if a nation achieves full employment, it is possible to assume that economic growth is likely to precipitate an inflationary situation. Since the 10 percent increase in nominal GDP cannot keep pace with a 40 percent inflation rate, the acceleration of economic growth seems to be overstated. For him, it is possible to assert that double digit inflation in Ethiopia is nothing but a clear sign of an unhealthy economy.

Jema and Fekadu, (2012) analyzed determinates of the recent soaring food inflation in Ethiopia and stated that, in Ethiopia food price accounts for the lion's share of the Consumer Price Index. This results in food price inflation necessitating general inflationary pressures in the economy both directly and indirectly. Moreover, food prices increased even faster than non-food items that made it the main contributor to high general inflation. Contrary to the government view, monetary developments also remain important and significant factors in explaining inflation in Ethiopia. Huge and persistent budget deficits, the growth of treasury bills, rapid increase in domestic credit, the move from food aid to cash transfers and other factors contributed for the rapid growth in money supply and put pressure on prices. In addition, world grain price index, lagged world DAP price index, domestic benzene price index, non-food price index, inflation inertia measured by the coefficient on lagged inflation and shocks in the goods market and money market are an important factor in explaining food inflation in the study.

Wolde-Rufael, (2008) investigated the causal link among inflation, money and budget deficits for the period 1964 to 2003 using the bounds test approach to cointegration and a modified version of the Granger causality test. To check the robustness of the bounds test, he also used two additional long run tests: the dynamic ordinary least squares and the

fully modified ordinary least squares (FMOLS). He found that, there was a long run cointegrating relationship among the series with a unidirectional Granger causality running from money supply to inflation and from budget deficits to inflation. He concluded that, the control of the money supply is essential policy tools for the long-run macroeconomic stability of Ethiopia. Fekadu, (2012) analyzed the relationship between inflation and economic growth in Ethiopia for the period 1980-2011. The Vector Autoregression (VAR) model showed that, an increase in economic growth decreases inflation whereas inflation does not have significant effect on economic growth in the short run. The Granger Causality test showed that, economic growth has forecasting power about inflation while inflation does not have predicting power about economic growth. The Cointegration test indicates that, there exist a long run relationship between economic growth and inflation in Ethiopia. Vector error correction estimates indicated that, economic growth significantly reduces inflation in short run while inflation does not have any significant effect on economic growth.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Type and Sources of Data

This study entirely used secondary data sources covering the year ranged from 1970/71 to 2010/11. Data are collected from Ministry of Finance and Economic Development (MoFED) and National Bank of Ethiopia (NBE). The data set includes Real Gross Domestic Product (RGDP), Money Supply (M2 or broad money supply) and Consumer Price Index (CPI).

Consumer Price Index (CPI_t): is the Ethiopian consumer price index and it measures changes in the prices of basket of goods and services that households consume. Such changes have an effect on the real purchasing power of consumers' incomes and their welfare. When the prices of different goods and services vary by different rate, a price index can only reflect their average movement. A price index is usually given a value of unity, or 100, in some reference period and the values of the index for other periods of time are intended to show the average proportionate or percentage change in prices from this price reference period. CPI is expressed in averages of the year in the data.

Money Supply (M2_t): traditionally, money supply is defined from its narrow and broader sense. Narrow money (M1) is a measure of money stock intended primarily for use in transactions. It consists of currency held by the public, traveler's checks, demand deposits and other checkable deposits. Broad money (M2) is a measure of the domestic money supply that includes M1 plus Quasi-money (savings and time deposits), overnight repurchase agreements, and personal balances in money market accounts. Mostly, M2 includes money that can be quickly converted to M1. The NBE takes the broader definition of money or M2 as money supply and in this study also this definition of money is used as money supply.

Real Gross domestic product (RGDP_t): is aggregate measure of the size of an economy adjusted for price changes. Gross domestic product (GDP) is the value of all final goods and services produced in the country for a given period of time. The market value of GDP depends on the actual quantity of goods and service produced, and their price. The

actual quantity of goods produced some times is called the volume. Therefore, RGDP was used to capture the overall economic performance.

3.2 Method of Data Collection

As the study is based on secondary data entirely, the collection of data is not as such as a difficult task unlike the primary data. The secondary data for the real GDP, Money supply and CPI are collected from the concerned institutions such as Ministry of Finance and Economic Development (MoFED) and National Bank of Ethiopia (NBE).

3.3 Model Specification

The quantity theory of money (QTM) relates a direct and proportional relationship between money supply and price level. The modern versions this theory is often associated with Irving Fisher, (1911), it measures expenditures in two different ways and arise with these two identities (Alimi, 2010):

$$Y = MV \text{ ----- (3.1)}$$

$$Y = py \text{ ----- (3.2)}$$

$$\text{Hence } MV = py \text{ ----- (3.3)}$$

Where: y = real output (of commodities)

P = price level (i.e. the average price of commodities)

Y = nominal value of output (= nominal output)

M = money supply

V = velocity of circulation of money (M) against output (y) over the designated period.

Fisher recognized equation (3.3) as an identity and he forward assumptions to transform the quantity of equation to the theory of prices determination. The two assumptions about economic behaviour are: i) there is no clearly identified relationship between the quantity of money in circulation and the velocities of circulation of money as well as deposits. Rather the velocity of circulation of money and deposits depend on technical conditions such as countries individual rates of turnover which depend also on individual

habits, density of population, commercial customs, rapidity of transport, and other technical conditions, but not on the quantity of money and deposits, nor on the price level. ii) Like the velocity of circulation of money, the amount of trade is independent of the quantity of money (Ibid).

The quantity theory of equation (QTM) can be rewritten in terms of percentage rate of change (in terms of growth rates):

$$m_t + v_t = p_t + y_t \text{ ----- (3.4)}$$

Where p is the logarithm of the price level, y is logarithm of real output, m is the logarithm of money supply, and v is the logarithm of the velocity of money.

Assuming the velocity of money is constant; the inflation equation can be specified by taking three variables in to account: consumer price index (CPI), Money supply (M2) and real GDP. Many works treat real output and the quantity of money (and their growth rates) as exogenous variables (see for example Alimi, (2010)). If the monetarist theory of inflation is true, the following relationship holds in the long run.

$$LCPI_t = \alpha + \beta_1 LM2_t + \beta_2 LRGDP_t + \varepsilon_t \quad \beta_1 = 1 \quad \beta_2 = -1 \text{ ----- (3.5)}$$

Where α is the constant term, β_i 's are the coefficients of the respected variables to be estimated, LCPI is logarithm of consumer price index, LM2 is logarithm of money supply, LRGDP is logarithm of real GDP and t is the time period. The residual ε_t is assumed to be white noise.

3.4 Method of Data Analysis

For discussing and analyzing different issues in the study both descriptive as well as econometric methods are utilized. The descriptive techniques are used to indicate the trending attributes of the series CPI, money supply, and RGDP used in the study. In the econometrics part Granger causality test in vector error correction model (VECM) framework are used to analyze the causal relationship between inflation and money supply and between inflation and economic growth. The Vector Autoregression model (VAR) model is used for the purpose of determining optimal lag length. Therefore, the analysis is performed in four steps: First, stationarity test; second, the lag length

selection; third, the cointegration test; fourth, the Granger causality test. The data are processed by using E-views 6.0 and PcGive 10 software packages.

The consumer price index (CPI) used as a proxy for inflation rate (INF), broad money (M2) used as a proxy for money supply and Real Gross Domestic Product (RGDP) used as a proxy for Economic growth. The three variables are transformed to logarithmic form to obtain LCPI, LM2 and LRGDP respectively over the period 1970/71-2010/11. Transforming data to logarithmic form have advantage of smoothing data distribution to some extent and makes data to have better goodness of fit for non-linearity. The most important is taking the difference of variables can obtain their respective change rate (Xiao, 2009). The above proxy for inflation, money supply and economic growth were used in the study of Alimi, (2010) and many others to determine the relationship between Inflation, Money supply and Economic growth.

3.4.1 Stationarity Test

In econometrics study when time series data are used the first step is to determine the order of integration each of the time series data used. A time series variable is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed otherwise, the time series variable is said to be non stationary. Making analysis with a combination of non stationary variables may result in spurious correlation (Gujarati, 2004). Therefore, to check for the existence of stationarity property in the time series data of consumer price index, money supply and real GDP, Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) methods of testing stationarity are employed.

a. Augmented Dickey Fuller (ADF) Test

The Augmented Dickey fuller test is performed to identify whether a data series is stationary or not. To allow for various possibilities, the ADF test is estimated in three different forms; which is primarily concerned with the estimates of δ .

$$\Delta Y_t = \delta y_{t-1} + \sum_{i=1}^k (\theta_i \Delta y_{t-i}) + u_t \quad \text{----- (3.6)}$$

$$\Delta Y_t = \alpha + \delta y_{t-1} + \sum_{i=1}^k (\theta_i \Delta y_{t-i}) + u_t \quad \text{----- (3.7)}$$

$$\Delta Y_t = \alpha + \text{BT} + \delta y_{t-1} + \sum_{i=1}^k (\theta_i \Delta y_{t-i}) + u_t \quad \text{----- (3.8)}$$

Where, α is a constant (drift), T is a trend, K is the lag length which is added to the model to ensure that the residual, $\mu_t \sim \text{IID}(0, \sigma^2)$ ³. The optimal lag length of K is selected by using the Akaike Information Criterion (AIC).

The hypotheses of this test will be:

H₀: $\delta = 0$, i.e., there is a unit root – the time series is non-stationary.

H₁: $\delta < 0$, i.e., there is no unit root – the time series is stationary.

If the computed absolute value of the tau statistic ($|\tau|$) exceeds the ADF critical tau values, we reject the hypothesis that $\delta = 0$, in which case the time series is stationary. On the other hand, if the computed tau statistic ($|\tau|$) is less than the critical tau value, we do not reject the null hypothesis, in which case the time series is non-stationary (Gujarati, 2004).

b. Phillips and Perron Test

The Phillips and Perron (PP) unit root tests differ from the ADF test mainly in how they deal with serial correlation and heteroscedasticity in the errors. In particular, where the ADF tests use a parametric autoregression to approximate the ARMA structure of the errors in the test regression, the PP test ignore any serial correlation in the test regression (Phillip and Perron, 1988). The test for the PP test is:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + u_t \quad \text{----- 3.9}$$

Where u_t is I(0) and may be heteroscedastic. The PP tests correct for any serial correlation and heteroscedasticity in the errors u of the test regression by directly modifying the test statistics $t_\pi = 0$. This modified statistics, denoted Z_t , is given by:

³This means that the errors are identically and independently distributed with a mean of zero and a constant variance.

$$Z_t = \left(\frac{\sigma^{\wedge 2}}{\lambda^{\wedge 2}}\right)^{1/2} \cdot t_{\pi} = 0 - \frac{1}{2} \left(\frac{\lambda^{\wedge 2} - \sigma^{\wedge 2}}{\lambda^{\wedge 2}}\right) \cdot \left(\frac{T \cdot SE(\pi^{\wedge})}{\sigma^{\wedge 2}}\right) \text{-----} 3.10$$

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

$$\sigma^2 = \lim_{T \rightarrow \infty} T^{-1} \sum_{t=1}^T E(u_t^2) \text{-----} 3.11$$

$$\lambda^2 = \lim_{T \rightarrow \infty} \sum_{t=1}^T E(T^{-1} S_t^2) \text{-----} 3.12$$

Where $S_t = \sum_{t=s}^T u_t$. The sample variance of the least square residual u_t^{\wedge} is a consistent estimate of σ^2 , and the Newey – West long run estimates of u_t using u_t^{\wedge} is a consistent estimate of λ^2 .

Under the null hypothesis that $\pi = 0$, the PP Z_t statistic has the same parametric distribution as the ADF t – statistic. One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroscedasticity in the error term u_t . Another advantage is that users do not have to specify a lag length for the test regression (Ibid).

3.4.2 Lag length Selection

Before estimating the Granger Causality test and the models, the first task is to decide on the maximum lag length. As Hall, (1991) pointed out that the choice of lag length is vital because too few lags may lead to serial correlation problem, whereas too many lags will consume more degree of freedoms and thus small sample problem. In this study, the VAR model is estimated at level by using different lag length selection criteria such as Sequential Modified Likelihood Ratio (LR), the Final Prediction Error (FPE), Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). If the results of these criteria are agreed the selection is clear. However, if conflicting results were found from the above criteria, the AIC is used to determine the optimal lag length. The AIC is selected because AIC performed better than any other information criterions (e.g. SC and HQ) when the estimated sample size is relatively small (e.g. less than 60 observations) (Liew, 2004; and Lutkepohl, 2005).

3.4.3 Cointegration Test

One possible means of avoiding spurious regression is the application of cointegration techniques which allow the estimation of non spurious regressions with non-stationary data. The economic interpretation of cointegration is that if two (or more) series are linked to form an equilibrium relationship spanning the long-run, then even though the series themselves may contain stochastic trends (i.e., non-stationary) they will nevertheless move closely together overtime and the difference between them will be stable (i.e. stationary) (Enders,1995). Therefore, it is important to view cointegration as a technique to estimate the equilibrium or long-run parameters in a relationship with unit root variables.

There are several types' of cointegration tests; but the two commonly used are Engle-Granger cointegration test and the Johansen-Juselius cointegration test. But the Johansen's approach is more superior to the Engle-Granger approach. According to Harris (1995), the Engle-Granger procedure has a number of drawbacks. These are: the test for cointegration is likely to have lower power against the alternative tests; its finite estimates of long-run relationship are potentially biased; inferences cannot be drawn using standard t-statistics about the significance of the parameters of the long run model; and the test procedure assumes that there is only one cointegration vector, when in fact there could be more, that is any linear combination of these vectors is obtained when estimating a single equation. The Johansen approach takes for the above weakness and therefore, in this study the Johansen cointegration procedure is employed to examine the long term relationship between inflation, money supply and economic growth in Ethiopia.

Johansen's cointegration methodology takes its starting point in the vector auto regression (VAR) of order P given by:

$$\Delta y_t = \mu + \pi y_{t-1} + \sum_{i=0}^{p-1} \Gamma \Delta y_{t-1} + \varepsilon_t \text{-----} (3.13)$$

Where: y_t is an $n \times 1$ vector of variables that are integrated of order one and ε_t is an $n \times 1$ vector of innovations. If the coefficient matrix π has reduced rank $r < n$, then there exist $n \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta'y_t$ is stationary. r is the

number of cointegrating relationships and each column of β is a cointegrating vector. Johansen proposes two different likelihood ratio tests of the reduced rank of the Π matrix: the trace test and maximum eigen value test, given below:

$$J \text{ trace } (r) = - T \sum_{i=r+1}^n \ln (1 - \lambda_i) \text{-----} (3.14)$$

$$J \text{ max } (r, r + 1) = -T \ln (1 - \lambda_{r+1}) \text{-----} (3.15)$$

Where T is the number of usable observations and λ_i is the largest estimated value of i^{th} characteristic root (eigen value) obtained from the estimated coefficient matrix. The trace statistic tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors where n is the number of endogenous variables, for $r=0,1,2,\dots, n-1$. The maximum eigen value test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of r + 1 cointegrating vectors. Neither of these test statistics follows a chi-square distribution in general; asymptotic critical values are given by Johansen and Juselius (1990) and by most econometric software packages (Hjalmarsson and Osterholm, 2007).

3.4.4 Granger Causality Test

Cointegration implies that causality exists between the series but it does not indicate the direction of the causal relationship (Granger, 1986). Therefore in this study for analyzing the causality between inflation and money supply and between inflation and economic growth in Ethiopia granger causality test is used. The Granger causality test assumes that the information relevant to the prediction of the variable is contained solely in the time series data on those variables (Gujarati, 2004). This test formulated the null and alternative hypotheses in the VECM framework as follows:

H₀: There is no Granger Causality between inflation and money supply.

H₁: There is Granger Causality between inflation and money supply.

H₀: There is no Granger Causality between inflation and economic growth.

H₁: There is Granger Causality between inflation and economic growth.

3.4.5 VAR and VEC Models

In economic variables facing the problems of endogeneity among the dependent and independent variables is common. This can occur when there are a two way influences between the independent and dependent variables. A VAR approach can address this endogeneity problem by allowing the data to be modeled in unrestricted reduced form, in which all variables are considered as endogenous (Papanicolas and McGuire, 2011).

A reduced form VAR explains each variable as a linear function of its own past values, the past values of all other variables being considered, and a serially uncorrelated error term. It is a set of k time series regression in which the regressors are lagged values of all k series. When the number of lags in each of the equations is the same and is equal to p, the system of the equation is called a VAR (p).

A tri-variate VAR model with three time series variables consists of three equations which are given as:

$$LCPI_t = \alpha_{11} + \sum_{i=1}^{\rho} \beta_{1i} LCPI_{t-i} + \sum_{i=1}^{\rho} \delta_{1i} LM2_{t-i} + \sum_{i=1}^{\rho} \gamma_{1i} LRGDP_{t-i} + \varepsilon_{1t} \quad (3.16)$$

$$LM2_t = \alpha_{21} + \sum_{i=1}^{\rho} \beta_{2i} LCPI_{t-i} + \sum_{i=1}^{\rho} \delta_{2i} LM2_{t-i} + \sum_{i=1}^{\rho} \gamma_{2i} LRGDP_{t-i} + \varepsilon_{2t} \quad (3.17)$$

$$LRGDP_t = \alpha_{31} + \sum_{i=1}^{\rho} \beta_{3i} LCPI_{t-i} + \sum_{i=1}^{\rho} \delta_{3i} LM2_{t-i} + \sum_{i=1}^{\rho} \gamma_{3i} LRGDP_{t-i} + \varepsilon_{3t} \quad (3.18)$$

Where LCPI is log of consumer price index; LM2 is log of money supply; LRGDP is log of real GDP, β 's, δ 's and γ 's are unknown coefficients, p is the lag length, t is the time period and ε_{1t} , ε_{2i} , and ε_{3i} are error terms with zero mean and constant variance.

After estimating this system of equations (3.16) to (3.18), we should test whether one of the lagged endogenous variables has effect on the other endogenous variable. For this purpose, the standard F-test is used under the assumption of variable stationarity. In testing $LM2_t$ has an effect on $LCPI_t$, the null hypothesis $H_0: \delta_{1i} = 0$ and alternative hypothesis H_a : one of δ'_{1i} 's is different from zero, where $i = 1, 2, \dots, \rho$. Similarly to test if $LRGDP_t$ has effect on $LCPI_t$, the null hypothesis is $H_0: \gamma_{1i} = 0$ and alternative hypothesis H_a : one of γ_{1i} 's is different from zero, where $i = 1, 2, \dots, \rho$. If the null hypothesis is rejected, in both case one can conclude that $LM2_t$ and $LRGDP_t$ have effects on $LCPI_t$.

Also the hypotheses are specified in this way in testing the significance of the explanatory variables in equations of $LM2_t$ and $LRGDP_t$.

If the variables included in the VAR are cointegrated and proved to have a long run relationship one needs to estimate a vector error correction model (VECM) including the error correction term to analyze the dynamic behavior of the model. Once the equilibrium conditions are imposed, the VECM describes how the examined model is adjusting in each time period towards its long run equilibrium state (Mishra, *et al.*, 2010). As the variables are supposed to be cointegrated, then in the short run, divergences from this long run equilibrium will react on the changes in the dependent variables in order to force their movements towards the long run equilibrium state. Therefore, the cointegrated vectors from which the error correction term is derivative are each indicating an independent direction where a stable meaningful long run equilibrium state exists. The VECM has cointegration relations built in to the specification so that it restricts the long run behaviour of the endogenous variables to converge to their cointegrating relationship while allowing for short run adjustment dynamics (Ibid).

In this study the tri-variate vector error correction model (VECM) is specified as:

$$\Delta LCPI_t = \alpha_{11} + \sum_{i=1}^{\rho} \beta_{1i} \Delta LCPI_{t-i} + \sum_{i=1}^{\rho} \delta_{1i} \Delta LM2_{t-i} + \sum_{i=1}^{\rho} \gamma_{1i} \Delta LRGDP_{t-i} + \Omega_{11} ECT_{t-1} + \varepsilon_{1i} \text{-----} \quad (3.19)$$

$$\Delta LM2_t = \alpha_{21} + \sum_{i=1}^{\rho} \beta_{2i} \Delta LCPI_{t-i} + \sum_{i=1}^{\rho} \delta_{2i} \Delta LM2_{t-i} + \sum_{i=1}^{\rho} \gamma_{2i} \Delta LRGDP_{t-i} + \Omega_{21} ECT_{t-1} + \varepsilon_{2i} \text{-----} \quad (3.20)$$

$$\Delta LRGDP_t = \alpha_{31} + \sum_{i=1}^{\rho} \beta_{3i} \Delta LCPI_{t-i} + \sum_{i=1}^{\rho} \delta_{3i} \Delta LM2_{t-i} + \sum_{i=1}^{\rho} \gamma_{3i} \Delta LRGDP_{t-i} + \Omega_{31} ECT_{t-1} + \varepsilon_{3i} \text{-----} \quad (3.21)$$

Where the variables are already defined, Δ denotes the difference operator, ECT_{t-1} is one period lagged error correction term and ε_{1i} , ε_{2i} , and ε_{3i} are error terms with zero mean and constant variance. In this specification, the coefficients of ($\Delta LCPI_{t-i}$, $\Delta LM2_{t-i}$, and $\Delta LRGDP_{t-i}$) appear as explanatory variables and the parameters of the ECT_{t-1} (Ω_{11} , Ω_{21} and Ω_{31}) represent the speed of adjustment in case of deviations from the long run equilibrium relationship. Long run uni-directional causal relationship from money supply and economic growth to inflation exist if $\Omega_{11} \neq 0$ while $\Omega_{21} = \Omega_{31} = 0$. Bi-

directional long run causality among inflation, money supply and economic growth will exist if $\Omega_{11} = \Omega_{21} = \Omega_{31} \neq 0$. In the short run, Granger causal relationship exist if either parameter estimates of the lagged variables in the estimated equations are statistically significant at the conventional test level. From equation 3.19, $\delta_{1i} \neq 0$ and $\gamma_{1i} \neq 0$ implies that uni-directional causality from money supply and economic growth to inflation. Similarly, $\beta_{2i} \neq 0$ in equation 3.20 and $\beta_{3i} \neq 0$ in equation 3.21 can be interpreted in the same way with regard to short run causality between inflation and money supply and between inflation and economic growth respectively. If $\delta_{1i} = \beta_{2i} \neq 0$ indicates short run bi-directional causality between inflation and money supply and $\gamma_{1i} = \beta_{3i} \neq 0$ implies bi-directional causality between inflation and economic growth.

3.4.5.1 Impulse Response Function

Impulse responses indicates the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. Generally, an impulse response shows the effect of an exogenous shock on the whole process over time (Fuss, 2007).

According to Chen and Patel, (1998) in dynamic analysis of VAR model is routinely carried out using the "orthogonalized" impulse responses, where the underlying shocks to the VAR model are orthogonalized using the Cholesky decomposition method. This method assumes the system is recursive and the estimations of impulse response function are orthogonalized so that the covariance matrix of the resulting innovations is lower triangular (Chen and Patel, 1998). Therefore, the Choleski decomposition method is criticised as an arbitrary method in attributing a common effect and changing the order of the equation may dramatically change the impulses. An alternative approach to Choleski decomposition method is, the generalised impulse response analysis, which is invariant to the ordering of the variables in the VAR. In contrast to the Choleski decomposition method, the generalised impulse response functions are unique (Pesaran and Shin, 1998).

CHAPTER FOUR

ECONOMIC GROWTH, INFLATION AND MONEY SUPPLY IN ETHIOPIA

Ethiopia is one of the poorest countries which have been experiencing a slow economic growth for the last several decades. In different world reports, it is located in the lowest range on per capita basis (Befekadu and Birhanu, 2000). For example, the per capita income of the nation was USD 370 which was low as compared to the average per capita of the whole SSA (WB, 2012).

The economy is predominantly dependent on agriculture whose performance depends on the unpredictable weather. Apart from its dependency on agricultural output the external performance of a country is dominated on few products like coffee, skin, hides and chat. In addition to this, frequent drought and famine together with poor policies and civil wars have made it impossible to bring about structural change in the economy. On this basis, this chapter discusses the trend analysis of economic growth, inflation and money supply in Ethiopia from 1970/71-2010/11. Even though, it is difficult to make conclusive deduction from simple trend analyses; descriptive trend line may help to show the overtime relationship of the variables.

4.1 Trends of Economic Growth and its Sectoral Contribution

Over the past five decades, the Ethiopian economy has been growing at an average annual rate of 4.2 percent while the population has been growing at annual rate of 2.6 percent. [See Table 4.1]

During the imperial era (1960/61-1974/75), the macroeconomic policy in Ethiopia was largely dominated by a market-oriented economic system. Between these years the average GDP growth rate was 4 percent and the average population and per capita growth was 2.3 percent and 1.7 percent per annum respectively. In these years, the value added contribution of agriculture was growing by 1.9 percent, industry, distribution and other services were expanding by more than 6.8 percent.

The period 1974/75–1990/91 witnessed a command economic system, where the state played a key role in all areas of economic activity. During this period, the economic performance of the country was poor and the economic growth slow down to 1.7 percent. While the population and per capita growth were 2.9 percent and -1.1 percent respectively and this implies that the economic growth was not enough even to keep the per capita income constant with the population growth. Due to the civil war, conflict with Somalia and drought that was existed in this period, the county had registered a negative growth rate of per capita GDP.

Table 4.1 Economic Growth Rate and its Sectoral Components (1960/61-2010/11)

Period	Growth rate of		Growth rates of value added in the Various sectors				
	RGDP	Population	PCGDP	Agriculture	Industry	Distributive service	Other service
1960/61 - 1973/74	4.0	2.3	1.7	1.9	6.8	8.1	7.3
1974/75 - 1990/91	1.7	2.9	-1.1	1.2	1.5	1.7	4.0
1991/92 - 2010/11	7.0	2.6	4.4	4.9	8.7	8.6	7.3
1960/61 - 2010/11	4.2	2.6	1.7	2.7	5.7	6.1	6.2

Source: Computed based on MoFED Data (2010/11)

The post-Derg period moved the country back to the market-oriented system and starting from 1991/92 the government of Ethiopia has introduced a variety of reforms aimed at improving macroeconomic stability, accelerating economic growth, and reducing poverty. Tariffs have been cut, quota constraints relaxed, licensing procedures eased, foreign exchange controls relaxed, compulsory grain delivery and forced membership to cooperatives discontinued, a privatization process begun, private banks authorized,

interest rates decontrolled, and an inter-bank money and foreign exchange market introduced (Alemayehu and Tadele, 2004).

In this period the Ethiopian economy showed relatively good performance. The annual average growth rate of the economy and per capita income was 7 percent and 4.4 percent respectively. The annual average growth rate of each sector was above the average growth rate of the past two regimes (i.e. the agricultural sector average growth rate was 4.1 percent and the industry and distributive and others service sectors was growing on average by more than 7.3 percent). In fact this makes the country one of the fast growing economies of sub-Saharan Africa. If there had not been frequent drought, the Eritrean aggression of 1998 and adverse terms of trade, the average annual growth rate of GDP would have been expected to be higher. However, the domestic absorption was significantly higher than GDP, having a share of 115.4 percent out of GDP on the average between 1997/98 and 2010/11. This is because, in our case, excess demand was a prevalent feature of the economy throughout the period under consideration (NBE, 2011).

Since 2003/04, the economy has been growing at higher growth rate and this growth has been sustained to the current period. The Real GDP growth averaged 11.4 percent per annum during the 2003/04 and 2010/11 period. This growth performance is more than the population growth rate and initially lead by agriculture the growth base is broadening with growing contribution from industry and service sector. In terms of the structure of the economy, the contribution of agriculture to overall GDP was 47 percent in 2003/04 and declined gradually to 41.2 percent in 2010/11. Though agricultural production has increased considerably, because of favorable weather conditions and enhanced support by Government (e.g., improved supply of fertilizer) the agriculture sector productivity remains low. The expansion in agricultural production has been driven by increases in the area of land cultivated, rather than major improvements in productivity. Given the present technological conditions and the structure of production, pushing the production frontier outward is difficult due to the already existing pressures on the land (ADB, 2010).

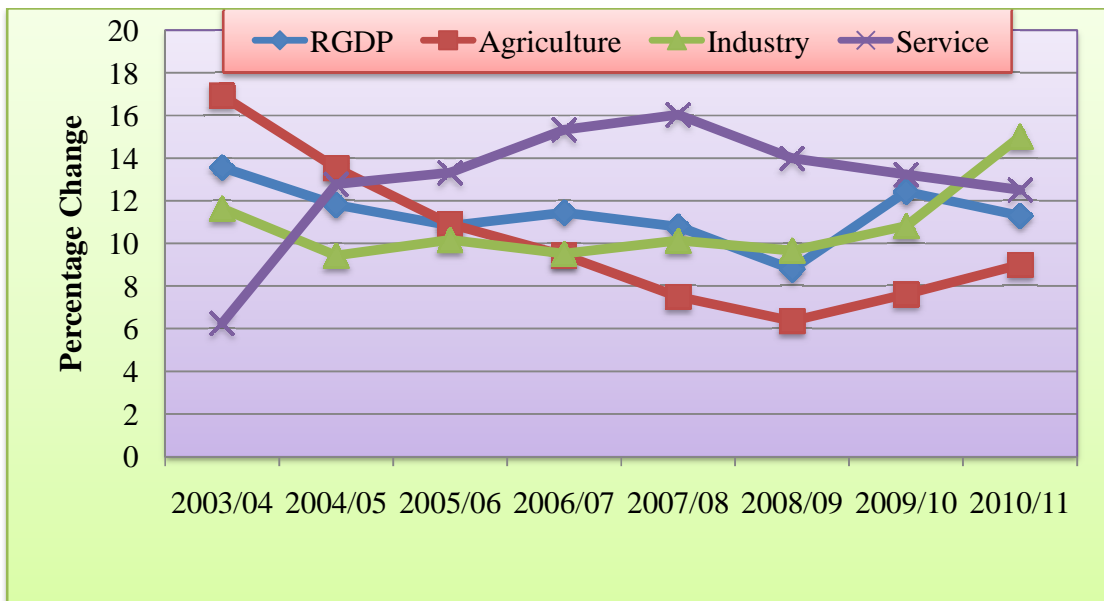
Table 4.2 Economic Growth Rate and its Components in Percent (2003/04-2010/11)

	2003/ 04	2004/ 05	2005/ 06	2006/ 07	2007/ 08	2008/ 09	2009/ 10	2010/ 11	Average
Real GDP growth rates									
Sector	11.7	12.6	11.5	11.8	11.2	10.0	10.6	11.4	11.4
Agriculture	16.9	13.5	10.9	9.4	7.5	6.4	7.6	9	10.2
Industry	11.6	9.4	10.2	9.5	10.0	9.9	10.8	15	10.8
Service	6.3	12.8	13.3	15.3	16.0	14.0	13.2	12.5	12.9
Sectoral share in %									
Agriculture	47.0	47.4	47.1	46.1	44.6	43.2	42.0	41.1	44.8
Industry	14.0	13.6	13.4	13.2	13.0	13.0	13.0	13.4	13.3
Service	39.7	39.7	40.4	41.7	43.1	45.1	46.1	46.6	42.9

Source: MoFED, (2010/11)

The major challenges that the agriculture sector continues to face are; it is extremely vulnerable to weather shocks due to dependency on rainfall, weak marketing infrastructure, limited use of improved farming practices, and rising cost of key agricultural inputs. Due to high population growth rates and the corresponding decline in farm size, there has been a general decline in per capita food production. However, considering that less than 15 percent of the arable land is cultivated and productivity is still among the lowest in sub-Saharan Africa, the potential for growth in agriculture is huge (ADB, 2012).

Figure 4.1 Economic Growth Rate and its components in percent (2003/04-2010/11)



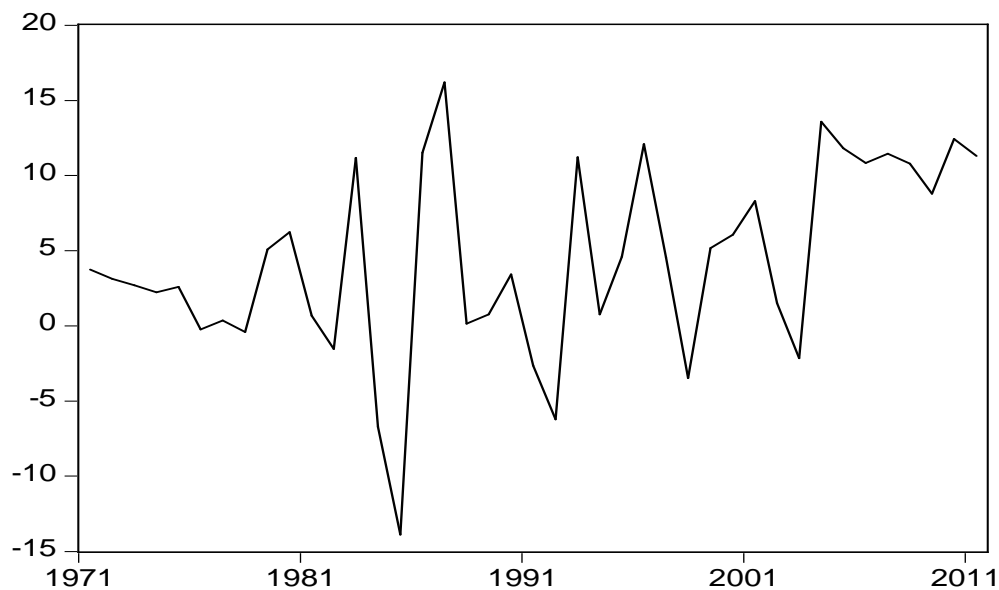
Source: Computed based on MoFED Data (2010/11)

The contribution of the service sector to the country’s GDP has been increasing continuously and becoming a significant source of growth. This remarkable growth in services was driven by the rapid expansion in public administration, financial intermediation, and retail business activities. These services sectors grew by more than 12 percent on average between 2003/04-2010/11 and become the dominate sector of the economy with its share increasing from 39.7 percent in 2003/04 to 46.6 percent in 2010/11. The sector is also emerging as a source for exports through tourism and air transport activities. It is expected to continue to grow rapidly, though at a slower rate than in previous years.

Although Ethiopia’s industrial base is still relatively small, the share of the sector showed no significant change, recording on average 13.3 percent of the total value added during 2003/04-2010/11. The improvement of industrial sector performance in 2010/11 was driven by gradual expansion of mining and manufacturing subsectors. This momentum is expected to continue given the priority accorded to industrialization, both for exports and import substitution, in the government’s plan and new industries are coming on stream and new projects are planned in other areas such as chemicals, pharmaceuticals and steel.

The overall growth prospects of Ethiopia are good, with public investment in infrastructure, transformation of agriculture and non-traditional exports are expected to continue driving growth. Despite its rapid growth, Ethiopia has continued to face very serious structural challenges; among them persistently low levels of foreign reserves, the recent high inflation trend, and recurrence of drought (UNFPA, 2011).

Figure 4.2 Trends in Economic Growth of Ethiopia (1970/71-2010/11)



Source: Computed based on MoFED data (2010/11)

As it is observed from the above figure, the rate of change of the economy declined sharply several times. For instance, in 1977/78 and 1982/83 due to the war with Somalia and sharp reduction in industrial sector, GDP was declined by -0.4 percent and -1.5 percent respectively. A devastating drought which claims the life of many Ethiopian and created the current image of the country in the world was happened in 1983/84 and 1984/85 and GDP was decelerated by 7 percent and 14 percent respectively. The other Significant contraction in GDP was observed in 1990/91 and 1991/92 when the country was in political transition from Derg to EPRDF. A gain the last two significant reductions in GDP were in 1997/98 and 2002/03 during Ethio–Eritrean war and the drought which has been occurred due to the absence of rain fall in the country.

4.2 Sources of the Recent Economic Growth in Ethiopia

In addition to favorable weather condition for agriculture since 2003/04, Ethiopia's recent growth performance has been associated with a number of deriving factors. The major factors behind the recent surge in growth rate are:

Investment in Major Infrastructures

In recent years, the government has implemented a broad growth and poverty reduction strategy, targeting on infrastructure development, improvements in access to basic services, commercialization of agriculture, as well as on private sector development, including the creation of suitable regulatory and institutional frameworks to support private business. Specifically, the huge public investment in infrastructure development has been important factor in driving growth (ADB, 2010). In the past five years, the government and public enterprises have invested billions of Dollars in roads, energy sector and telecommunication. In 2006/07 government capital expenditure was 18.3 billion birr and within five year increased about three fold and reached 53.2 billion birr in 2010/11. These intensive investments have led to development in infrastructure from a low base. For instance, the power generation capacity has been increased nearly doubled and reached 2000 MW in 2010/11 and; also the paved road network increased three fold (MoFED, 2010/11). In general, the huge public investment in infrastructure and social services has created a major expansion in domestic demand, raising overall growth (ADB, 2010). However, these huge public investments have increased the domestic money supply and become the main explaining factor behind the recent inflation in the country.

Expansion of Exports and Remittances

The country's exports have also been growing strongly, averaging about 21.73 percent per annum since 2003/04. Coffee is the largest source of merchandize export earnings and other non-traditional exports have registered faster growth. In the later case, the growing demand by China and India for Ethiopia's non-traditional exports, such as sesame and other oilseeds, has contributed to the country's product and export growth. In fact, the continued rapid expansion of both these economies is likely to sustain the growth in Ethiopia's exports in the medium term. Similarly, remittances and FDI have

also been growing at an impressive rate. Remittances by Ethiopians living abroad to relatives and investment in Ethiopia have also played a significant role. The remittance has grown from 9.22 million U.S dollar in 1997 to 513.24 million U.S dollars in 2011 (WB, 2012). Imports have been growing by about 18.3 percent on average since 2003/04 (ADB, 2010).

Increased Tax Collection and Aid

Government revenue has been increased by 22.8 percent on average between 2003/04-2010/11. Tax revenue reached about 59 billion Birr in 2010/11 from about birr 10.5 billion in 2003/04; which makes tax revenue 13.5 percent of GDP in 2010/11 (MoFED, 2011). Net Official Development Assistance (ODA) has increased in recent years, reaching USD 3.5 billion in 2010 from USD 1.5 billion in 1990 (WB, 2012). This surge in foreign aid, along with improved domestic revenue mobilization, has enabled the government to increase expenditure on infrastructure, thereby stimulating growth (ADB, 2010).

4.3 Trends of Inflation in Ethiopia

Historically, Ethiopia has not suffered from high inflation and the economy was known for long for its low inflation and rise in prices were associated mainly with the fall in agricultural output and years of higher production were known to witness falling prices. For instance, between the periods 1981-1985, real GDP decreased by about 2.43 percent on average and the general prices experienced a growth rate of 5.82 percent on average. On the other hand average rate of inflation declined to 2.8 percent between 1986 and 1990 because of real output recorded a growth rate of 6.04 percent over same period. In the following years, inflation rate climbed to double digit level led by food price inflation. In this five years average rate of inflation was 13.25 percent (mainly due to 15 percent average rate of food price inflation) and average growth rate of RGDP was slow down to 1.36 percent. The second half of the 1990s has witnessed stable prices with average general inflation level of 1.61 percent. Here it is important to note that, the real GDP growth rate over the same period was 4.66 percent which is indicative of the co-movement between the output growth and inflation [see table 4.3 below].

Table 4.3 Annual Average Growth Rate of Inflation and RGDP (1970/71-2010/11)

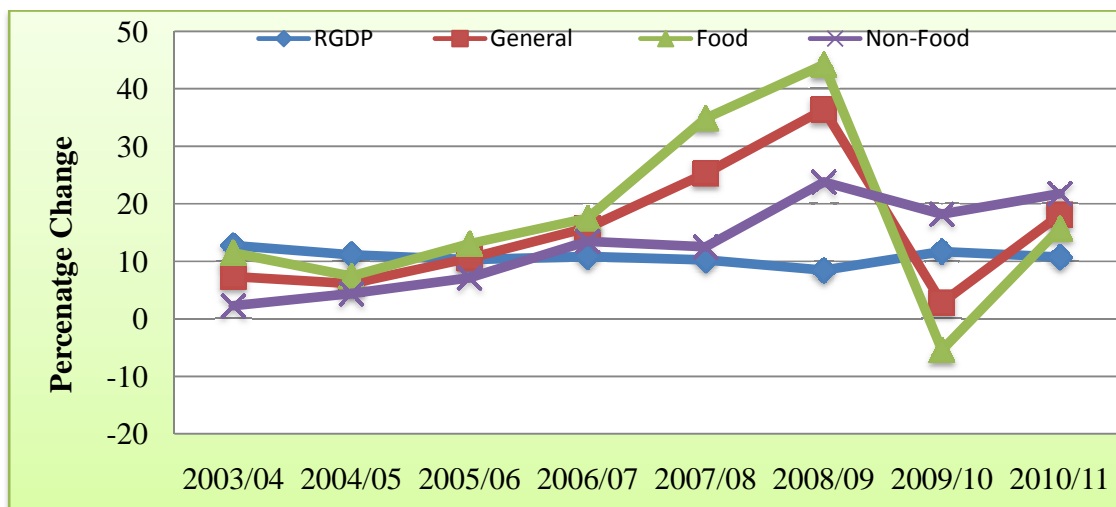
Average rate of Inflation and RGDP				
Year	General	Food	Non-Food	RGDP
1970/71– 1974/75	2.95	2.21	4.29	2.84
1975/76– 1979/80	16.96	20.42	11.0	2.15
1980/81– 1984/85	5.82	7.21	3.33	-2.43
1985/86– 1989/90	2.79	1.28	6.25	6.04
1990/91– 1994/95	13.25	15.0	9.35	1.36
1995/96– 1999/2000	1.61	2.56	0.93	4.66
2000/01– 2004/05	2.7	3.91	1.61	6.24
2005/06– 2010/11	18.2	20.0	16.16	10.37

Source: Computed based on NBE and MoFED data (2010/11)

In recent years however, the systematic trends of inflation and economic growth has been changed. High inflation rate lead by the food price inflation has been occurred despite double digit output growth. From 2003/04-2010/11 onwards, output on average grew by 10.8 percent per annum while during the same period; prices have grown by 15.3 percent per annum. Regardless of the relatively good weather conditions and better harvest in 2004/05, prices have been increased by 6.1 percent on average. The inflation level continuous to increase in the year 2005/06 and reached to 10.16 percent. This level of inflation is not a record high in Ethiopian history, such rate is puzzling given the double digit economic growth claimed by official reports and the rate was lead by the food price inflation. On the following years, the inflation rate increased further and reached to about

16 percent and 25.5 percent in 2006/07 and 2007/08 respectively, again in the midst of double digit economic growth. During the same period food price inflation was 17.5 percent and 35 percent respectively. Despite, several measures taken by government the rate kept on increasing mood to reach average growth rate of 36.4 percent in 2008/09 (NBE, 2010 and MoFED, 2011/12). In 2008, for instance government moved to the extent of importing food items and providing petroleum products at subsidized price considering the claim that imported inflation is the dominant determinant of domestic inflation. After a short relief in 2009/10, the rate resumed its previous double digit level in 2010/11. This time the government claimed that the domestic monopolistic market behavior in the market for several commodities was the leading cause of the inflationary pressure in Ethiopia. This required the government to place price limit on several domestically produced and imported commodities as a mechanism to curb inflation. However, shortly afterwards it proved that the measure was not working when the intervention in the market created supply shortage of these commodities.

Figure 4.3 Annual Inflation Rate and RGDP Growth (2003/04-2010/11)



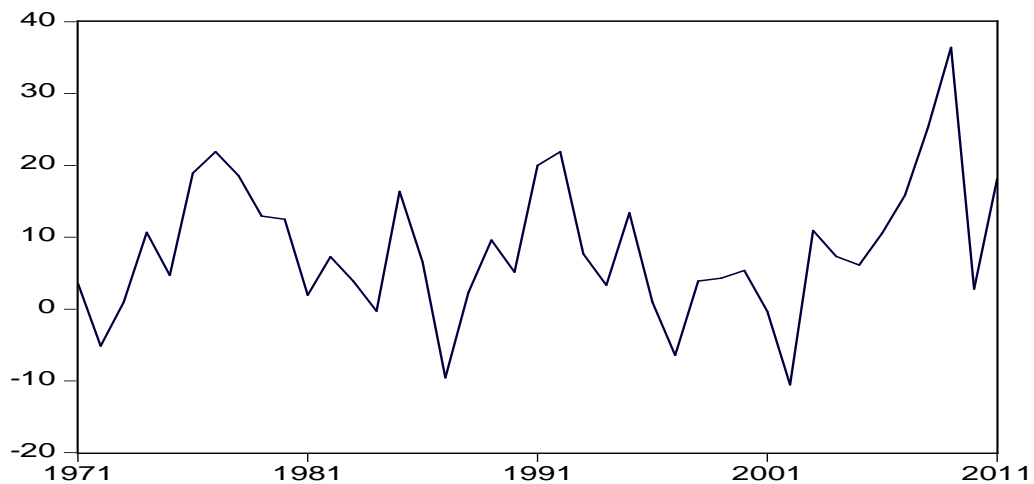
Source: Computed based on NBE and MoFED data (2010/11)

In general, from the above discussion one can notice the following points. First, periods before the year 2002/03 are relatively periods of low inflation with average annual inflation rate of 6.4 percent between 1970/71-2001/02. Since the inflation rate started to rise in 2002/03 the periods between the years 2002/03-2010/11 witnessed higher inflation

rates reaching annual average of 15 percent. Second, agricultural sector which constitutes a lion's share in GDP and is the main supplier of the food needs of the economy, prices in most of the cases, move at odds with agricultural production, with low production always accompanied by relatively higher inflation rate. Third, close observation of the data reveals that food prices increased relatively faster than the non-food prices in most of the years under consideration except in the second half of the 1980s. This coupled with the relatively higher share of food item in the CPI made the food prices the main contributor to the general inflation.

The above discussion, however, doesn't undermine the fact that several other factors had contributed to the soaring inflation pressures in Ethiopia. Specifically, the trends in fiscal deficit, international oil and food prices, increase in money supply growth and other factors of inflation also affects the path that inflation rate takes over short to long run periods (ADB, 2011; Jema and Fekadu, 2012; Desta, 2009; Alemayehu and Kibrom, 2008).

Figure 4.4 Inflation Trend in Ethiopia (1970/71-2010/11)



Source: Computed based on NBE data (2010/11)

As we observe from the above figure, trends of inflation looks the same with trends of GDP and show moderate ups and downs from 1970/71 to 2002/03 with exceptions of 1973/74, 1977/78, 1984/85, 1990/91, 1997/98 and 2002/03. In 1973/74 the imperial government over thrown by the military junta and in 1990/91 it was the time when a

group of guerilla fighters overthrown the dictatorial military junta which ruled the country for 17 Years. In 1977/78 and 1997/98 there was a war with Somalia and Eritrea respectively which reduce the expansion of the economy. As mentioned earlier in 1984/85 there was a devastating drought and again in 2002/03 the economy has been suffered from drought which resulted in a fall of GDP and this in turn increased the price level. Since the country depends on rain fed agriculture as a main source of income, the drought diminished output growth which in turn has a significant pressure on the increment of inflation.

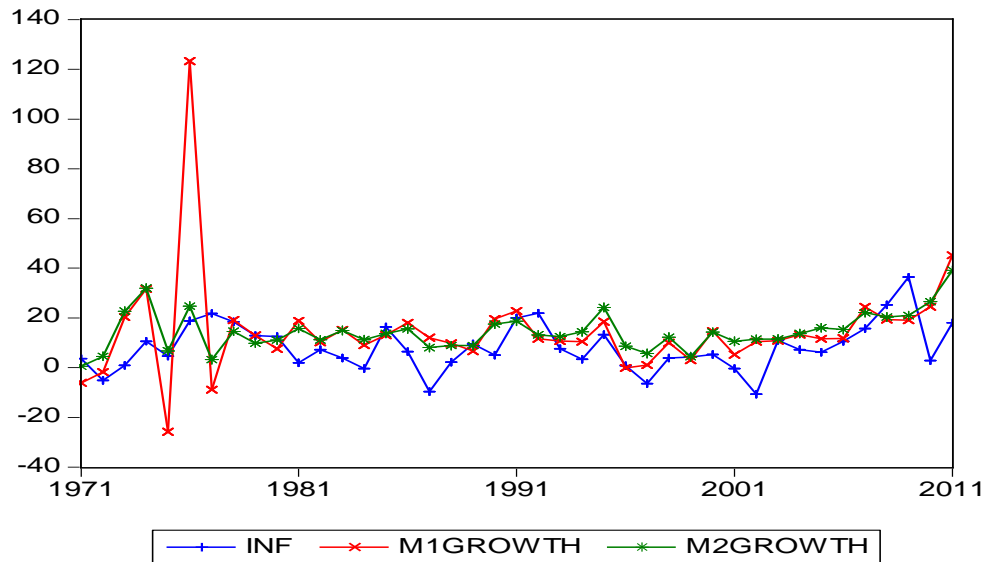
4.4 Trends of Money Supply in Ethiopia

Monetization of budget deficit is one of the links between fiscal and monetary policy (Haile, 2003). During the imperial regime, government expenditure had been very low and apparently, money supply remained low and revealed little growth during the same regime. In 1970/71 M1 was birr 445.9 million and M2 was birr 654.4 million and the annual growth rate was -6.1 percent and 0.64 percent respectively. The percentage ratio of M1/GDP and M2/GDP was about 5.1 percent and 7.6 percent respectively. The then low level of government expenditure and thereby low budget deficit may have helped the government to maintain low level of borrowing from the banking sector that explained the slow growth rate of money supply during the same regime.

The military government that succeeded to power in 1974/75 subscribed to socialist ideology and apparently, government expenditure to GDP ratio recorded tremendous growth. Hence money supply, M1 and M2, showed a fast increase from 1974/75 to 1990/91 with annual average growth rate of about 17 percent and 13 percent and reached birr 6131.7 million and 7959.2 million respectively. During the last years of the Derg regime, there existed rising public expenditure against low revenue collection. Consequently, this has resulted in expansionary monetary policy enticed by financing the fiscal deficits (monetization of the deficit). This was revealed by a higher growth rate of money supply; for instance in 1989/90 the annual growth rate of M1 and M2 was 20 percent and 18 percent respectively. The fact that the government was financing its deficits mainly through printing of money and there was lack of external financing resulted in an accelerated money supply growth. Despite this, however, the increased

money supply was not a major problem as historically inflation was not a serious problem in Ethiopia.

Figure 4.5 Evolution of Inflation and Money Supply (1970/71-2010/11)



Source: Computed based on NBE data (2010/11)

Soon after the fail of the military government in 1990/91, the transitional government switched to market economy. In terms of monetary policy, the post-Derg performance between the periods 1991/92-2001/02 was good, particular in maintaining a fairly stable M2 growth rate. Domestic liquidity (broad money) by 1991/92 was about 25 billion birr, showing a growth rate of about 12 percent over the period between 1991/92– 2001/02. However since 2002/03, there has been a fast increase in money supply.

Between 2002/03 and 2010/11, the years of soaring inflationary pressures in Ethiopia, the rate of money supply growth climbed to 20.7 percent on average. While the real GDP was grew by 11 percent on average during these period. Based quantity theory of money (QTM), assuming money held only for transaction purposes and the velocity of money roughly constant, the growth rate of money supply (the 20.7 percent) should be equal to the growth rate of real GDP to leave the price level constant. However, before 2002/03 velocity of money on average was continuously falling and after 2002/03 it has been growing continuously in the economy. Therefore, in the situation of rising velocity of

money, the corresponding money supply growth should have been slower to keep the price level stable.

In 2002/03 the starting of inflation, M1 and M2 was 35 billion and 16.8 billion birr respectively and this amount jumped to 76 billion birr and 145 billion birr with annual growth rate of about 39 percent and 45 percent respectively in 2010/11. More convincing, in 2008/2009 during which the average rate of inflation reached 36.4 percent, the average rate of money supply growth was close to 21 percent. The acceleration in the growth rates of M1 and M2 reflects an increase in the growth trends of four major components of the monetary aggregates, currency, demand deposits, saving and time deposits. The annual average growth rates of each of the four components, also shown in table 4.4 below, were higher during the 2002/03-2010/11 periods. Although it is difficult to conclude without rigorous and comprehensive analysis, this may indicate that there is a close relationship between inflation rate and the money supply growth in Ethiopian economy.

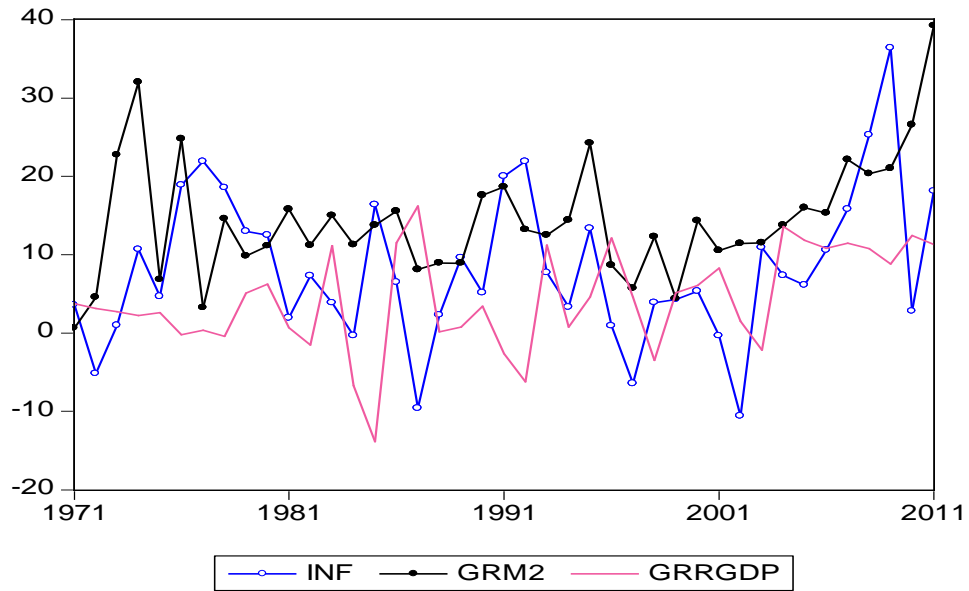
Table 4.4 Annual Average Growth Rate of Money supply (2002/03-2010/11)

Year	Broad Money (M2)	Narrow Money (M1)	Currency outside banks	Demand deposits	Saving deposits	Time deposits
2002/03	11.52	10.83	17.25	6.03	13.21	4.08
2003/04	13.76	13.35	16.66	10.61	14.93	7.00
2004/05	16.00	11.63	12.90	10.53	20.47	32.08
2005/06	15.33	11.84	13.93	10.00	18.34	29.04
2006/07	22.15	24.38	20.01	28.42	15.77	59.57
2007/08	20.35	19.36	28.78	11.23	24.30	1.06
2008/09	21.01	19.13	11.67	26.57	26.02	-3.15
2009/10	26.57	24.51	22.78	26.03	29.32	21.79
2010/11	39.21	45.27	34.57	54.44	34.34	17.95
Average	20.66	20.03	19.84	20.43	21.86	18.82

Source: Computed based on NBE Data (2010/11)

Figure 4.6 below shows the relationship between Inflation, money supply and economic growth in Ethiopian economy between 1970/71 and 2010/11. As we observe from the figure, the rate of inflation, money supply and economic growth moves the same trend.

**Figure 4.6 Trends in Inflation, Money supply and Economic Growth
(1970/71-2010/11)**



Source: Computed based on NBE and MoFED data (2010/11)

CHAPTER FIVE

EMPIRICAL RESULTS

This paper employed tri-variate Granger causality test with Vector Error Correction Model (VECM) framework of the analysis on the causal relationship between inflation money supply and economic growth in Ethiopia. In this analysis the direction of causality between inflation and money supply and between inflation and economic growth is determined and the response of variables for the dynamic change is also assessed. Moreover, the VAR model is also used for the purpose of optimal lag length selection. Accordingly, results of unit root test are given first and next pair wise standard Granger causality test results are summarized. The Johansen cointegration and Granger causality test results based on VECM then followed. Finally, the impulse response analysis results are presented.

5.1 Stationarity Analysis

In order to apply VAR and VECM methodologies, order of integration of each series should be determined. In this study, stationarity of the data is checked by using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The Akaike Information Criterion (AIC) is used to determine the lag length. The null hypotheses of a random walk ($H_0: \delta = 0$) against the alternate hypothesis of a stationary process ($H_1: \delta < 0$) is tested by using Dickey-Fuller and Phillips-Perron critical values. The appropriate lag length is automatically determined by the econometrics soft ware (E-views 6.0).

The results in table 5.1 below indicate that all the variables were non-stationary in levels. This can be seen by comparing the P-values of both ADF and PP test statistic with 1%, 5% and 10% level of significance. The results of this table show strong evidence of non-stationarity in level and it is adequate to conclude that there is a unit root in the variables at level. Therefore, to make all the variables stationary all of them were differenced once and the ADF and PP test were conducted, and the result is given below in table 5.2.

Table 5.1 Unit Root Test for Stationarity at Level

		ADF test	LCPI	LM2	LRGDP
None	Test statistic	5.0664	4.6178	4.1736	4.1736
	P-Value	1.0000	1.0000	1.0000	1.0000
Intercept	Test statistic	0.3493	1.1608	4.0781	4.0781
	P-Value	0.9781	0.9973	1.0000	1.0000
Intercept and trend	Test statistic	-1.4965	0.6450	1.5789	1.5789
	P-value	0.8142	0.9994	1.0000	1.0000
PP test					
None	Test statistic	4.2104	11.6824	3.8588	3.8588
	P-Value	1.0000	1.0000	0.9999	0.9999
Intercept	Test statistic	0.1714	1.3721	6.2798	6.2798
	P-Value	0.9673	0.9986	1.0000	1.0000
Intercept and trend	Test statistic	-2.0077	-0.1233	1.6095	1.6095
	P-value	0.5795	0.9927	1.0000	1.0000

(*), (**) and (***) denotes rejection of the null hypothesis at 1%, 5% and 10% level of significance.

Table 5.2 Unit Root Test for Stationarity at First Difference

		ADF test	LCPI	LM2	LRGDP
None	Test statistic	-3.3477	0.0788	-1.0946	-1.0946
	P-Value	0.0014*	0.7018	0.2431	0.2431
Intercept	Test statistic	-4.9047	-4.5305	-2.0642	-2.0642
	P-Value	0.0003*	0.0008*	0.2596	0.2596
Intercept and trend	Test statistic	-4.8505	-4.6724	-6.6018	-6.6018
	P-value	0.0019*	0.0030*	0.0000*	0.0000*
PP test					
None	Test statistic	-3.4424	-0.2144	-3.6788	-3.6788
	P-Value	0.0010*	0.6026	0.0005*	0.0005*
Intercept	Test statistic	-4.9029	-4.9242	-4.7787	-4.7787
	P-Value	0.0003*	0.0003*	0.0004*	0.0004*
Intercept and trend	Test statistic	-4.8545	-5.0244	-6.0250	-6.0250
	P-value	0.0018*	0.0012*	0.0001*	0.0001*
Order of Integration		I(1)	I(1)	I(1)	I(1)

(*), (**) and (***) denotes rejection of the null hypothesis at 1%, 5% and 10% level of significance.

The above table 5.2 shows that all the variables were stationary at first difference. Therefore based on this result, the null hypothesis of unit root is rejected and it is safe to conclude that, all the variables become stationary at first difference and they are integrated of order one I(1).

We can also verify the non-stationarity of these series at levels by just observing at the graphs of the series which is shown in Figure A.1 of the appendix part. Apparently the time series line graphs of the variables: log(CPI), log(M2) and log(RGDP) shows an upward sloping during the sample period. This suggests the series are non-stationary at level and implies that the mean and variance are increasing over time. However, the figure also suggests that the variables are stationary in their first difference, that is they are likely integrated of order I(1).

5.2 Lag Length Selection

Granger causality test, cointegration and VECM are usually preceded by a test of optimal lag length due to the estimated results are affected by the number of lag included. So, we must determine the maximum lag length before estimating the models and the standard Granger causality test. In this study, the sequential modified LR test statistic (LR), Final Prediction Error (FPE), Akaike Information Criteria (AIC), Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ), which are given automatically by E-Views 6.0 econometrics software package to specify the maximum number of lags are employed. Therefore, as Table 5.3 reveals that from lag length selection analysis lag length of 1 is optimal for series at level in all of the above types of criteria.

To check that the selected lag length was appropriate, one can needs to perform diagnostic test of residuals as none white noise residual may render invalid result. Therefore, the existence of autocorrelation and heteroscedasticity in the VAR model should be identified. Moreover, normality of the model should be tested. Based on the results which are shown in table 5.4 the null of no serial correlation, homoscedasticity and normality are not rejected at 1 percent significance level.

Table 5.3 Lag Order Selection Criterion

VAR Lag Order Selection Criteria						
Endogenous Variables: LCPI, LM2 and LRGDP						
Sample: 197/71-2010/11						
Included Observations: 35						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-22.3533	NA	0.0007	1.3344	1.4637	1.3804
1	162.2821	330.4001*	7.39e-08*	-7.9096*	-7.3925*	-7.7256*
2	165.4720	5.2046	1.01e-07	-7.6038	-6.6988	-7.2818
3	175.0123	14.0593	1.01e-07	-7.6322	-6.3394	-7.1722
*indicates Lag order selected by the criterion						
LR: Sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike Information Criterion						
SC: Schwarz Information Criterion						
HQ: Hanna-Quinn Information Criterion						

Table 5.4 Diagnostic Tests for the VAR

	LCPI, LM2, LRGDP		
	Df	Chi – Square	P-value
Autocorrelation: LM Test	9	12.3344	0.1952
Normality Test (Skewness)	3	6.3744	0.1181
(Kurtosis)	3	0.1679	0.9826
Heteroscedasticity Statistic: (No Cross Terms)	36	39.5796	0.3132

(*) denotes rejection of the null hypothesis of no misspecification at 1% significance level.

5.3 Granger Causality Test Results

Granger causality test is undertaken here to have the idea about the causal relationship between inflation and money supply and between inflation and economic growth. Since all the variables are found to be I (1), the test is applied to the first differenced variables. Results about the relationships of variables are given below:

Table 5.5 Pair-wise Granger Causality Test between DLCPI, DLM2 and DLRGDP

Lags	Null Hypothesis	Obs.	F-stat.	Prob.
1	DLM2 does not granger cause DLCPI	39	4.5196	0.0404*
	DLCPI does not granger cause DLM2		0.3512	0.5570
1	DLRGDP does not granger cause DLCPI	39	4.2947	0.0455*
	DLCPI does not granger cause DLRGDP		1.0704	0.3545
1	DLRGDP does not granger cause DLM2	39	0.8356	0.3667
	DLM2 does not granger cause DLRGDP		1.8161	0.1862

(*) denotes rejection of the null hypothesis at 5% significant level

Granger causality test result presented in table 5.5 reveals money supply granger causes inflation that the null hypothesis money supply does not granger cause inflation is rejected at 5 percent level but inflation does not granger cause money supply. Therefore this result indicates that causality running from money supply to inflation in the short run. The implication of the result is that money supply growth has valuable information in forecasting the values of inflation in the short run.

In table 5.5 the null hypotheses that economic growth does not granger causes inflation is rejected at 5 percent level of significance. However, the reverse is not rejected indicating that is economic growth which causes inflation and not the other way round. This implies that economic growth significantly suggest something about short run behavior of inflation rate while inflation rate does not predict anything about the short run properties of economic growth in Ethiopia for the periods between 1970/71-2010/11.

Although it is not under the objective of the study, the result in table 5.5 also shows economic growth does not granger cause money supply and money supply does not granger cause economic growth, which implies there is no causality between economic growth and money supply in the short run. Therefore money supply growth does not predict anything about economic growth and vice versa.

5.4 Cointegration Test Results

As shown in table 5.2 above, all the variables are integrated of the same order i.e. I(1), then this implies that there is a possibility that these variables are cointegrated. When cointegration exists, it indicates that the variables have long run equilibrium relationship. To check for the presence the Johansen cointegration test is performed and the testing hypothesis is the null of no cointegration against the alternative of existence of cointegration.

Table 5.6 Cointegration Test Result

Sample: 1970/71 to 2010/11 Sample (Adjusted): 1972/73 to 2010/11 Included Observations: 39 after adjustments Trend Assumption: Linear Deterministic Trend Series: LCPI LM2 LRGDP Lags Interval (in first differences): 1 to 1				
Unrestricted Co-integration Rank Test (Trace)				
Hypothesized				
No. of CE(s)	Eigen value	Trace statistic	0.05 critical value	Prob.**
None*	0.4321	37.2937	29.7971	0.0057
At most 1	0.2683	15.2255	15.4947	0.0549
At most 2	0.0750	3.0401	3.8415	0.0812
Trace test indicates 1 cointegrating equation(s) at the 0.05 level. (*) denotes rejection of the hypothesis at the 0.05 level. (**) Mackinnon-Haug-Michelis (1999) p-values.				
Unrestricted Co-integration Rank Test (Maximum Eigen value)				
Hypothesized		Max-Eigen		
No. of CE(s)	Eigen value	Static	0.05 critical value	Prob.**
None*	0.4321	22.0681	21.1316	0.0368
At most 1	0.2683	12.1855	14.2646	0.1039
At most 2	0.0750	3.0401	3.8415	0.0812
Max-eigen value test indicates 1 cointegrating equation(s) at the 0.05 level. (*) denotes rejection of the hypothesis at the 0.05 level (**) Mackinnon-Haug-Michelis (1999) p-values				

Based on the results of Johansen cointegration test which is presented in table 5.6 above, the trace test reveals the existence of one cointegrating equation at 5 percent level of

significance and the maximum eigen value test also confirms the result. Therefore, it is safe to conclude that these two variables (LM2 and LR GDP) are individually cointegrated with aggregate price level. Thus, aggregate price, money supply and real output have long run or equilibrium relationship between them. As the variables are cointegrated and the objective of this study is to examine the relationship of aggregate price to money supply and RGDP the cointegrating vectors are normalized by aggregate price (LCPI). The normalized coefficients of long run relationship in table 5.6 below show that long run effect of money supply on aggregate price is positive and statistically significant at 1 percent level. On the other hand, RGDP is negatively related to aggregate price in the long run and it is statistically significant at 1 percent level. Clearly this finding is consistent with the monetarist view that in the long run keeping output constant hence only change in money supply will lead to price change.

Table 5.7 Normalized Cointegration Coefficients: 1 Cointegrating Equation

LCPI	LM2	LR GDP
1.0000	3.4734* (0.6706) [5.1795]	-12.8910* (2.5378) [-5.0796]

*denotes rejection of the null hypothesis at the 1 percent level of significance and Standard error in () and t-statistic in []

5.5 VECM Test Results

Since the cointegration test confirmed the existence of long run relationship among the variables, the vector error correction model helps to estimate the short run relationship and the speed of adjustment towards long run equilibrium.

Table 5.8 Summary Results of Causality Test using Vector Error Correction

Modeling

Modeling DLCPI				
Variable	Coefficient	Std. Error	t-value	t-prob.
Constant	0.0354	0.0385	0.9201	0.3597
ECTcpi-1	-0.0157	0.0087	1.8129	0.0728**
DLCPI-1	0.1333	0.1422	0.9372	0.3509
DLM2-1	0.2168	0.1029	2.1063	0.0380*
DLRGDP-1	-0.7729	0.2481	-3.1156	0.0024*
$R^2 = 0.4078$		$Adj. R^2 = 0.3360$		$F - statistic = 5.6819$
Modeling DLM2				
Constant	0.1594	0.0240	6.6486	0.0001*
ECTm2-1	-0.0857	0.0188	-4.5643	0.0001*
DLCPI-1	-0.0079	0.0855	-0.0896	0.9288
DLM2-1	-0.0845	0.1580	-0.5347	0.5940
DLRGDP-1	-0.2383	0.1545	-1.5423	0.1261
$R^2 = 0.4140$		$Adj. R^2 = 0.3451$		$F - statistic = 6.0870$
Modeling DLRGDP				
Constant	-0.0101	0.0282	-0.3588	0.7205
ECTrgdp-1	-0.0086	0.0818	-0.1050	0.9166
DLCPI-1	0.0402	0.0572	0.7280	0.4729
DLM2-1	0.1789	0.1855	0.9644	0.3372
DLRGDP-1	0.1759	0.1815	0.9696	0.3345
$R^2 = 0.2410$		$Adj. R^2 = 0.1517$		$F - statistic = 2.6999$

(*) and (**) denotes significance of the p – value at 1% and 10% significance level

Based on the results of VECM from the above table 5.8, the error correction term in LCPI equation is weakly significant at 10 percent level and has a negative sign, implying that there exists a long run relationship running from money supply and economic growth to inflation. Its relative value (-0.0157) shows that, the rate of convergence to the

equilibrium state per year. More clearly, the speed of adjustment of any disequilibrium toward long run equilibrium is that about 1.57 percent of the disequilibrium in inflation is adjusted each year. The degree of adjustment mechanism is not powerful. The coefficient of error correction term with money supply as dependent variable is observed to be statistically significant at 1 percent level, indicating that there exists a strong long run relationship running from inflation and economic growth to money supply. Contrary the error correction term of RGDP as dependent variable was observed to be statistically insignificant, implying non existence of long run causality was observed from inflation and money supply to economic growth. Therefore from table 5.8 there exist bi-directional granger causal relationship between inflation and money supply and uni-directional granger causal relationship from economic growth to inflation in the long run.

In the short run, the coefficients of the first difference of LM2 and LRGDP in LCPI equation of table 5.8 are statistically significant at 5 percent level and 1 percent level respectively, which indicates the presence of short run causality from money supply to inflation and from economic growth to inflation. The sign of the coefficients shows that an increase in money supply increase inflation and an increase in output growth decrease inflation. However, in LM2 and LRGDP equations no short run causality indicated in Ethiopia for the period's 1970/71-2010/11.

The finding that money supply granger cause inflation supports the monetarist view that inflation in Ethiopia is a monetary phenomenon. But, this does not mean that there are no other important determinates of inflation in Ethiopia. As was mentioned previously there are other factors that can stimulate inflation such as structural supply shortage, specifically shortage of agricultural output, droughts and wars, which Ethiopia has experienced over the years. The result that economic growth has an inverse effect on inflation implies the supply side argument also holds. That is boosting the supply of goods and service will reduce the pressure on price level and helps to stop excessive inflationary pressure.

5.5.1 Diagnostic Tests

Before concluding the model result analysis it is better to check the diagnostic test. The existence of autocorrelation and heteroscedasticity as well as normality of the model

should be identified. Moreover, model stability is tested. In the diagnostic testing, the null hypothesis is that there is no misspecification in the model. Table 5.9 below shows diagnostic test results of the model and we can conclude that this model pass all the diagnostic tests at 1 percent significance level.

Table 5.9 Diagnostic Tests for the VECM

	DLCPI, DLM2, DLRGDP		
	Df	Chi – Square	P-value
Autocorrelation: LM Test	9	8.6417	0.4710
Normality Test (Skwness)	3	5.7958	0.1220
(Kurtosis)	3	0.6598	0.8826
Heteroscedasticity Statistic: (No Cross Terms)	48	52.1953	0.3142

(*) denotes rejection of the null hypothesis of no misspecification at 1% significance level.

The adequacy of model and stability of the parameters in the VECM is tested by the plot of recursive estimates of non-zero eigen values. The plots of the recursive graphics that bounds within the 95 percent critical values are shown in the figure B.2 of the appendix part. As the graphs suggests, the null hypothesis of overall parameter consistency can't be rejected based on the 1-step recursive residuals (1-step residuals $\pm 2^{\text{nd}}$ SE).

5.5.2 Impulse Response Analysis

An impulse response function shows how a variable in the VECM system responds to a single 1 percent exogenous change in other variable of interest. The result of the impulse responses of LCPI to one standard deviation shocks exerted on LCPI, LM2 and LRGDP is presented in table 10 below, while the impulse response table of LM2 and LRGDP is shown in the appendix part. All of the responses are analyzed for 10 periods.

From table 10 below, in response to a one standard deviation disturbance of LCPI itself future LCPI increases by 0.08 in the first year and reaches 0.09 in the fourth year and it increases continuously in the time horizon and never die out in the long run. A one standard deviation disturbance originating from LM2 produce up to 0.002 increases in LCPI in the first year and reaches 0.024 in the fourth year and it did not die out and continuously increase in the time horizon and reaches 0.04 in the tenth year. Similarly, a one standard deviation disturbance originating from LRGDP results in an approximately – 0.4 percent decline in LCPI in the first year and further LCPI declined by - 3.6 percent in the second year and it did not die out in the time horizon but after the fourth year LCPI respond positively to one standard deviation shock exerted on LRGDP. The result from table 11 shows the impact of money supply and real GDP on CPI is permanent.

The above impulse response function analysis indicates the responses of CPI to impulse in money supply and RGDP. This tend to support the events happened earlier that caused increase in money supply and reduction of output. In the post 2002/03 period inflation began to appear as a major problem were following the government’s shift towards less conservative monetary and fiscal policy. Similarly, in 1984/85 and 2002/2003, the country was severely affected by drought which significantly reduced the economy. The reduction in country’s production increased the rates of inflation.

Table 10 Responses of LCPI to LM2 and LRGDP Shocks

Response of LCPI

Period	LCPI	LM2	LRGDP
1	0.081246	0.002936	-0.004014
2	0.093421	0.017855	-0.035714
3	0.085023	0.024909	-0.033013
4	0.086209	0.024134	-0.008171
5	0.096602	0.025520	0.012050
6	0.106746	0.029862	0.026311
7	0.114866	0.034513	0.041770
8	0.123251	0.038700	0.060467
9	0.132947	0.043015	0.080932
10	0.143587	0.047831	0.102372

5.5.3 Results of the Model

Based on VECM and impulse response function analysis, the relationship between inflation and money supply and inflation and economic growth are summarized in table 5.10.

Table 5.11 Summary of the Results of the Model

	Direction of Relationship	
	Short run Relationship	Long run Relationship
DLCPI – DLM2	From money supply to inflation	Bi-directional
DLCPI- DLRGDP	From Economic growth to inflation	From economic growth to inflation

As summarized in table 5.10 above, in the short run there is causal relationship between inflation and money supply which runs from money supply to inflation. This result is consistent with several studies in developing countries: Chimobi and Uche, (2010), Ailkaeli, (2007), and Amin, (2011). In Ethiopia, this result is consistent with Wolde-Rufael, (2008) that the variation in price level is caused by money supply and inflation in Ethiopia is a monetary phenomenon. Similarly, the granger causality between inflation and economic growth runs only one way from growth to inflation in Ethiopia using the data for the period 1970/71-2010/11. The result coincides with the findings of Fekadu, (2012) for the case of Ethiopia, Umaru and Abdulrahan, (2012) for the case of Nigeria and Gunasinghe, (2007) for the case of Sri Lanka. In the long run it is observed that two way (bi-directional) causal relationship between inflation and money supply and uni-directional causality between inflation and growth, which runs from economic growth to inflation for the period 1970/71-2010/11 in Ethiopia.

CHAPTER SIX

CONCLUSION AND POLICY IMPLICATIONS

6.1 CONCLUSION

Ethiopian economy has the feature of low and stable inflation for the periods before 2002/03. However in the post 2002/03 period, persistence increase in prices of goods and services along with sustained and rapid economic growth has been emerged. Empirical studies on the possible sources of the inflationary situation in the country indicated that, the fast increase in broad money supply, the widening of public budget deficit and the surge in price of oil and food items as the possible sources of inflation. On the other hand the government mentioned structural factor that is, the hoarding of goods by traders (piling up stocks), rapid economic growth and the rise in oil and food price, as the main causes of inflation in the country.

On the basis of this situation, this study has attempted to analyze the causal relationship between inflation and money supply and between inflation and economic growth in Ethiopia from 1970/71-2010/11. In the examination, tri-variate Granger causality with VECM methodology along with impulse response function analysis is used. First the unit root test is carried out by using the Augmented Dickey-Fuller and Phillip-Perron in order to determine the order of integration of the series. The result reveals that all the series have unit root at levels and they become stationary when they are differenced once.

The Johansen cointegration test shows that aggregate price, money supply and real GDP are cointegrated. This implies that the variables have long run equilibrium relationship. The normalized coefficient of long run relationship shows that, long run effect of money supply on aggregate price is positive and RGDP is negatively related to aggregate price in the long run. Following the cointegration result, VECM is formed and the result indicates that there is bi-directional causal relationship between inflation and money supply and uni-directional granger causal relationship from economic growth to inflation in the long run.

In the short run the model indicates the presence of uni-directional causality from money supply to inflation. The finding that money supply causes inflation implies that the monetarist view exists in Ethiopian economy. The monetarist argued, to the extent that monetary expansion is not accompanied by expansion from production sector of the economy, the supply of money will have a direct effect on inflation. A number of recent studies that looked on inflation and money growth over long periods found strong relationship between growth rates of the money supply and of the price level for countries with high inflation rates. On the other hand, there is no reverse causation from inflation to money supply. To explain this result, in Ethiopia in addition to inflationary way of financing different public investment by the government which has contributed to the current inflation, all kinds of financial markets are not well developed and their influence is not that much significantly felt in the country. Besides, majority of the people don't have sufficient knowledge and trust in these financial markets, therefore it seems that spending on goods and services as the main alternative to holding of money. As a result, it is most likely that the supply of money that will determines expenditures on goods and services and thus causes inflation. However, besides money supply there are also other factors that can fuel inflation such as structural supply shortage, specifically shortage of agricultural output, droughts and wars, which Ethiopia has experienced over the years.

The model also reveals economic growth has negative effect on inflation in the short run. This result should be interpreted carefully as it depends on the nature of the economy being studied and the sources of inflation and economic growth in the country. If the basic sources of economic growth are noninflationary like increase in production and productivity, economic growth reduces inflation. However, if economic growth comes from sources which increase money supply above the real output, it creates problems of too much money chasing too few goods which in turn results inflation as indicated above. Economic growth must decrease inflation because the more goods are produced, the lower the prices of goods. This association between the level of production and the level of prices also holds for economic growth and inflation rate. If the growth rate of real GDP increases and the growth rates of money supply and velocity of money are kept constant, the growth rate of the price level must decline. But the growth rate of the price level is just another term for the inflation rate; therefore, inflation must decline. An

increase in the rate of economic growth means more goods for money to chase, which puts downward pressure on the inflation rate. However, this can hold if the underlying source of economic growth is productivity or supply growth.

Further from the model there is no causation from inflation to economic growth and this finding is similar with Sidrauski's model. The result of Sidrauski's model indicated that, if the representative individual's real discount rate is unaffected by inflation, an increase in the inflation rate doesn't affect the steady state capital stock, i.e., neither output nor economic growth is affected. Nevertheless, Sidrauski's result seems to have little significance in explaining the current situation of the country. Furthermore, like many other developing economies, the economy of Ethiopia is a dual economy in which the traditional sector is the most dominate since majority of the population (around 80 percent) live in this sector. Therefore, due to this the increase in inflation rate does not seem to affect the output of the traditional sector which constitutes a large share in GDP. This is due to the fact that the economic activity of this sector is highly determined by exogenous factors. This might be another reason why no significant causation is found from inflation to economic growth at least in the short run.

The Impulse response function analysis also indicates that the response of CPI to impulses in money supply and RGDP. If a shock like policy change and drought which can significantly increases money supply and reduces output respectively occurs, then inflation will arise. For example, in the post 2002/03 period inflation began to appear as a major problem were following the government's shift towards less conservative monetary and fiscal policy. Similarly, in 1984/85 and 2002/03, the country was severely affected by drought which significantly reduced the economy. The reduction in country's production increased the rates of inflation.

6.2 POLICY IMPLICATIONS

This study has tried to investigate the causal relationship between inflation and money supply and between inflation and economic growth both in the short and long run. Based on the empirical findings, the policy implications which can be derived from the study are:

The empirical results of this study indicate positive causal relationship between money supply and inflation both in the short and long run. Given this relationship a monetary policy can play a critical role. The results support monetarist view that is inflation is a monetary phenomenon and other similar results were found in Ethiopia. On the basis of the present study result, reduction of money supply can result in reduction of inflationary pressure in Ethiopia. Therefore, the National bank of Ethiopia needs to exercise tight monetary policy. Although the empirical evidence shows the change in money supply causes inflation, it does not mean that the implementation of tight monetary policy alone is effective anti-inflationary instrument. Because based on the negative causal effect of economic growth on inflation, supply-side policy can also be appropriate to contain inflation.

In Ethiopia, there is fast economic growth as well as high level of inflation at the same time. Hence it is essential to identify the possible sources of the country's current economic growth and inflation. If the sources of growth are dominated by inflationary way of financing different public investments, this exacerbates the problems of high inflation existing in the country by creating more money than real output in the economy. However, if the growth comes from productivity and production increases mainly, inflation will tend to decrease. Therefore combined effort should be made by policy makers to increase the level of output in Ethiopia by improving productivity and supply so as to reduce the prices of goods and services (inflation) and improve the growth of the economy. Since the share of agriculture in GDP is high, efforts to enhance and stabilize domestic agricultural production and productivity, more specifically production of main food staples, is very important in reducing inflation because movement in price level in the country is highly due to prices of food staples. Therefore, enhancing production and productivity of food staples must be given priority by providing incentives to the

agricultural sector and transforming the sector from rain dependent ways of production to modern farming system.

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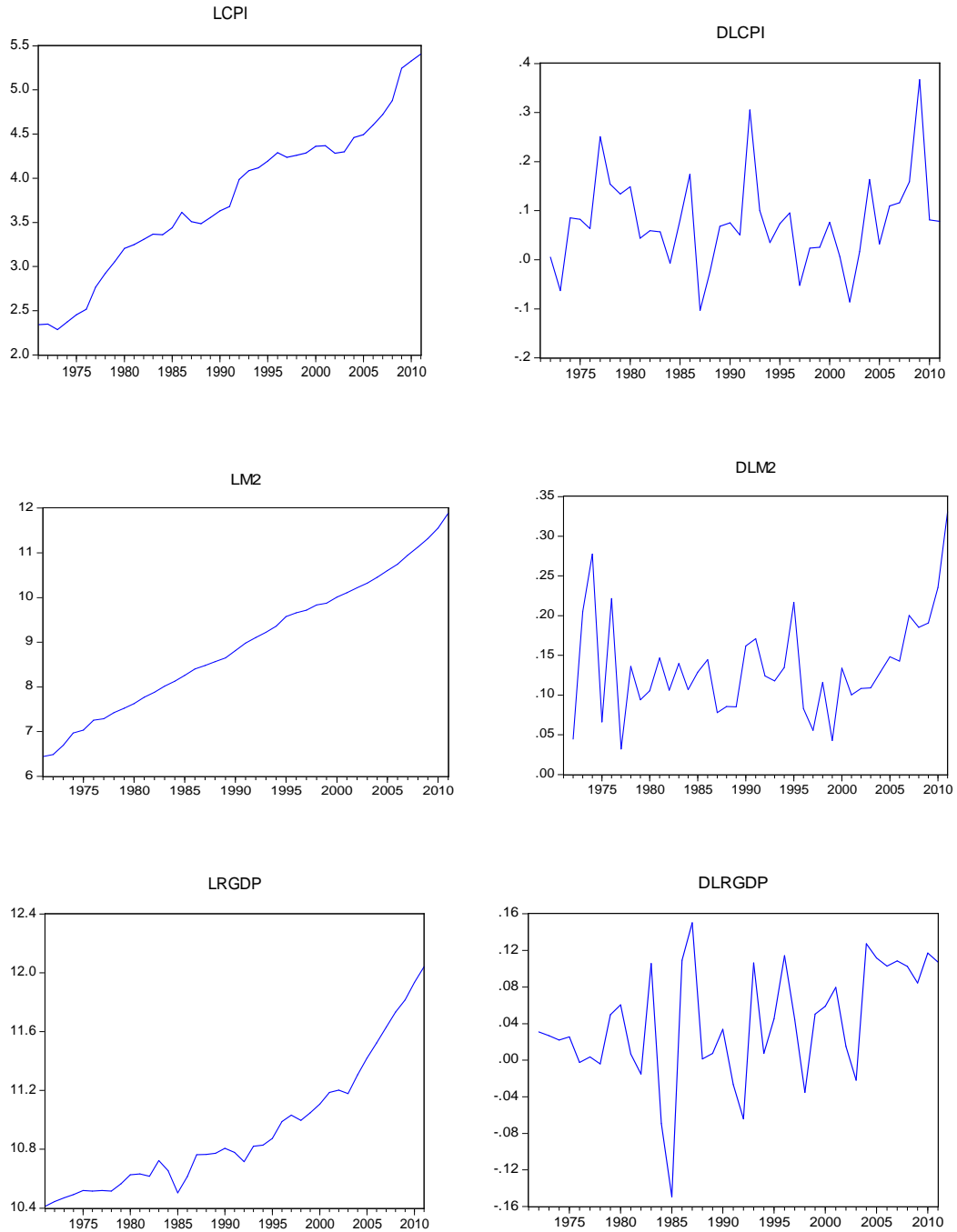
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APPENDICES

APPENDIX A

Figure A.1 Plot of the Logarithm of Variables in Levels and First Difference



APPENDIX B

Figure B.1 Long Run Model Stability (1 –step residuals $+/2^{\text{nd}}$ SE)

(Plot of Recursive Graphs)

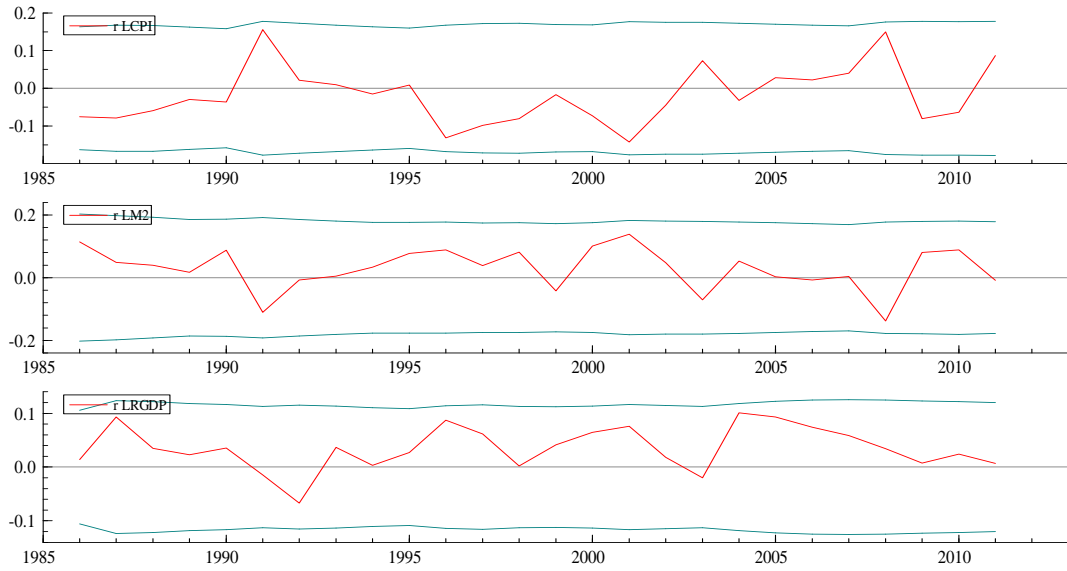
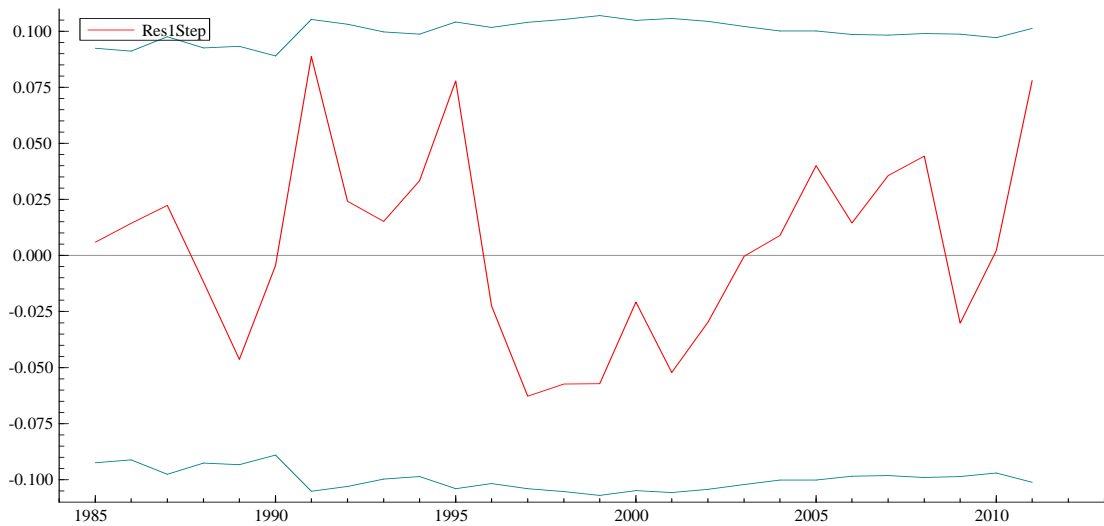


Figure B.2 Short Run Model Stability (1 –step residuals $+/2^{\text{nd}}$ SE)

(Plot of Recursive Graph)



APPENDIX C

Table C.1 Impulse Responses of LM2 and LRGDP

(Generalized One S.D Innovation)

Response of LM2

Period	LCPI	LM2	LRGDP
1	-0.003771	0.050590	0.006528
2	-0.002004	0.042493	0.010089
3	0.000950	0.042800	0.027993
4	0.009024	0.044833	0.044801
5	0.017545	0.047412	0.059276
6	0.025407	0.049420	0.074565
7	0.033580	0.051349	0.091922
8	0.042649	0.053574	0.110807
9	0.052511	0.056058	0.130848
10	0.063032	0.058699	0.152217

Response of LRGDP

Period	LCPI	LM2	LRGDP
1	0.006057	0.007668	0.059428
2	0.010202	0.016484	0.069472
3	0.002847	0.020942	0.062735
4	0.000522	0.019706	0.065033
5	0.003699	0.019156	0.074728
6	0.007139	0.020324	0.083991
7	0.009193	0.021756	0.091655
8	0.011037	0.022836	0.099697
9	0.013395	0.023845	0.108918
10	0.016106	0.025021	0.118986