DETERMINANTS OF INFLATIONARY EXPERIENCE IN ETHIOPIA

(1974/75 – 2014/15)

BY

TESHALE DABA

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF SCIENCE IN ECONOMICS (ECONOMICS POLICY ANALYSIS)

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COLLEGE BUSINESS AND ECONOMICS DEPARTMENT OF ECONOMICS

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Determinants of inflationary experience in Ethiopia

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CERTIFICATION

As university advisors, we hereby certify that we have read and evaluated the thesis undertaken by Teshale Daba under our guidance, which is entitled "Determinants of inflationary experience in Ethiopia (1974/75 to 2014/15)". We recommend that the thesis to be submitted to school of graduate studies of Jimma University with our approval as it fulfilled the requirements to award the Degree of Masters of Science in Economics (Economic Policy Analysis).

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I hereby declare that this thesis entitled "Determinants of inflationary experience in Ethiopia" has been undertaken by me under the guidance and supervision of Wondaferahu Mulugeta (PhD) and Mr. Endeg Tekalegn (MSc).

This thesis is my original work and has not been presented for the award of any degree or diploma to any university or institutions.

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ABSTRACT

The main aim of this study is to investigate the determinants of inflationary experience in Ethiopia. The study focused on economic and econometric criterion to examine the long run and short run impacts of macroeconomic variables on inflation in Ethiopia. In order to accomplish this paper, the study has employed time series data for the period from 1974/75 to 2014/15. To check for the stationarity of the variables, the researcher has used augmented dickey fuller and Phillips-perron unit root test and all variables become stationary at first difference. Then, long run and short run estimates had been examined by using Johansen Co-integration methodology and Vector Error Correction approach with lag length of two. Data on macroeconomic variables were taken from National Bank of Ethiopia, Ethiopian Economic Association and World Bank database. The most visible determinants of inflation in Ethiopia are money supply, real gross domestic product and overall budget deficit. The findings of the study indicated that in the long run consumer price index has found to be positively influenced by money supply, real gross domestic product and overall budget deficit in which these all variables are positive and statistically significant determinants of inflation. Long run elasticity of price level with respect to broad money supply, real gross domestic product and overall budget deficit are 0.5922, 0.5299 and 0.3604 respectively. In the short run, only last year overall budget deficit is involved in affecting consumer price index of current year. The growth of money supply should be continually kept in control, given its long run potential impact in accelerating inflationary pressure in order to ensure stable price level in an economy and keep on the growth of real gross domestic product with single digit inflation rate, since single digit inflation is essential for economic growth. Also displaying a high sense of transparency in fiscal operations to bring about a realistic budget deficit that would serve as incentives to productivity; hence, the general price level will be stable.

Keywords:

Consumer price index, broad money, real gross domestic product, overall budget balance, Johansen Co-integration technique, Vector error correction model

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Acronyms

ADF - Augmented Dickey Fuller

CPI - Consumer Price Index

CSA - Central Statistical Agency

EEA - Ethiopian Economic Association

IMF - International Monetary Fund

INF - Inflation

M2 - Money Supply (Broad Money)

MoFED - Ministry of Finance and Economic Development

NBE - National Bank of Ethiopia

REER – Real Effective Exchange Rate

OBB – Overall Budget Balance

RGDP - Real Gross Domestic Product

UNDP – United Nation Development Program

VAR – Vector Auto Regressive

PP – Phillips-Perron

VECM – Vector Error Correction Model

CUSUM – Cumulative Sum

CUSUM Square – Cumulative Sum of Square

CHAPTER ONE
INTRODUCTION

1.1. Background of the Study

Inflation is a monetary phenomenon and the persistent inflation has widely attracted the attention of the economists all over the world. It defined to be a continuous and persistent rise in the general price level and then leads to fall in purchasing power. Inflation may be caused by either an increase in the money supply or a decrease in the quantity of goods being supplied. Inflation is a highly controversial term, which has undergone modification since the neo-classical economists first defined it. Neo-classical defined inflation as a galloping rise in prices caused by excessive increase in the quantity of money. For Keynesians true inflation happens when money supply increases beyond full employment level (Jhingan, 1997).

Though various economists define inflation in different ways, there is an agreement that inflation is a sustained increase in the general price level. Even though, inflation is a sustained rise in prices, it may be of various magnitudes. When the rise in prices is very slow like that of a snail or creeper, it is called creeping inflation. Creeping inflation happens when prices increase less than 3 percent per annum. Such an increase is regarded as safe and essential instrument of economic development. When prices rise at a rate greater than 3 but less than 10 percent per annum, it is called walking inflation. Walking inflation is a warning signal for the government to control inflation before it becomes running inflation. An annual increase in prices at rate of the 10 to 20 percent is called running inflation. When inflation rate goes above 20 percent, it is called jumping inflation/hyperinflation. It is the rise in prices very rapidly and a condition when the rate of inflation becomes immeasurable and completely uncontrollable. Such inflation is not preferred because, it will cause uncertainty and cost-push shocks, which will affect the stability and performance of an economy. Therefore, low inflation rate and stability in prices is always one of the core objectives targeted by policy makers in designing the monetary policy (Ibid)

Economists widely argue that inflation is the general rise in the price of goods and services. Most recently, it is widely regarded as key macroeconomic variables used to get an in-depth insight into the overall status of a given economy. According to the classical and neoclassical

economists, stable inflation fostering socioeconomic condition for economic growth and poverty reduction. According to Fischer (1995), optimal inflation ranging from 2–3% is good for economic growth. It encourages investment and production by raising the rate of profit. On the other hand, most argued that sustained inflation has harmful effects on societal welfare and income inequality in such a way that the income distribution tends to be skewed (Loening, 2007).

Price stability is one of the principal economic goals in any economy. It is desirable that the overall price level for goods and services remain relatively stable. Price stability is always one of the common objectives of economic integration policies and has been a strategic one for monetary policy of the West African Monetary Zone (Tucker, 2003). Inflationary pressures are known for their negative impact on social welfare and disable the domestic economy from performing efficiently (Fullerton, et al 1997). Therefore reducing inflationary rates is a top priority in any economic policy agenda.

Several studies have attempted to address, the underlying causes of the global price rise. Typically identifying a combination of factors ranging from long-term economic and demographic trends combined with short-term problems, such as bad weather, speculation, high oil prices, and export bans in a number of countries. At the same time, we know less about how world food prices affect domestic food prices in individual developing countries; particularly in Sub-Saharan Africa (Minot, 2010). One of the most affected countries is Ethiopia, which, with the exception of Zimbabwe and some small island economies, had the strongest acceleration in food price inflation in Sub-Saharan Africa (IMF, 2008a, 2008c; Minot, 2010). At the peak of the global food crisis, in July 2008, annual food price inflation go beyond 90 percent. This was a historically exceptional rise, which began in 2006.

There is no consensus on why Ethiopia experienced such dramatic price rises. The increase in inflation coincide with relatively favorable harvests, whereas in the past inflation had typically been associated with agricultural supply shocks due to droughts. World food price increases are believed to have small effects in Ethiopia because of the limited size of food imports, which amounts to about five percent of agricultural GDP (Minot, 2010).

The International Monetary Fund (IMF, 2008b), suggests that inflation is being led by rapidly rising food prices. However, since inflation is higher in Ethiopia than in neighboring countries, domestic factors, including demand pressure and expectations should be important. Some supply-side factors may also explain part of the rise in food prices, such as reduced distress selling by farmers and the switch from food to cash aid. The IMF thus recommends addressing macroeconomic imbalances and forcefully tightening monetary and fiscal policies. Rising global commodity prices may be important, but the transmission mechanism is not clear because the amount of non-food aid imports is relatively small. IMF (2008a) notes that there might be a process of convergence to world food prices driven by high food prices in neighboring countries, though there is a lack of empirical evidence.

According to FAO report (2014/15), annual food price inflation fell globally to 5.2% in 2014, the lowest rate in the last four years. All regions saw annual food inflation decreasing from 2011 to 2014, except Latin America and the Caribbean, where food price increase accelerated from 8.4% in 2011 to 9.7% in 2014. The most remarkable decrease was recorded in Africa, where annual food inflation decreased from 12.8% in 2011 to 6.3% in 2014. In the same period, Northern America and Europe experienced the lowest food inflation rate, Latin America and Caribbean, Asia and Africa the highest. Within 2014, global food inflation fell from a high of 6% year-over-year in January to a low of 4.4% in November, before rising to 5% in December when food price inflation raised almost all regions, but in particular in Asia and Eastern Europe. Short term forecasts predict declining food price inflation throughout the first quarter of 2015, down to 4.6% in March 2015. (Zewdu H. 2015)

In Ethiopia, General inflation rate shows stable trend which is almost between 5-9% since March 2013 until now. In August 2011, the general inflation rate was very high, which reaches 40.6%, and the lowest in august 2010 that was nearly 5.3 % compared to all preceding years and months. Currently, general level inflation show some increment due to increase in food and non-food inflation, it was 9.5% in May 2015. Regarding to food inflation, it has relatively stable growth rate up to first quarter of 2010. Starting from third quarter of 2010 up to second quarter of 2012, there was high annual food inflation rate, which jumps from single digit to double digit. The trend of food inflation showed the highest growth rate from February 2011 and reached its peak

of 51.7% in October 2011. In recent periods, the food inflation shows some increment trend since November 2014 until May 2015 that is 10.2%. (Ibid).

Hence, food inflation shows more volatile trends than non-food inflation and it takes a lion share for the volatility of inflation in the country. It is thus of vital importance to improve the understanding of the causes of food price inflation and its dynamics in Ethiopia to allow adequate policies in order to achieve the price stability objective.

Therefore, this paper thoroughly was analyzed the determinants of inflationary experience and its trends in Ethiopia using time series data of annual base.

1.1. Statement of the Problem

Inflation is the major concern for the consumers and policy makers. Because, it reduces the purchasing power and brings down the government purchase in the country. In fact, a continued and sustained inflation for economic development of a country is very much harmful. Inflation in Ethiopia has been low relative to other countries over the last 30 years at the earlier time. As Habtamu (2000) worked out it, averaged inflation rate about 7.3 percent during the 1967 to 1999, which is far below an average inflation rate of 10.3 percent, 39.8 percent, 13.4 percent, 90 percent and 19 percent for Asia, Europe, Middle East, Western Hemisphere and Africa respectively.

Additionally, according to Yohannes (2000) in 1980, in most cases the Ethiopian economy experienced rate of in inflation that is below 7.5 percent except for year at which a sudden shot in price were registered. The supply decrease specially related to agricultural sector, which determines food prices, was responsible for the stimulate of inflation to surge to 18.4% particularly in 1984/85 during which serious famine took place

However, during the Dergue regime (1974-1991), inflation rate was low but volatile that accounted for 9 percent, which is high as compared with previous regime. Some of the possible factors responsible for such low; but, volatile inflation rate were the nominal exchange of the birr, which was over-valued. The other factor was, the economy was directed through central planning, which sets all sorts of physical and financial targets including price, investment,

saving, interest, credit, money supply and output. The role of monetary and fiscal policies was related to secondary importance (Ashebir, 2005).

But recently, the most significant and serious problem facing Ethiopia is the rampant inflation rate. During the fiscal year Ethiopian millennium in 2000 E.C. the country level inflation rate stood at 25.3 percent which 9.5 percentage points above 2006/07 fiscal years inflation (i.e. 25.3-15.8= 9.5) . Representing more than 50 percent of the general consumer price index, it was clear observation in the country that food inflation stood at 34.9% in 2007/08 fiscal year, which is 17.4 percentage points above the previous fiscal years inflation. During the same period, the non-food inflation rate stood at 12.5 percent, which is about 1 percentage point below last year's inflation (MoFED 2000). In January 2008, the inflation rate raised to 44.4 percent. The cause for the rise of this rampant inflation rate is greedy merchants, economic growth and /or farmer who happen to demand higher price for their product or an increase in demand (Said, 2008).

According to NBE annual report (2010/11), annual average general inflation at the close of the fiscal year 2010/11 was 18.1 percent, 15.3 percentage point higher than the preceding year level. This was predominantly due to the hike in the prices of food items that contributes the lion's share of 14.1 percentage point of the total annual change in headline inflation while non-food items made up the remaining 1.2 percentage. And also annualized food inflation, scaled up to 15.7 percent from -5.4 percent in June 2010 registering notable rise of 21.1 percentage point on account of a significant surge in the prices of cereals (which accounts roughly for about 39.5 percent of food CPI,) coffee, potatoes, oil and fats, milk & cheese, bread and prepared food among others. Likewise, annual average core inflation slightly increased to 21.8 percent from 18.2 percent at the end of last fiscal year.

On contrary, year-on-year, in 2011/12 headline inflation slowed down to 20.8 percent from 38.0 percent a year ago as both food and non-food price inflation registered 19.9 and 12 percentage points decline, respectively. Annual food inflation, which was 45.3 percent in June 2011, declined to 25.4 percent in June 2012 while annual core inflation dropped to 15.8 percent from 27.8 over the same period. NBE Annual Report (2011/12)

As reported on NBE annual report of 2012/13, Similar to annual average, year-on-year, headline inflation has slowdown to 7.4 percent from 20.8 percent a year ago resulted from slowdown in both food & non-alcoholic beverage and non-food price inflation by 13.5 and 3.4 percentages, respectively. Annual food and non-alcoholic inflation, which was 20.8 percent in 2011/12, declined to 7.4 percent in 2012/13 while annual core inflation reduced to 11.9 percent from 15.3 over the same period.

In contrast, annual headline inflation slightly went up to 8.5 percent from 7.4 percent a year ago as food and non-alcoholic beverages inflation rose by 2.6 percentage point offsetting a 0.9 percentage point decline in non-food inflation. Annual food & non-alcoholic beverages inflation, which was 3.7 percent in 2012/13, increased to 6.2 percent in 2013/14 while annual non-food inflation slightly declined to 11 percent from 11.9 over the same period as referred on NBE Annual Report (2013/14). Its irregularity and volatility nature has conveyed diversified macroeconomic risks and uncertainties (Eden 2012).

Haji and Gelaw (2012) had conducted research on determinants of recent soaring food inflation in Ethiopia for the period 1997- 2010 using Johansson cointegration test and Vector error correction model. They used variables like Broad money supply, Nominal exchange rate, Oil price and world Food price but they did not incorporate gross domestic product and overall budget deficit, which are important macroeconomic variables.

Another researcher Temesgen (2013) undertook research on determinants and impacts of inflation in Ethiopia using the time series data for the period of 1998 - 2010. By using variables like Broad money growth, Oil price, Real output growth and Nominal exchange rate, but They did not include overall budget deficit which is always negative in our country's context and adversely affect government purchase.

This study examines determinants of inflationary experience in Ethiopia for the period of 1974/75 to 2014/15 by using Johansen co integration approach. What makes this study different from previous study is that; first, the time series data used in previous studies were short period data; but data used for this study is time series data of long time in years**.** Secondly, in this study, budget deficit was incorporated as a determining factor of inflation in Ethiopia, assuming

that it is an important macroeconomic variable in affecting inflation since; budget deficit has been experienced in the country. And thirdly, the researcher is consider that there is unstable inflationary experience in Ethiopia since recent time, starts from 2008, when high inflation is observed in Ethiopia and as per the above trend of inflation in Ethiopia, there is volatility of inflation in an economy, which is one time inflated, and in other time deflated. Hence, it is this scenario, which motivated the researcher to undertake the study on the determinants of inflation in Ethiopia.

1.2. Objective of the Study

The general Objective of the study is to identify the determinants of inflationary experience in Ethiopia for the period ranging from 1974/75 to 2014/15.

More specifically, the study was attempted:

1) To describe inflationary trends in Ethiopia
2) To identify determinants of inflation in Ethiopia
3) To examine the short run and long run impacts of the determinants on inflation in Ethiopia
4) To provide possible policy options to control the inflationary trend in Ethiopia

1.3. Significance of the Study

This study examines determinants of inflationary experience in Ethiopia for the period of 1974/75 to 2014/15 by using Johansen co integration approach. The paper has of significant importance to policy makers (1) in their quest of providing the appropriate incentives to control inflation in Ethiopia. (2) in adding more knowledge on existing literature, since there is no much literature on Ethiopian inflation because of low inflation rate experienced in the past, according to Getachew (1996) and (3) it is used as a guideline (reference) for those researchers who want to undertake the study on the inflation.

This study will have contribution immensely to the overall goal of macroeconomic policy, in particular price stabilization policy. It will provide a range of econometric analytical tools towards a better understanding of inflation path in Ethiopia. The study will also assist in highlighting the significance of different economic variables in the determination process of inflation in Ethiopia. The study adds knowledge to the already existing literature in the area of price stability for future. This study is vital in that it will further assist in recognizing the most significant variables in the model which can be taken into consideration in formulation of anti-inflationary policies.

Therefore, this paper would have significant importance to policy makers and other scholars in their quest of providing the appropriate policies to control inflation in Ethiopia and to undertake studies further on the areas of inflation. Besides, this paper was expected to contribute in achieving one of macroeconomic policy objectives, which is maintaining stable price in an economy.

1.4. Scope of the Study

In this study the determinants of inflationary experience in Ethiopia was studied by using time series data in which annual data employed for all variables. The study was covered the time ranges from the year of 1974/75 up to 2014/15. The period is chosen because of it was best to explain the long run inflationary trend experienced in Ethiopia.

1.5. Limitations of the Paper

The main aim of the study is to examine determining variables of inflation in Ethiopia and to ascertain statistical significance of the parameters in the model. There is problem of easily getting macroeconomic variables since there is no data server in the country besides time and financial limitation which are well known problem in least developing countries. The chosen variables might not be the only variables in the economy capable of influencing domestic prices level. The study consists of only 41 observations. The reason is that no suitable data was available prior to 1974/75 and this lack of data for a sufficient period poses serious estimation challenges.

1.6. Organization of the Paper

The paper is organized as follows, Chapter one dealt with introduction, statement of the problem, objective of the study, significance of the study, delimitation an limitation of the study were discussed. Chapter two dealt with the theoretical and empirical reviews related to the inflation. Chapter three will present data description and data sources, methodology of the study, Econometric model specification, methods of data analysis which include unit root test analysis, long-run regression and short run regression analysis, whereas Chapter four deals with the data analysis and interpretation of result. Lastly, chapter five provides conclusions and policy options recommendation of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURES

2.1. Theoretical Literature review

On different ground, different economists have classified inflation in to various types, mainly into three major categories, based on rate of inflation, causes of inflation and government reaction on inflation. Based on the rate of inflation, inflation can be walking (moderate), running and jumping (hyperinflation). Moderate inflation is a mild and tolerable form of inflation. It occurs when prices are rising slowly when the rate of inflation is less than ten percent annually or it is a single digit annual inflation rates. However, when the movement of price accelerates rapidly, running inflation emerges. Running inflation is double digit annual inflation rates. It was treated as a signal for hyperinflation. Thus, when price rise more than ten percent a year running inflation occur (Mithani, 2001). On the other hand, under the hyperinflation, the price increases every movement and there is no upper limit to the price rise. The classical examples of hyperinflation are the great inflation of German after the world war first and the great inflation of china after the world war two.

Based on the causes of inflation; there are two main causes of inflation. These are increase in effective demand and an increase in production cost. The former gives rise to demand pull inflation while the later leads to cost push inflation. The demanded pull theory point out that inflation (demanded pull) might be cause, in the first place by an increase in quantity of money, when the economy is operating at full employment level. As the quantity of money increase, the rate of interest will fall and investment fortune will increase. This increased investment expenditure will soon increase the income of the various factors of production. As a result, aggregate consumption expenditures will leads to an effective increase in the effective demand with the economy already operating at the level of full employment. This will immediately raise prices, and inflationary forces may emerge. Thus, when the general monetary demand rises faster than the general supply it pulls up prices (commodity prices, as well as factors prices, in general). Demand-pull

inflation therefore, manifests itself when there is active cooperation, or passive collusion, or failure to take work against measures by monetary authorities (Ibid).

Demand –pull inflation is defined as "a situation where the total monetary demanded persistently exceeds total supply of real goods and services are pulled upwards by the continuous upward shift of the aggregate demand function" according to Hubbard (2000)

However, demand –pull inflation can also occur without an increase in the money supply. This can happen when either the marginal efficiency of capital increases or the marginal prosperity to consume rise, so that investment expenditure may rise, there by leading to raise in the aggregate demand, which will exert its influence in raising prices beyond the level of full employment already adjusted in the economy (Ibid).

The other cause of inflation is the cost – push inflation that is cause by an increase in factors of production costs. It is generally caused by two main factors, increases in wages and nears the increase in wage may be caused by a monopolistic labor union through pressure tactics. This attempt on the part of the trade unions to push up wages invariably causes cost inflation in the economy (Liol, 1974).

Cost-push inflation caused by an organized attempt on the part of industrialists to push-up their profit margins. However, the profit push elements are not so important in causing inflation as the wage push elements. Powerful trade unions get wages pushed up even without an equivalent increase in the productivity of the workers under this circumstance. The increase in wages cannot result in an increase in prices. When cost-push inflation arises in one particular industry, it soon spreads to other sectors of economy as well, the reason being that the various sectors of the economy closely linked with each other (Mithani, 2001).

Friedman (1963), who coined the term "Monetarism", mentioned several key long run properties of the economy including the quantity theory of money and the neutrality of money. Friedman proposed that inflation was the product of an increase in the supply or velocity of money at a rate greater than the rate of growth in the economy. The quantity

theory of money linked inflation and growth by equating the total amount of spending in the economy to the total amount of money in existence. The neutrality of money theory took place when the equilibrium values of real variables including the level of GDP are independent of the level of money supply in the long run. Super neutrality holds when real variables - including the rate of growth of GDP are independent of the rate of growth in the money supply in the long run period. If the neutrality of money holds then inflation will be harmless. In general, monetarist suggest that in the long run prices are mainly affected by the growth rate of money, while having no real effect on growth and if the money supply growth is higher than the economic growth, then inflation will occur (Gokal and Hanif, 2004).

Keynes' (1936) most famous work, the General Theory of Employment, Interest and Money was based on the assumption of under employment. Kibritcioglu (2002) argues that this work of Keynes' was not designed to analyze the dynamics of inflation. Keynes (1940), however, provides an alternative theory of inflation in a full employment condition, which represents a marked deviation to his previous works which serve as basis for stabilization policies. In his theory, Keynes sites short run price rigidities in the labor market as the force behind inflation. He considered inflation as means of income redistribution that "acts like a pump that transfers income from wage earners who have a low propensity to save and a low marginal tax rate to the entrepreneurial sector with a higher propensity to save and a higher marginal tax rate" (Frisch, 1983: 230). According to Keynes, unexpected increase in aggregate demand creates "inflationary gap" and leads to inflation under full employment conditions. This in turn creates unanticipated profits for firms while nominal wages remain temporarily constant. The rising profit creates excess demand in the goods market. The rise in profit compels firms to expand their production, thereby creating excess demand in the labor market. The competition for fully employed labor among firms pushes nominal wages until real wage is restored at its initial level. The increase in real wage in turn produces excess demand in the goods market and hence inflationary pressure. The interaction of the labor and goods market produces wage-price spiral that can only be reversed by checks to aggregate demand (Kibritcioglu, 2002).

Inflation has been the most hotly debated macroeconomic issue during the past two decades and numerous theories have been advanced to explain this phenomenon. Many have turned to economic theory for answers, but unfortunately, even economic theory does not offer an exact remedy to the problem of inflation. The main reason why economic theory cannot offer them an exact remedy is because many economists still holds different and sometimes conflicting view on what could be the possible causes of inflation. It is for this reason that when one turns to a discussion of the causes of inflation, one usually finds that the literature contains two major competing propositions which attempt to explain the phenomenon. First, there is a monetarist model, which sees inflation as essentially a monetary phenomenon the control of which requires as a necessary and sufficient condition control of the money supply in such a way that it grows consistent with the growth of demand for money at stable prices. Second, a structuralist model that looks at the structural set up of an economy and the supply side. Monetarist uses Friedman (1969)'s proposition, to argue that excess supply of money in an economy leads to domestic inflation. This school of thought, completely rule out the possibility that inflation could also be a result of changes in demand for, and cost of producing, goods and services in an economy. For them, changes in demand is only capable of producing only one-round shifts in prices, and this shift can only be transformed into sustained inflation if monetary growth rate is increased in order to accommodate the changes and their effects on prices. They simply argue that changes in demand are not capable of resulting into sustained price increases in the absence of monetary accommodation by monetary authorities such as central banks. Monetarist believes that increase in cost will be reflected in nominal money supply if monetary authorities increase the rate of growth in money supply to prevent a decline in output (Atta et al 1996).

Money supply growth can be transformed into inflation directly or indirectly. The direct process occurs when the increases in money supply directly ends up into the hands of economic agents such as consumers, producers and suppliers of factors of production, who will then spend it on goods and services. This sort of expenditure has the ability to exert too much pressure on aggregate demand. These upward pressures then lead to inflation. The indirect process occurs when economic agents decides not to spend directly on goods and services, and choose to instead deposit their new money into their bank accounts at

commercial banks and other financial institutions. In this instance, inflation will occur because the money that have been deposited into various bank accounts by these economic agents provides a basis for further increase in money supply; these institutions will now have the capacities extend more credits to economic agents than before. In their view therefore, the only remedy for inflation is a reduction in growth in money supply providing the assumption that says money supply is exogenously determined by monetary authorities. Perhaps, Laidler (1985) gave the most illustrated scenario of how monetary growth can influence inflation. Laidler provided a dynamic model of inflation to show that there exists a positive relationship between monetary expansion and inflation rate. His model is derived from the work of Cagan (1956), but the discrete-time formulation, which he used, follows Dutton (1971). This model begins by considering an economy in which the demand for real money balances depends on the level of real income (or permanent income) and the expected rate of inflation, the latter being given by an error-learning process. Fix the level of real income at exogenously given full employment level and specify the demand-for-money function. so that, the log of real-money balances at time t, M_t-P_t depends upon the log of (constant) real balances over Y and the level of the expected rate of inflation that ruled the end period t-1 ΔP^e_{t-1} thus:

$$Mt - Pt = w + kY - \propto \Delta P^e_{t-1} \quad \text{(I)}$$

Note that the first difference in the log of the price level, ΔPt, is equal to the proportional change in the price level that takes place between period t and defines the expected rate of inflation as:

$$\Delta P^e_t = h\Delta P_t + (1-h)\,\Delta P^e_{t-1} \quad \text{(II)}$$

Substituting equation (II) into (I), performing the $K_o$yk transformation, and rearranging the results yield:

$$P_t = hw + hkY + M_t - (1-h)\,Mt_{-1} + (1 - h + \alpha h)\,Pt_{-1} - \alpha h P_{t-2} \quad \text{(III)}$$

And because the rate of change of real income assumed equals to zero, the first difference of equation (III) gives:

$$\Delta P_t = \Delta M_t - (1-h)\,\Delta M_{t-1} + (1-h+\Delta h)\,\Delta P_{t-1} - \alpha h \Delta P_{t-2} \quad \text{(IV)}$$

For a constant rate of change in the nominal money supply, the rate of inflation in long-run equilibrium, when ΔPt equals ΔP_{t-1} and ΔP_{t-2} reduces to:

$$\Delta P = \Delta M \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (V)$$

In the long-run equilibrium, the rate of inflation is equal to the rate of monetary expansion. What equation (V) tells us is that the impact effect in period t of an increase in the rate of monetary expansion is to increase the inflation rate by the same amount. In the next period, the coefficient of ΔP and ΔM becomes relevant. They push in opposite direction but, because the latter is larger in absolute value, the inflation rate continues to rise in the next period, thus over-shooting its long-run equilibrium value. Perhaps the most important implication of the model is that it shows the inflation rate to be equal to the rate of monetary expansion only in the long-run equilibrium. This failure to equality between the inflation rate and the monetary expansion rate in the real world in no sense negates a monetary explanation of inflation.

Structuralist attempts to discredit the monetarist's opinion that inflation is a purely monetary phenomenon. According to them inflation is not a result of money supply growth but changes in structural set ups, and cost which leads to changes in relative prices in the real-world situation in which money prices especially wages, tend to be inflexible downward, which is capable of leading to inflation. For them, growth in money supply is an indication of the existence of upward pressure exerted on price by structural and cost changes (Canavese, 1982). Odada et al expressed the basic Structuralist model as follows:

$P_t = d_0 + d_1C_t + d_2D_t + u_t$

Where p_t is the rate of inflation in period t; C_t is the rate of change in an appropriate index of costs of production in period t; D_t is the is the rate of change in aggregate demand for goods and services and; u_t is a random error term. D_i (I = 0, 1, 2) are the parameters of the model. In this model, P_t is expected to vary positively with C_t and $D_{t.}$ Odada et al's expression of the structural model is driven from Canavese (1982)'s proposition, which says; structural inflation arises from three inter-related phenomena: Changes in economic structural causes changes in relative prices; some money price (especially wages) are inflexible downward or rigid downward; an induced growth in money supply occurs to

accommodate the resulting increase in the price level. Structuralist uses institutional framework to explain how changes in structures and cost leads to inflation. They argue that if for instance, trade unions agitate for higher wages by putting pressure on their employers especially governments through the threats of strikes. This demands may be greater than the increase in production that follows from the increase in wages, this may lead to increase in prices. Alternatively, the producers view the rise in wages as an increase in the cost of production, and it is passed to consumers in the form of higher prices of goods and services.

The other frequently mentioned structural characteristic, which is missing in Odada et al's model, is the relative inelasticity of the supply of food in various countries. It is argued that there is a tendency for food supply to lag behind the demand generated by the expansion of income in the non-agricultural sector, which is concomitant of economic development and that this cause food prices to rise. The other structural aspect that this school of thought advances in their debate is the exchange rate. Exchange rate policy is an important instrument for achieving broad objects of general economic policy namely; growth, internal balance, external balance and price stability.

Structuralist believes that foreign price pass-through effects are a significant cause of domestic inflation, especially for import-dependent countries. Structuralist argues that the causes of inflation must be sought in certain structural characteristics of economies, and that elimination of inflation, requires that policies be directed towards removing the various structural bottlenecks, which are said, initiate and perpetuate inflation.

2.2. Empirical Literature review

In the absence of significant analysis of inflation in Ethiopia, it is worthwhile to look at some of the inflation determinants in the world and other African countries. Taylors (1988) had tried to explain the reasons why government is open to high fiscal deficits by forwarding three arguments. First, a government deliberately favors high spending and lower taxes for political reasons to make their governance legitimate and this view is termed as the view of political deficit. Second, it is argued that structural factors like fall in term of trade (TOT), export supply and their price fluctuations etc worsen the growth of public sector deficit; this view is called the structural view. The third view, on the other

hand, argues that inflation reduces real tax revenue and thus causes high fiscal deficit. This is termed as the inflationary approach to fiscal deficit. Sometimes the situation may be described as deficit caused by a decline in real tax revenues during period of high inflation as a result levels reduce real tax revenues of the government significantly as the government collects and accounts its tax receipts in later and expenditures causing high budget deficit in the country (Carlos R. 1994).

Moser (1994) examines Nigeria's case while the model is simple OLS and the regression based on annual data. Money stock is the main determinant of inflation in Nigeria and could have effect without lags. The exchange rate is also an important factor. Rainfall is significant in the model, and fiscal and monetary policies have large effect on inflationary process.

Ubide (1997) looks at inflation in Mozambique. There is a long-run relationship between prices, money stock and exchange rates. Rainfall data is used to explain inflation in Mozambique as a proxy of output. The control of monetary expansion would have significant effect on inflation, mainly by stabilizing the exchange rate. Tight monetary policy explains a reduction of Mozambique's inflation performance.

Durevall and Njuguna (1999) analyze the dynamics of inflation for Kenya's case by using time series data for the period of 1974 – 1996 by using general error correction model. Their findings suggest that inflation inertia was a significant factor of inflation in Kenya, until exchange rate regime changed from a discretionary crawl to a floating regime with removal of price controls. They also find that money stock would not explain inflation in Kenya in the long run. The exchange rate, foreign price level and terms of trade are the main determinants.

Ghartey (2001) found fiscal deficit to be inflationary in Ghana between the periods of 1972 to 1992, because substantial amount of financing budget deficit came from printing money. He concluded that budget deficit monetization generated inflationary pressures, which created, in turn, an adverse environment for economic growth.

Nechega (2005) assessed the Fiscal Dominance hypothesis in Democratic Republic of Congo for the period 1981 to 2003, using Johansen co-integration analysis. His empirical findings depict a strong and statistically significant long-term relationship between fiscal deficit and money growth and between money creation and inflation. This supports the assumption that the fiscal dominance hypothesis applies throughout the period

Ndaferankhande and Ndholovu (2006) on Malawi and Diouf (2006) on Mali suggest that money stock and exchange rate have significant influence on inflation. Rainfall data is used as a proxy of output data. Sowa (1994) on Ghana finds that real factor, such as shortage of goods, are more dominant than monetary factor. Money could have effect on inflation without any lag. Some literature shows the existence of inflation inertia in African countries.

Woodford (2006) present interpretations of inflation inertia, which often expressed as lagged inflation in an econometric model. One can interpret lagged inflation because of indexation to the aggregate price index in the price formation. Another interpretation is that omission of lag inflation term in hybrid new Keynesian Phillips curve equation could cause spurious positive coefficient of lagged inflation term. Other possible interpretation of lagged inflation is that it is proxy for departures from rational expectation. These interpretations hardly exclude each other. In sum, the inflation literature for Africa finds existence of inflation inertia, and inertia often explains a large fraction of inflation. Money stock is an important factor of inflation though it has sometimes-insignificant effect on inflation. Rainfall data were used as a proxy of output in some countries.

Abdullah and Khalim (2009) have studied the main determinants of food price inflation in Pakistan. For the purpose of the study, they have used time series data for the period of 1972 to 2008. Johansen co-integration approach has been employed to estimate long run analysis. The analysis illustrates that money supply per capita GDP, agriculture support price, food exports and food imports are direct associated with food inflation in Pakistan.

Moseyed and Mohammad (2009) have find out the main determinants of inflation in Iran. They have used the time series data from 1971 to 2006 in their study. The study uses Autoregressive distributed lag model to discover the long run estimates. The study investigate that money supply, exchange rate, gross domestic product, change in domestic prices, foreign prices are presenting the effect of Iran or Iraq war on Iran's economy, and all are positively contributing to the domestic prices in Iran.

Oladipo and Akinbobola (2011) used Granger causality pair-wise test in determining the causal relationship between budget deficit and inflation. The results showed that there was no causal relationship from inflation to budget deficit, while the causal relationship from budget deficit to inflation exists in Nigeria

Getachew (1996) is his study of inflation in Ethiopia used two models. In the first model, monetary model has been used using monthly data from July 1990/91 to February. In the second model, a long run model, an assessment of annual data from 1972/73 up to 1990/91. The results from the first model show that in the short run money stock was found to be significant determinant of inflation in Ethiopia. The long run model had shown that in the long run inflation in Ethiopia is determined by supply factors. He also recommends that in the short run controlling money supply is important to control inflation while in the long run he suggested in removing the bottleneck of the supply side of the economy.

Yohannes (2000) in this study of inflation in Ethiopia used quarterly data from 1967/68 to 1998/99. Yohannes used three econometrics models; monetarists, demand and supply side model and structuralism model. Results from the first model show that money supply is a cause of inflation in the short run. The results from the second model show that inflation inertia and actual world inflation affect Ethiopian inflation in the short run. In the last model, structural variables have been found to explain both short run and long run inflation in Ethiopia while inflation inertia, money supply and world inflation explain inflation only in the short run. Based on his findings, He recommended that the primary concern of policy makers should not be to control inflation, rather to give priority to the supply side. He also adds that demand side factors should not ignored but must be delegated secondary

importance. From the studies reviewed on Ethiopia; in the short run money supply, inflation inertia and actual world inflation have been found to affect inflation while in the long - run Ethiopian inflation is attributed to structural factors, mainly to the bottlenecks of the agricultural sector, and to monetary factors.

Zekarias M. (2004) examines the effect of monetary shocks on Ethiopia's economy. In an error-correction model, money stock explains inflation in both the long run and short-run. The result of the estimate suggests that there is inflation persistence in Ethiopia. Based on simulation by using the model, a monetary shock, such as contraction of domestic credit, would decrease the price level.

There is some literature on the determinants and situation of recent Ethiopia's inflation. Klugman (2007) examines food inflation in Ethiopia based on microanalysis. She suggests that recent food inflation can largely explained by overall inflation, which related to increase of money stock. The analysis is based on accounting equation, not on an econometric estimation. It also provides some other explanations of the high inflation. For example, a shift from food aid to cash aid could affect the price of food. Activities of cooperatives would also affect the price level by improving the bargaining power of farmers. It points out the possibility that increasing marketization of agricultural production would increase demand for money without necessarily having inflationary effects. Velocity of money may have increased by 16% during the period from March 2002 to July 2006, suggesting shifts in the demand for money, due to structural changes in the economy, such inflationary expectations, or other factors.

Ahmed (2007), 'Structural Analysis of Price Drivers in Ethiopia' and concludes "structural changes" such as increasing bargaining power of farmers and monetary expansion are the main reasons of inflation in Ethiopia. He argues that monetary expansion largely dictated by credit expansion in both the public and private sector. Credit expansion explained, on the public side, by decline in foreign finance flow, including a reduction foreign aid. At the same time, he points out private sector credit expands substantially, which supported by negative real interest rate and increased investment demand.

Ayalew (2007) constructs a macroeconomic model and simulates impact of various shocks on inflation. He used annual data from 1970 to 2006, which limits the interpretation of the analysis due to significant changes of the economy. He suggests that inflation in Ethiopia is affected by real GDP, money stock, foreign prices, and the exchange rate. The coefficient of lagged inflation in the food price equation implies the existence of inflation inertia in Ethiopia.

Mehari and Wondafrash (2008) investigated the impact of money supply on inflation in Ethiopia. The researchers used quarterly data from the first quarter of 1996/97 until the second quarter of 2006/07. They used independent models for the narrow money supply and broad money supply. The result from their work reveals that money supply has a direct impact on inflation. The impact of narrow money supply, which includes currency outside banks and net demand deposits found to be greater than that of broad money supply, which includes narrow money supply and quasi money.

CHAPTER THREE
DATA SOURCE AND METHODOLOGY

3.1. Sources of data and Collection Techniques

To achieve the basic objective of the study, researcher has used secondary data and the necessary data required for the study were obtained from different secondary data sources. such as publications, annual bulletins and reports by concerned institutions like Ministry of Finance and Economic Development (MoFED, 2014/15), Ethiopian Economic Associations(EEA, 2014/15), National Bank of Ethiopia (NBE, 2014/15) and World Bank .

Table 1: Sources of data

S/N	Variables	Sources
1	Consumer price Index (CPI)	NBE
2	Real Gross Domestic Product (RGDP)	NBE
3	Broad Money Supply (M2)	NBE
4	Overall Budget Deficit (OBB)	EEA
5	Real Effective Exchange Rate (REER)	WB

3.2. Method of Data Analysis

Data analysis part would have constitute both descriptive and econometrics regression analysis. The descriptive method was used to assess trends of inflation within specified time period 1974/75 to 2014/15, whereas, the time series econometric technique was used to estimate the long run and short run relationship among determinant variables of inflation in Ethiopia. The researcher was conducted unit root test by using Augmented Dickey Fuller (ADF) test and Phillips-Perron Test (PP) in order to test for the stationarity of the data. Because, stationarity test is very important in time series data and after stationarity test was conducted by using ADF and PP test, the next step was to determine optimal lag length selection. After the above tests were fine, the researcher would proceed to Cointegration

test by using Johansen Cointegration approach to test whether variables have long run relationship and co integrated of the same order.

3.3. Model Specification

The first and most important step the researcher must have to take in attempting the study of any relationship among variables is to express this relationship in mathematical form that is to specify the model, with which the economic phenomenon will be explored empirically. This is termed as specification of the model or formation of the maintained hypothesis.

Various functional models have been used in multivariate regression analysis. The researcher has used functional analysis to reveal the quantitative relationship between variables and set of explanatory variables. To determine the effects of the various factors such as Money supply, real effective exchange rate, Overall Budget Balance and Real Gross Domestic Product.

This study was assessed the determinants that influence over general price level. Based on this information, the researcher is writing the model. My model is akin to Sisay M. (2008) and presented as follows:

$$INF = f(M2, REER, OBB, RGDP) - (I)$$

Where INF - represented by Consumer Price Index (CPI)

M2 – Broad money supply a stance of monetary policy

REER – Real Effective Exchange Rate

OBB – Overall Budget Balance

RGDP - Real Gross Domestic Product as a measure of fiscal policy

The multivariate linear regression econometric model was specified as follows:

$$\underset{}{\text{CPIt}} = \underset{}{\beta 0} + \underset{(+)}{\beta 1\ \text{M2t}} + \underset{(+)}{\beta 2\ \text{RGDPt}} + \underset{(-)}{\beta 3\ \text{REERt}} + \underset{(+)}{\beta 4\ \text{OBBt}} + \varepsilon \text{t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(II)}$$

Where, εt is the error term

Transforming the model into logarithm form, the following econometric model was taken place:

$$LNCPIt = \beta 0 + \beta 1LNM2t + \beta 2LNGDPt + \beta 3LNREERt + \beta 4LNOBBt + \varepsilon t \ldots\ldots (III)$$

The Parameter β_0, β_1, β_2, β_4 would have expected to have positive sign, which postulates a positive relationship money supply, overall budget balance and real GDP growth. In addition to this, β_3 would have a negative sign, which postulates a negative relationship between inflation and real effective exchange rate.

3.4. Estimation Techniques

The estimation techniques was based on secondary data analysis of Johansen co-integration analysis framework, which includes unit root test, lag length selection, and co-integration test, identification of long run model, short run dynamics of vector error correction model and all diagnostic test of validity. If variables have no Cointegration in the long run, we use unrestricted vector autoregressive (VAR) model. However, if the variables have long run relationship, multivariate vector error correction model (VECM) is appropriate to use (Engel and Granger, 1987). All the analysis in the study was conducted by using E-views 6 version software package.

3.5. Unit Root Test

Stationary stochastic process has received a great deal of attention and scrutiny by time series analysis. Broadly speaking a stochastic process 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 disturbance or gap or lag between the two time periods and not the actual time at which the covariance is computed. On the other hand, if a time series is not stationary in the sense that a time series will have a time varying mean or a time varying variance or both (Gujarat, 2003). Therefore the paper uses the unit root test in order to test the stationary or non-stationary of time series data. A commonly applied technique to test for existence of a unit root in the data is the Augmented Dickey Fuller (ADF)

The pre-requisite of Co integration test is the stationarity of each individual time series over the sample period. Hence, before turning to the analysis of the long-run relationships between the variables we check for the unit root properties of the single series, as non-stationary behavior is a prerequisite for including them in the Co integration analysis. The modeling procedure of unit root test of the series at their level is described as follows:

$\Delta CPIt = \alpha 0 + \alpha 2CPIt - 1 + \sum_{i=1}^{p} \delta i \Delta CPIt - i + \varepsilon i$ ……..…… (2a)

Where $CPIt$ is the variable of choice; Δ is the first difference operator αi (for i = 1, 2… 4); and δi (for i = 1, 2 …p) are constant parameters; and εi is a stationary stochastic process. P is the number of lagged terms chosen by Akaike Information Criterion (AIC) to ensure that εi is white noise. The hypotheses of the above equation form are as follows:

H0: αi = 0, i.e there is a unit root – the time series is not stationary
H1: αi # 0, i.e there is no unit root – the time series is stationary

If the calculated ADF test statistic is higher than McKinnon's critical values, then the null hypothesis (H0) is accepted this means that a unit root exists in CPI_{t-1} and ΔCPI_{t-1}, implying that the series are non-stationary or not integrated of order zero, i.e., I (0). Alternatively, the rejection of the null hypothesis implies stationarity of the underlying time series. Failure to reject the null hypothesis leads to conducting the test on the difference of the time series, so further differencing is conducted until stationarity is achieved and the null hypothesis is rejected (Harris, 1995). Hence, in order to determine the order of integration of a particular series, equation (2a) has to be modified to include second differences on lagged first and *k* lags of second differences. This is as follows:

$\Delta 2CPIt = \varphi \Delta CPIt - 1 + \sum_{i=1}^{p} \theta i \, \Delta 2CPIt - 1 + \mu t$ … … … … … … … … … … … … … … … … (2b)

In this case, the hypotheses to be tested are:

H0: $\varphi_1 = 0$, i.e there is a unit root – the time series is not stationary
H1: $\varphi_1 \# 0$, i.e there is no unit root – the time series is stationary

If the time series are stationary in their first differences (that is $\varphi_1 \neq 0$), then they can be said integrated of order one, i.e., I(1); if stationary in their second differences, then they are integrated of order two, i.e., I(2). The order of integration of the variables in equations (2a) and (2b) is investigated using the standard Augmented-Dickey-Fuller (ADF) [Dickey and Fuller, 1981] and Phillips-Perron (PP) [Phillips and Perron, 1988] unit-root tests for the presence of unit roots. An important aspect of empirical research based on VAR is the choice of the lag order, since all inference in the VAR model depends on the correct model specification. Hence, the optimal lags required in the cointegration test is chosen using the most common traditional information criteria being the Akaike Information Criteria (AIC), Schwarz Criterion (SC), Hannan and Quinn's (HQ), Final Prediction Error (FP and the likelihood ratio (LR).

3.6. Cointegration Test

Using the stationarity properties of the data series, tests for co-integration of the variables is conducted because co-integration necessitates that all variables of a model must be integrated of the same order. A test for co-integration indicates stable long run relationships among non-stationary economic variables. Therefore, co-integration test is designed to check for the existence of co-integrating relationships between non-stationary variables. Just testing the stationarity of the residual term makes the test for the presence of co-integration and then, the method established by Johansson co-integration will involves examining the stationarity of the residuals from the long-run relationship.

VAR based Johansson cointegration test is the most widely used approaches to test cointegration among variables. In contradict to other approaches like Engle-Granger test that allows only single co integration relationship test at one time; Johansen approach permits to test one or more co integrating relationship among variables in one or more equations and also it has the many advantages. 1. It permits the existence of co integration among series of variables without imposing any bias on estimates. 2. It used to identify more than one co integrating vector existence at one time. 3. It helps us to estimate long run relationship between non-stationary using VECM (Johansen and Juselius, 1990). Thus, in this study Johansen (1988) Co integration analysis will be performed to investigate long-term relationship between inflation and real economic

growth, money supply, and official exchange rate and overall budget deficit in Ethiopia. The purpose of the Co integration test is to determine whether a group of non-stationary series is co integrated or not. The vector autoregressive (VAR) model as considered in this study is:

$CPI_t = A_1CPI_{t-1} + A_2CPI_{t-2} + \ldots + A_pCPI_{t-p} + BX_t + \square_t$ ..... (3)

Where CPI_t is a k Vector of non-stationary I (1) endogenous variables; X_t is a d vector of exogenous deterministic variables. $A_1 \ldots A_p$ and B are matrices of coefficients to be estimated and $\square_t$ is a vector of innovations that may be contemporaneously correlated; but, they are uncorrelated with their own lagged values and uncorrelated with all of the right hand side variables. Since most economic time series are non-stationary, the above stated VAR model is estimated in its first-difference form as:

$$\Delta CPIt = \prod CPI\ t-1 + \sum_{i=1}^{p-1} \sigma i \Delta CPIt - i + \beta Xt + \varepsilon i \quad \ldots\ldots (4)$$

Where $\prod = \sum_{i=1}^{p} Ai$ and $\sigma = -\sum_{j=i+1}^{k} Aj$

The Johansen approach to Co integration test is based on two test statistics, viz., the trace test statistic, and the maximum eigenvalue test statistic, as suggested by Johansen (1988) and Oseterwald Lenum (1992).

Trace Test Statistic: The likelihood ratio statistic (LR) for the trace test (λ_{trace}) as suggested by Johansen (1988) can be specified as follows:

$$\lambda trace(r) = -T \sum_{i=r+1}^{k} \log (1 - \hat{\lambda}\, i) \quad \ldots\ldots (5a)$$

Where $\hat{\lambda}$i is the n^{th} largest eigenvalue of matrix Π and T is the number of observations. In the trace test, the null hypothesis is that the number of distinct co integrating vector(s) is less than or equal to the number of co integration relations (r). In this statistic $\lambda trace$ will be small when the values of the characteristic roots are closer to zero.

Maximum Eigenvalue Test: The maximum eigenvalue test as suggested by Johansen (1988) examines the null hypothesis of exactly r co integrating relations against the alternative of n+1 co-integrating relations with the test statistic:

λ_{Max} (r, r+1) = -T ln (1-$\hat{\lambda}_{r+1}$) ..... (5b)

Where $\hat{\lambda}_{r+1}$ is the $(r+1)^{th}$ largest squared eigenvalue. In the trace test, the null hypothesis of r = 0 is tested against the alternative of r+1 co integrating vectors. If the estimated value of the characteristic root is close to zero, then the λ_{trace} will be small.

After detecting the number of co integration, the normalized co-integration coefficients of inflation and its determinants along with the test of significance of the variables is examined by imposing a general restriction on each variable($\beta i = 0$) in the regression models. Finally, we apply the Wald test on the various null hypothesis-involving sets of regression coefficients.

Johansen (1988) and Johansen and Juselius (1990) have proposed few steps for reliable results discussed below.

1. For the application of Johansen Co-integration approach, all time series variables involving in the study should be integrated of order one [I(1)].
2. At second step, lag length would be chosen using VAR model on the basis of minimum values of Final Predication Error (FPE), Akaike Information Criterion (AIC), and Hannan and Quinn information criterion (HQ).
3. At third step, appropriate model regarding the deterministic components in the multivariate system are to be opted.
4. Johansen (1988) and Johansen and Juselius (1990) examine two methods for determining the number of co -integrating relations and both involve estimation of the matrix $\prod$. Maximal Eigen value statistics and trace statistic are utilized in 4^{th} step for no of co-integrating relationships and also for the values of coefficients and standard errors regarding econometric model.

CHATER FOUR
DATA ANALYSIS, DISCUSSIONS AND INTERPRETATION OF RESULTS

4.1. Descriptive Analysis

In this descriptive analysis part the trend of the variables were discussed. This section was revealed the trends followed by various variables incorporated in the model with that of the trend of consumer price index or inflation. The aim of the trend analysis is to serve as a base for the basic analysis that was based on the econometric results.

Table 2: Summary of descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Lncpi	41	3.01	0.88	1.41	4.87
Lnrgdp	41	11.18	0.83	10.49	13.53
Lnm2	41	9.55	1.61	7.04	12.82
Lnobb	41	4.99	0.80	3.61	6.01
Lnreer	41	4.91	0.37	4.4	5.63

The average inflation rate for the period 1974/75 up to 2014/15 was 3.01 percent. Targets have been set on both the levels and growth rates of money supply, real gross domestic product, real effective exchange rate and overall balanced budget. A trend in the general level inflation rate has shown that the highest rate in the country was recorded since 2008/09 which (36.25) and in 2011/12 (33.5). It is possible to curb the inflation from further escalating if not possible to monitoring at single digit. The increment in the general price level for the year is the reflection of both the increase of inflation in the food component and non –food component. During the fiscal year under review, the food inflation remains high at 18.9 percent when it compared to the level of 14.0 percent in the preceding fiscal year. Similarly during the fiscal year Ethiopian Millennium year (2000 E.C) the country level general infraction rate stood at 25.3 percent which is 9.5 percentage points above 2006/07 fiscal years inflation representing more than 50 percent of the general consumer price index, it was clearly observed that the food index sets the pace of general inflation in the country. The food infraction stood at 34.9% in 2007 /08 fiscal year, which is 17.4 percentage points

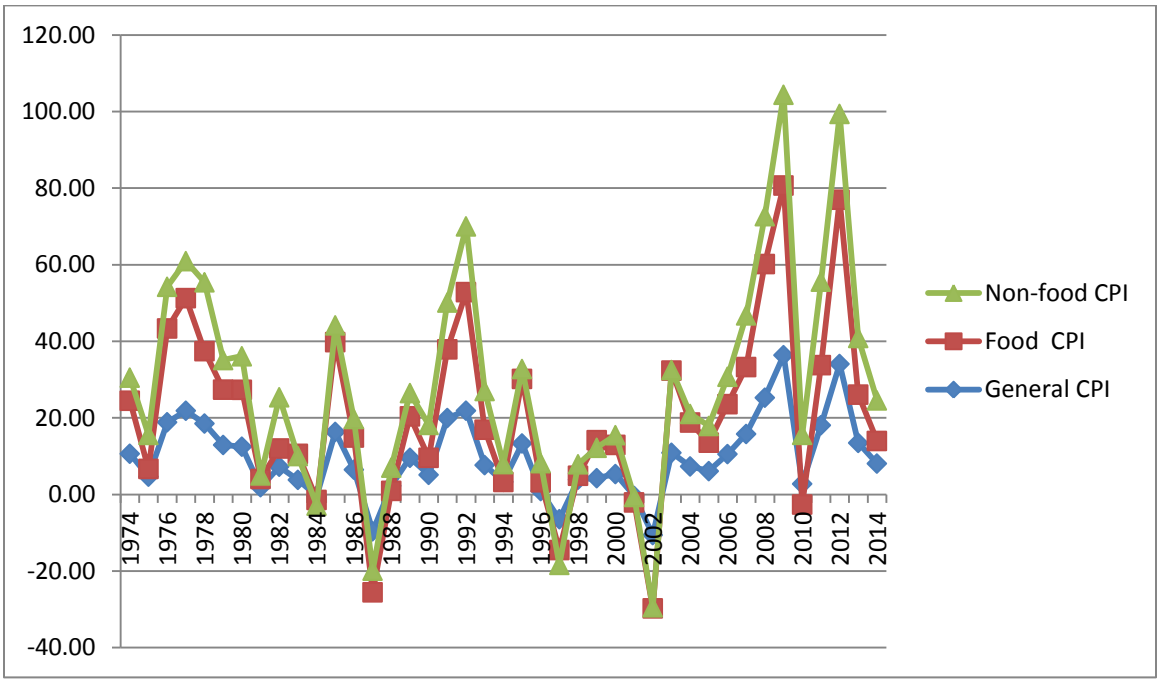
above the previous fiscal years inflation. During the same period of time the non-food inflation rate stood at 12.5 percent which is about 1 percentage point below last year's inflation the other hand the country level consumer price index (CPI) reported using December 2006 retail prices of goods and services as a base period. The new based CPI incorporates non- food index as an independent group and it has then major groups. The new based CPI weights for and non food is 57% and 43% respectively. During the last three consecutive fiscal years, the country level general inflation rate calculated on the twelve months moving average base was more than ten percent. In 2003/04 and 2004/05 fiscal years, the country level general inflation rate was 7.3 and 6.1 Percent respectively.

4.1.1. Inflation Development and Trend in Ethiopia

Trends of inflation show the change in the inflation over the years. Looking at the trends of the inflation would enable the reader to understand the change of inflation during the study period over the years. Further, it observes what goes wrong or right at a particular year. Regarding inflation, the government and other international institutional reports indicate that the country has been experiencing the higher price rise since 2004. In 2000 and 2001, the inflation rate was negative 7.2 and 8.5 percent respectively. In 2002, the inflation rate increased to 15.1 percent. However, the recovery of the agricultural production and general economic growth has reduced the inflation rate to 6.1 percent in 2004. In 2004, the inflation rate declined by 60 percent as compared to 2002. After 2004, the inflation rate could not show any sign of declining until 2008. In 2008, the inflation reached its highest 36.4 percent. However, in 2009/10 the rate was reduced to 2.8 percent. In 2010/11, the rate was 18.10% that shows again inflationary situation. In 2011/12, it was continue to be increased and reached 34.10%, in 2012/13 it was become 13.5%, in 2013/14 the rate was 8.1% and in 2014/15 continued to be decline, which reached at 7.7% that is single digit inflation. Therefore, from this trend analysis, in inflation in Ethiopia shows volatility behavior since recent time starts from 2002/2003.

The trend analysis revealed that General CPI showed a similar trend with food inflation and non-inflation, they depicted the trend that one time increased and in other time, decreased. Meaning it seems that there is volatility of inflation. Non-food inflation is high than general CPI and food CPI.

Fig 1: Inflation General, Food and Non – food



Source: Drawn by Using Data from National Bank of Ethiopia

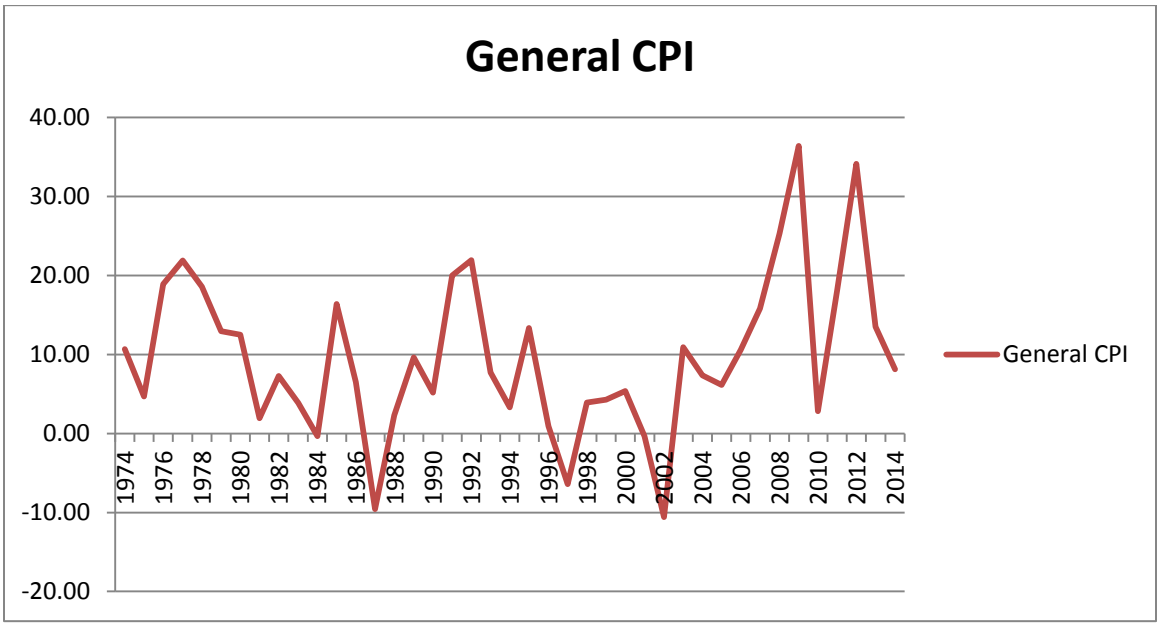
General CPI was having almost similar trend with that of CPI Food and CPI non-food under the period scoped for this study. CPI Food and Non Food were having an upward trend, which was similar with that of CPI General, CPI food and non-food gradually in one time increased and in other time decreased under the study period from 1974/75 to 2014/15 reaching a maximum of 36.40, 44.30 and 23.70 respectively.

The figure reveals that CPI General, CPI Food and CPI non-food inflation were having similar trends. This shows the influence of CPI Food and non-food inflation on the trend of CPI General. This influence may be due to the huge share of CPI food (57.01 %) in CPI General. The stability of the price of Non Food products may have contributed to the higher impact followed by CPI Non Food on the trend of CPI. Recently, after CPI Non Food was influencing the trend of CPI. This may come from the rise in petroleum and internationally traded commodities such as cement and consumer goods etc.

Inflation in Ethiopia during 1974/75 to 2014/15 showed a fluctuating behavior characterized by successive ups and down. The impact of CPI food and non-food on the trend of general

CPI is also revealed by the similar trends of general and food inflation. Inflation non-food has also showed ups and down but its impact on influencing the trend of inflation was higher than that of food inflation. However, after 2005/06 non-food inflation starts to have similar trends to that of general inflation and influencing the trend of general inflation.

Fig. 2: General Inflation Rate



Source: Drawn using data collected from NBE

The similar trend of General and Food inflation comes from the huge share of food items in the CPI. The recent rise of non-food inflation due to rise in the prices of petroleum and other internationally traded commodities may have contributed to the similar trends of CPI general and non-food. As the above figure reveals, the year 2008/09 was peculiar in that the highest inflation rates were revealed. The year 2008/09 with an inflation rate of 36.40 was the highest in the period under study, while the year 2002/03 with an inflation rate of -10.57 was the lowest. The highest inflation in 2008/09 was due to the lower output growth while the lower inflation in the second quarter was attributed to the highest output growth revealed in the year.

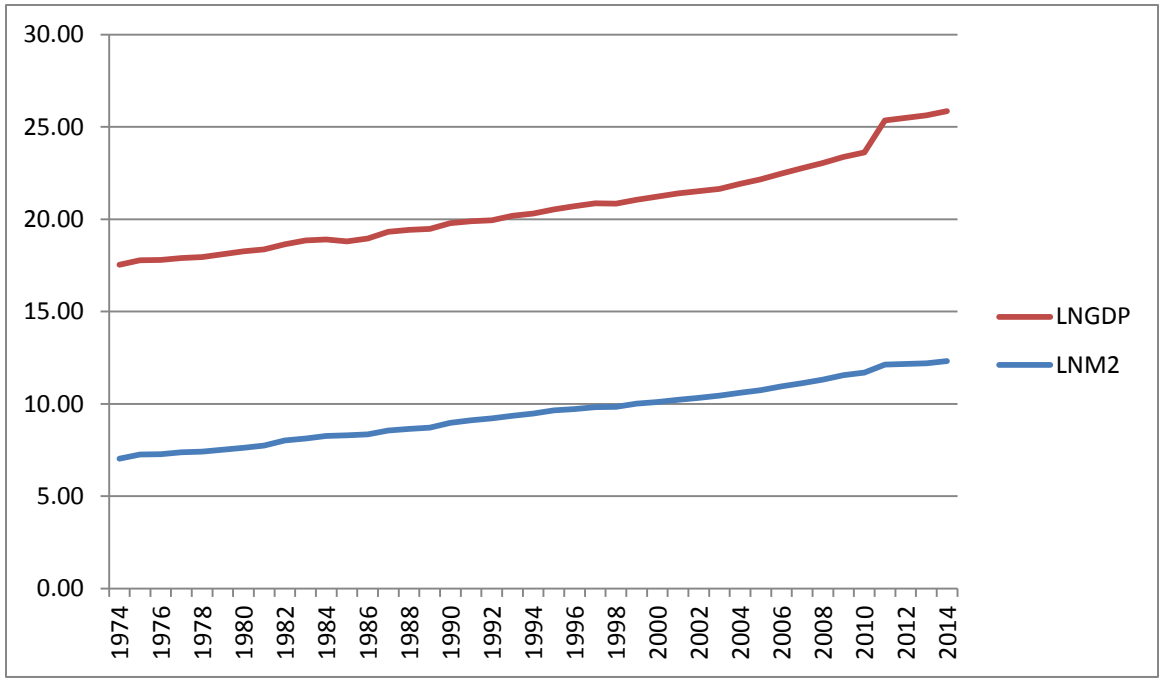
4.1.2. Inflation and broad money supply growth trends

The Quantity Theory of Money states that increase in money supply has a positive and direct impact on inflation. Looking at the trend of broad money supply, broad money supply and inflation reveals that both variables were moving in the same direction during the period under study.

One of the key variables used in this analysis is Broad money supply (M2). M2 is defined as include currency in circulation, transferable and other deposits of the other non-financial corporation. Fig 2 illustrates the relationship between the inflation rate as measured by the rate of change in the consumer price index and the growth rate of the M2. According to economic theory, if the money supply grows faster than the real GDP, then accelerated inflation can occur due to more money chasing a given quantity of goods and services. Thus, we might expect a direct relationship between M2 and inflation rate.

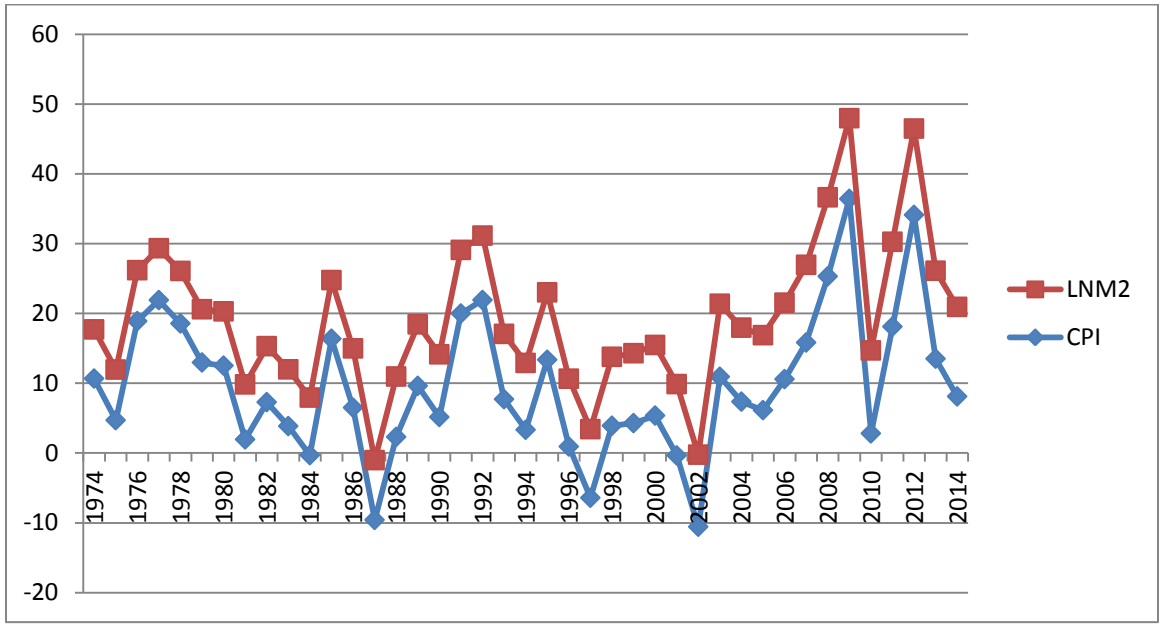
As fig 3b revealed, though moving in the same direction, M2 growth rate was greater than inflation in all years. This shows the presence of expansionary monetary policy in the country. Most strikingly, money supply (M2) was also higher than that of real output growth in almost all years. The higher real GDP than that of inflation during the study period implies the strong impact of real GDP on inflation in Ethiopia.

Fig. 3a: Broad money supply (M2) and real GDP



Source: Drawn using data from NBE

Fig.3b. Comparative trends between inflation rate and monetary growth



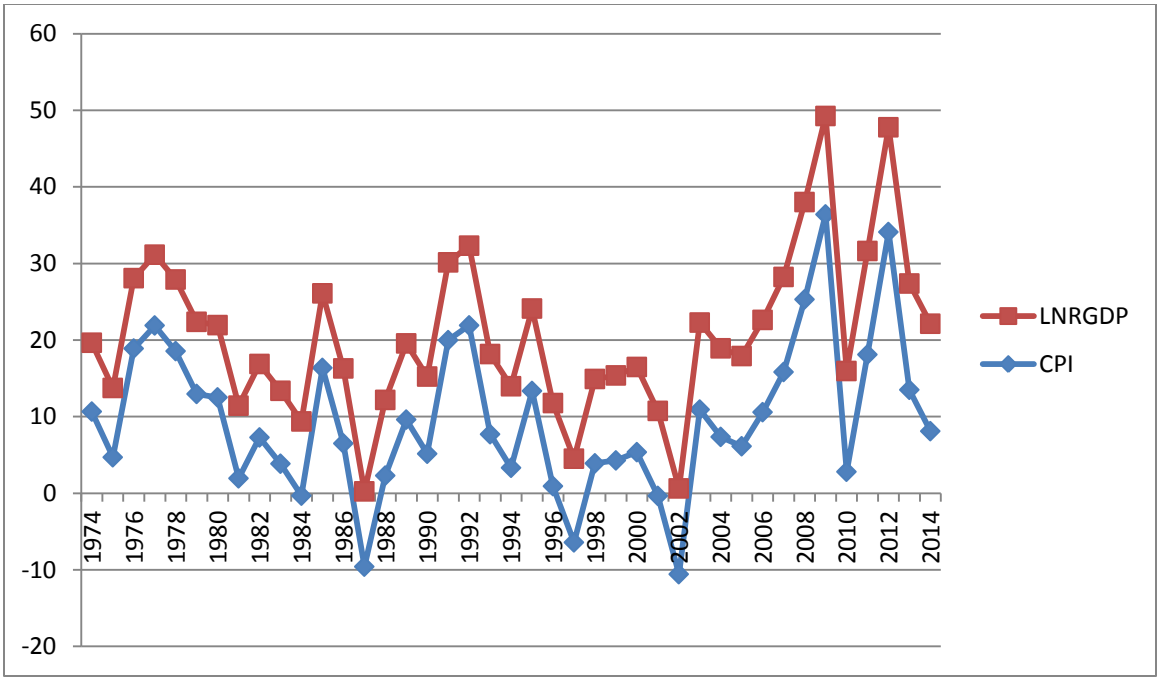
Source: Drawn using data from NBE

The graph indicates that periods of high monetary growth were followed by high inflationary trends. Thus, confirming our expectation in line with the economic theory; that there is a positive relationship between money supply growth and inflation rate throughout the period under study.

4.1.3. Inflation and Real GDP Trends

According to economic theory, inflation and real gross domestic product goes in the same direction. During 1974/75 to 2014/15, inflation and real GDP have been moved in same direction most of the time, which is in accord with theoretical expectations.

Fig 4: Inflation and real GDP trends



Source: Drawn Using Data from NBE

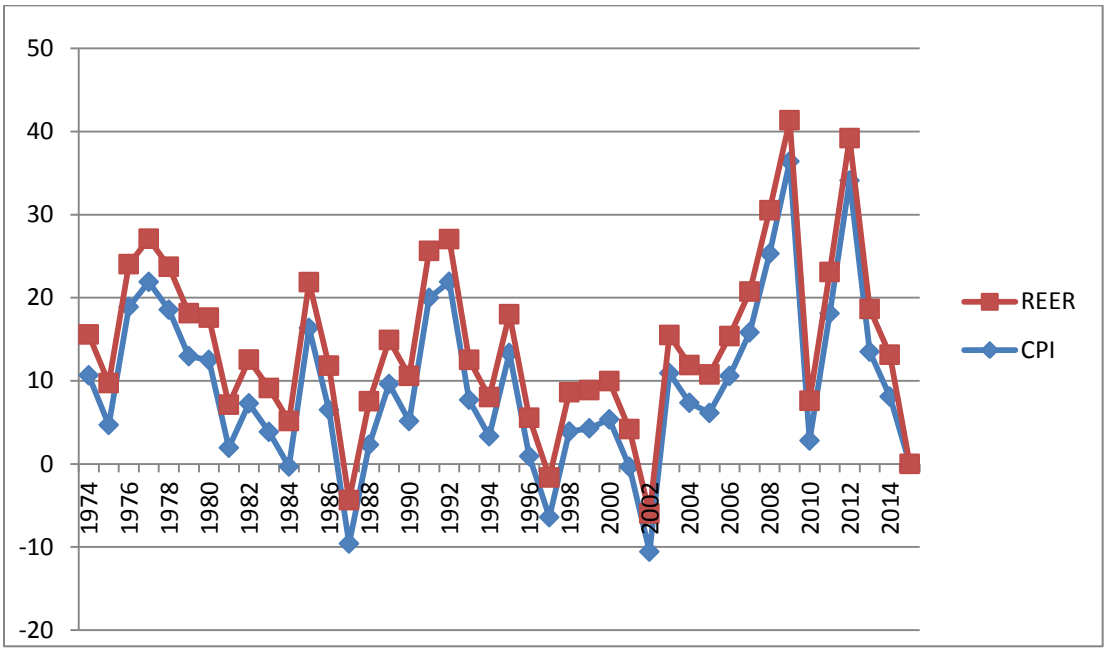
The above figure reveals that in all years real GDP exceeds inflation with high differences. The figure also reveals the close association of inflation and real GDP. The highest inflation during the study period occurred when output growth was the high. Similarly high inflation rate occurred when output growth was the maximum.

The strong and positive relationship between inflation and output is due to the dominance of Agriculture. As a result, increased output is accompanied by increased food production; food is the major shareholder in the CPI, which intern results in increasing inflation

4.1.4. Inflation and real effective exchange rate trends

The trend of real effective exchange rate has been varying with inflation. This vary trend of real exchange rate may have resulted in the high impact of its trend on the trend of inflation minimum

Fig. 5. Real Effective Exchange Rates and inflation



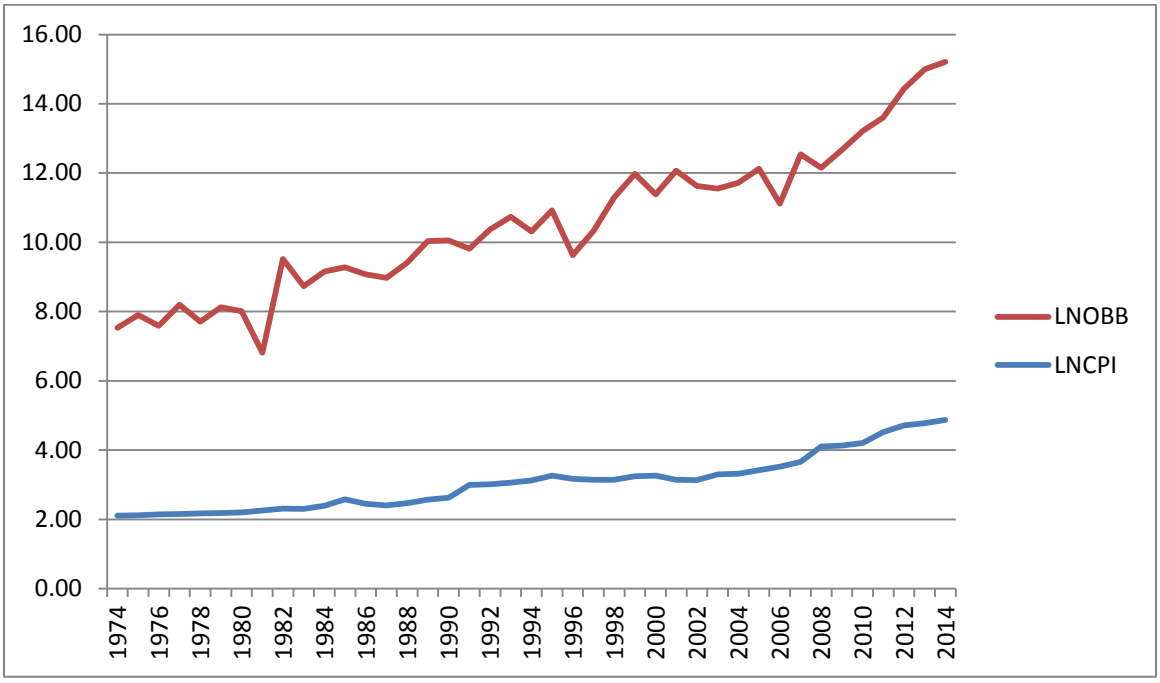
Source: using data collected from world development indicators and NBE respectively.

Real effective exchange rate is defined as the number of units of foreign currency that can be purchased with one unit of domestic currency (Gottheil, 1996). This analysis uses the Ethiopian and USA exchange rate; this is the number of US dollar that can be purchased with one Ethiopian ETB. Unlike the exchange rate arrangement that exists between Ethiopia and its neighboring country, the exchange rate that exists between Ethiopia and United States is determined strictly by the demand for and supply of the nation's currency and it is known as a floating exchange rate. This study is concerned with the effect that movements in the exchange rate could have on the levels Inflation, M2 Growth Rate of price in the country. This is movement is often referred to as either an appreciation or depreciation. An appreciation occurs when there is a rise in the price of a nation's currency relative to a foreign currency. Moreover, depreciation occurs if there is a fall in the price of a nation's currency relative to a foreign currency. According to theory, depreciation could have both positive and negative effects on the economy. On the negative side, a depreciating currency results in high import prices and these high import prices leads to increases in domestic prices and eventually inflation. On the positive side also, a depreciating currency makes domestically produced goods more competitive on the export market and could increase the demand for those goods.

There are more benefits to this movement, such as increases in employment among others. As far as Ethiopia is concerned, throughout most parts of the 1990s, the monetary policy continued to be oriented towards exchange rate stabilization through the maintenance of the fixed exchange rate between the Ethiopia ETB and the US dollar. This has been the objective of the monetary policy over the years and has proved to be effective in attaining the ultimate objective of price stability. The data indicate that the change in the Ethiopia dollar exchange rate against the United States remained relatively stable from 1974/75 to 2014/15 but started to appreciate in 1998, and heavily appreciated in 2001. It started to depreciate again in 2002. Fig 5 above shows an existence of a positive relationship though out the period of the study.

4.1.5. Inflation and balanced budget trends

Fig 6. Overall balanced budget and inflation



Source: Drawn using data collected from EEA and NBE respectively

As seen from the above figure 6 both overall budgets deficit growth and inflation growth rate is go to the same direction under the period of study 1974/75 to 2014/15. However, the growth of overall budget deficit is highly greater and shows volatility behavior than growth rate of inflation.

4.2. Econometric Analysis

4.2.1. Unit root test

To proceed to estimate a more specific relationship between inflation and its determinants, the researcher has to be sure that the time series data is stationary. Most economic data are non-stationary (random walk) at level. There exists a trend element in which both the dependent variable and independent variables grow up ward or decreases down ward continuously together.

Running ordinary, least squares (OLS) on this data give higher R^2, which seems as the explanatory variables well explain the regressed. However, the higher magnitude of the multiple coefficient of determination (R^2) arises from spurious (false) relationship between the dependent and independent variables. If the time series data are found to be non-stationary most of classical assumption for econometric estimation will be violated clearly, if available data mean and variances will change over time. In such cases, econometric results may not be ideal for policy making because the OLS estimation gives inconsistent estimates (Gujarati, 1995). In the past, the popular method to overcome the problem was to estimate the rates of changes between variables instead of using their absolute levels. However, this does not capture the long-run information of the model.

The common tests used are Augmented Dickey Fuller (DF) and Phillips-Perron (PP) tests. These tests are required to ascertain a number of time variables must be differenced to arrive at stationary. A time series data are said to be differenced of ordered 'p' if it become stationary after differencing it 'p' times. Economic variables stationary from the outset are I (0) series and a variable that requires to be differenced once are stationary at I (1) series (Gujarat, 1995).

Table 3: ADF test for unit roots

Variables	At level		At first difference		Order of integration
	With C	With C and T	With C	With C and T	
LNCPI	1.8	-0.757	-5.435*	-5.949*	I(1)
LNM2	1.27	-1.523	-6.764*	-7.235*	I(1)
LNRGDP	1.888	-0.046	-5.569*	-6.327*	I(1)
LNREER	-1.058	-1.452	-5.053*	-4.984*	I(1)
LNOBB	-0.246	-1.519	-11.098*	-11.039*	I(1)

Note: ** and * indicate level of significance at 1% and 5%

Table 4: PP test for unit roots

Variables	At level		At first difference		Order of integration
	With C	With C and T	With C	With C and T	
LNCPI	1.8	-0.82	-5.447*	-5.941*	I(1)
LNM2	1.27	-1.523	-6.764*	-7.235*	I(1)
LNRGDP	3.65	0.394	-5.572*	-6.397*	I(1)
LNREER	-1.16	-1.62	-5.083*	-5.016*	I(1)
LNOBB	-0.856	-1.516	-12.475*	-13.324*	I(1)

Note: ** and * indicate level of significance at 1% and 5%

The unit root test results indicated in the above table 3 and 4, indicated that the unit root of null hypothesis are rejected for all the variables at 5% significance level. These all variables are stationary at their first difference with constant and with constant & trend by using the augmented dickey fuller (ADF) and Phillips-Perron unit root test (PP). The stationarity of data is the prerequisite for the next steps in time series analysis. Hence, after stationarity of data confirmed, the next step is lag length selection.

4.2.2. Lag length order selection

Table 5: Lag length selection order criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-88.04939	NA	9.22e-05	4.677336	5.112808	4.974000
1	120.7642	351.6861*	5.87e-09	-4.344811	-3.484232	-4.317084
2	137.5514	23.85551	9.72e-09*	-4.777064*	-3.974621*	-4.501516*
3	156.4090	21.83504	1.63e-08	-4.021524	-0.573974	-2.794912

* indicates lag order selected as 2 by the criterion

FPE: Final prediction error test statistic (each test at 5% level)

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

As it can be seen from the above table 4 result, lag length selection of two was used for this multivariate model, because the Hannan–Quinn information criterion (HQIC) method, Schwarz information criterion (SBIC) method, Final prediction error (FPE) method and Akaike

information criterion (AIC). All are support the same lag length as indicated by the "*" in the output. Except LR sequential modified LR test that selects lag (1) order.

4.2.3. Co-integration Analysis

The results of the Johansen co-integration tests, reported in table 6 below indicate that there exists a stable long-run relationship between consumer price index and its determinants. Both the trace statistics test and the maximum eigenvalue statistics test reject the null hypothesis of no co-integration between the variables in long run at conventional level (0.05) critical values. Therefore, accepting of alternative hypothesis tells us, that there is long run relationship among variables. Specifically, the results show that there is one co-integration vector in this multivariate model.

Table 6. Unrestricted Cointegration Rank Test (Trace and Maximum Eigen Value)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.626588	77.34909	69.81889	0.0111
At most 1	0.432640	38.93124	47.85613	0.2630
At most 2	0.246729	16.82758	29.79707	0.6528
At most 3	0.093150	5.777720	15.49471	0.7216
At most 4	0.049121	1.964365	3.841466	0.1610

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.626588	38.41785	33.87687	0.0134
At most 1	0.432640	22.10366	27.58434	0.2151
At most 2	0.246729	11.04986	21.13162	0.6424
At most 3	0.093150	3.813355	14.26460	0.8785
At most 4	0.049121	1.964365	3.841466	0.1610

Max-eigenvalue and trace test indicates 1 Cointegration eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-value

Once the order of cointegration was identified for each variable that enters the specified model of Inflation determination, the next step is to estimate the long run relationship between inflation and its determinants using the Johansen (1988) maximum likelihood method. This method is selected because it produces consistent estimates of the long run parameter, which could be tested using likelihood ratio (LR) statistics.

The normalized cointegration equation is depicted in the table below by changing the signs of the standard β coefficients (See table below) which reveals that money supply, real gross domestic product of home country and overall budget deficit are positive determinants of inflation in the long run. Since all variables were used in the logarithmic form, the estimated coefficients can directly be interpreted as long-term elasticity. All the variables are significant at 5 percent, except real effective exchange rate, which is found to be statistically insignificant.

Table 7. Normalized co-integration coefficients (standard errors in parenthesis)

LNCPI	LNM2	LNRGDP	LNREER	LNOBB	Constant
1.000000	-0.592180 (0.09902)	-0.529948 (0.12658)	0.004558 (0.12658)	-0.360424 (0.07286)	5.772224
t-statistics	-5.98048	-4.18664	0.03304	-4.94678	

Long run equation of the model is as follows:

$$\text{LNCPIt} = -5.7722 + 0.5921\text{LNM2t} + 0.5299\text{LNRGDPt} - 0.0046\text{LNREERt} + 0.3604\text{LNOBB}$$

$$(5.9805) \qquad (4.1866) \qquad (0.0330) \qquad (4.9468)$$

In long run, responsiveness of inflation (CPI) to the change in money supply is 0.592180. It means that a 1% increase in broad money supply increases inflation by 0.592180%. The positive result conform to our a priori expectation as a unit rise in the money supply in the economy was supposed to result in a rise in the inflation since increases in money supply lead to increase in the

aggregate demand. The explanatory variable was statistically significant in influencing inflation in Ethiopia, as variation in money supply is a major factor responsible for inflation at any given point in time since there would not be a corresponding increase in the available goods

The coefficient having positive sign is significant at 5 percent level of significance suggesting that 1 percent increase in money supply leads to 0.59 percent increase in consumer price index on the average in the long run. Price elasticity with respect to broad money is 0.59. The result is according to macroeconomic phenomenon of classical economists given in the quantity theory of money as increase in money supply leads to higher price levels.

Due to higher money supply, more funds will be available to investors in the economy in the form of credit, then investment will be taken place, more employment will be generated, aggregate demand will increase, and finally there will be increase in consumer price index. Therefore, broad money supply affects price level through demand side. Our results are consistent with previous findings of Mehari and Wondafrash (2008), Ahmed (2007), Yohannes (2000), Getachew (1996) and Moser (1994)

The responsiveness of inflation towards the change real GDP is 0.529948 that is a 1% increase in real gross domestic product leads to increase of inflation by 0.529948% in the country. The rationale may be that higher income level leads to higher aggregate demand of goods and services and eventually price level will increase due to higher aggregate demand that leads to demand side inflation. Real Gross domestic product influences inflation through demand side. Our findings are matched with previous findings of Moseyed and Mohammad (2009), Abdullah and Kalim (2009) and Ayalew (2007).

In addition, the 1% increase in budget deficit, results in 0.360424% increase in inflation. This is true, if budget deficit is the result of excessive expenditure used by the government to promote economic growth and achieve full employment. The increase in economic growth will increase aggregate demand. The increase in aggregate demand leads to demand pull inflation. Moreover, the other way in which budget deficit is directly affects inflation is raised from the way budget deficit is financed that is, if budget deficit is financed via monetary base, money supply will be increased and this will leads to increase of inflation in economy. This finding is consistent with the finding of Ghartey (2001), Nechega (2005), Oladipo and Akinbobola (2011)

4.2.4. Short Run Dynamics Error Correction Model

The most important thing in the short run analysis is speed of adjustment term. It shows that how much time would be taken by the economy to reach at long run equilibrium. Negative sign of speed of adjustment term shows that the economy will converge towards long run equilibrium. However, if it is positive, the economy will not converge to the long run equilibrium rather diverge or move away from long run equilibrium, which leads to disequilibrium in the long run.

The Vector Error Correction Model (VECM) result in table 8 below shows that only one variable affects the inflation in the short run. That is, only the Last year overall budget deficit affects current inflation in the short run. The more overall budget deficit in the last year, the more inflation pressure in the current year. This may be because of country financing its deficit by using monetary base, which has immediate response to pressurize inflation in the country. Here the adjustment coefficient is negative which shows that the variable will converge towards long run equilibrium after taking 38 percent of annual adjustments in the short run.

Table 8: Vector Error Correction Model Results

Variables	Coefficient	Std. Error	t -value	Prob.
ECM1	-0.378168	0.149515	-2.529299	0.0178
D (LNCPI (-1))	0.221986	0.234280	0.947524	0.3521
D (LNCPI (-2)	-0.108734	0.226461	-0.480144	0.6351
D (LNM2 (-1))	0.361452	0.354493	1.019631	0.3173
D (LNM2 (-2)	0.334566	0.350534	0.954448	0.3486
D (LNRGDP (-1))	-0.220014	0.147781	-1.488784	0.1486
D (LNGDP (-2)	-0.103980	0.131501	-0.790714	0.4363
D (LNREER (-1))	-0.345737	0.197377	-1.751655	0.0916
D (LNREER (-2)	0.036715	0.209562	0.175199	0.8623
D (LNOBB (-1))	-0.097865	0.045661	-2.143300	0.0416
D (LNOBB (-2)	0.050645	0.034998	1.447097	0.1598
Constant	-0.021884	0.055509	-0.394242	0.6966

R-square = 0.3998 Adjusted R-square = 0.1459 S.E of regression = 0.1084

F – Statistic = 1.5745 Prob (F-statistic) = 0.1653 Durbin Watson stat = 2.21

The speed with which the model converges to equilibrium was shown by ECM coefficients. The equation of interest in this study was the INF equation. The results show that, the coefficient of ECM (-1) is -0.3781, it was properly signed and significant, indicating that the adjustment is in the right direction to restore the long-run equilibrium. The ECM value is less than zero while the speed of adjustment is about 38% percent. This significance of ECM also supports the conclusion of co-integration. The R^2 is 0.3998 for the inflation equation indicates that 39.9 percent of variations in INF growth have been explained by the independent the variables in the model. To reach at long run equilibrium, it needs two years and six months that is (1/0.37818 = 2.645)

4.2.5. LM Autocorrelation Test

No autocorrelation tells us that the error term (Residual) at time t is not correlated with the error term at any other point of time. This means that when observations are made over time, the effect of the disturbance occurring at one time period does not carry-over into another period.

Null hypothesis: There is no autocorrelation or absence of serial correlation
Alternative hypothesis: There is autocorrelation or there is serial correlation

Table 9: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.235641	Prob. F(2,24)	0.3085
Obs*R-squared	3.547570	Prob. Chi-Square(2)	0.1697

As shown on the above table, Breusch - Godfrey test was conducted for residual serial correlation and the null hypothesis of no residual serial correlation was tested against the alternative hypothesis of residual correlation. The result in table 9 above indicates that accept the null hypothesis of no residual serial correlation as indicated by the given probability value at conventional 5% critical levels of significance.

4.2.6. Heteroscedasticity Test

Null hypothesis: Homoscedasticity

Alternative hypothesis: Heteroscedasticity

Table 10: Breusch-Pagan test for heteroscedasticity

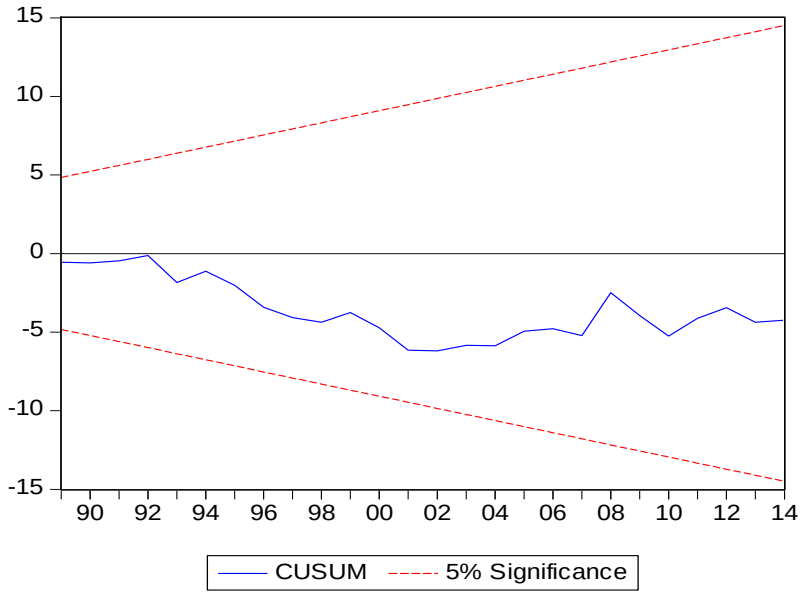
F-statistic	1.074000	Prob. F(15,22)	0.4289
Obs*R-squared	16.06350	Prob. Chi-Square(15)	0.3778
Scaled explained SS	12.28086	Prob. Chi-Square(15)	0.6577

Breusch-Pagan-Godfrey test was conducted for heteroscedasticity and the null hypothesis of Homoscedasticity was tested against the alternative hypothesis of heteroscedasticity. The result in table 10 above indicates that accept the null hypothesis of homoscedasticity as indicated by the given probability value at conventional 5% critical levels of significance, which means variance of the residual does not vary with time.

4.2.7. Stability of the model

To assess the validity of our VECM model, we test for stability of the model. The VAR stable command examines the dynamic stability of the system. None of the Eigen values is even close to one, so our system model is stable. To test consistency of the parameter over time the paper use the CUSUM test which provides a plot of against t and the pair of 5 percent critical lines. As with the CUSUM test, movement outside the critical lines is suggestive of parameter or variance instability. The figure 7 below shows that stability test of the model.

Fig. 7: Stability test of the model



From the figure 7 above, the test finds the parameter or variance are stable, because the cumulative sum does not goes outside the area between the two critical lines. The stability of the model confirmed with graphical representation of the following three tests. These are cumulative sum test, cumulative sum of square test and recursive coefficient test. All these tests ascertain that the model stable. Therefore, the paper concludes that the parameters are not change overtime. This implies that forecast or other policy measures are possible based on the above model. (Refer appendix 5(a, b, c)).

4.2.8. The VEC Stability Condition Check

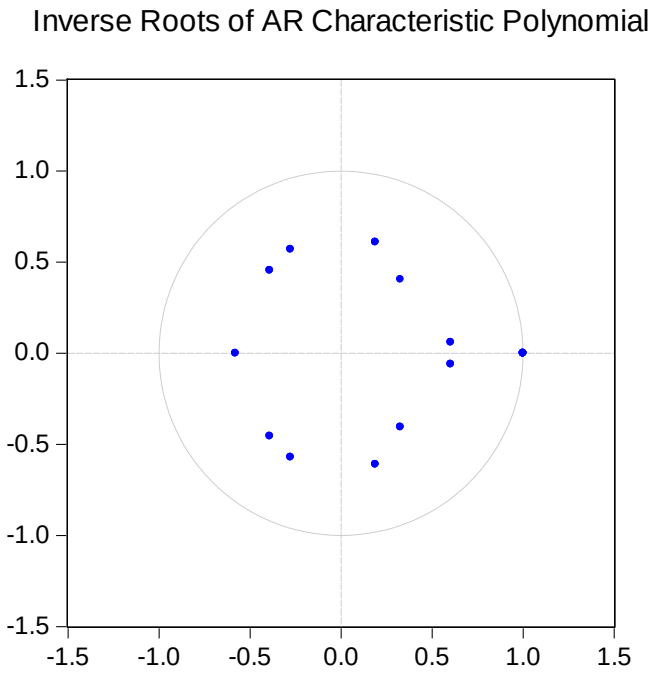
There are four real unit roots inside the unit circle that indicates, the VEC model stability but any unit root outside the unit circle depicts that VEC is instable. Therefore, the figure 8 below confirmed that VEC is in stable condition. To say VEC is stable or not, there must be at least one unit root in the test that is inside the unit circle.

Fig. 8: VEC Stability Condition Check

Roots of Characteristic Polynomial
Endogenous variables: LNCPI LNM2 LNGDP LNREER LNOBB

Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
0.189855 - 0.610241i	0.639092
0.189855 + 0.610241i	0.639092
-0.276967 - 0.570968i	0.634598
-0.276967 + 0.570968i	0.634598
0.603459 - 0.059668i	0.606402
0.603459 + 0.059668i	0.606402
-0.391341 - 0.455204i	0.600299
-0.391341 + 0.455204i	0.600299
-0.579049	0.579049
0.326028 - 0.405589i	0.520382
0.326028 + 0.405589i	0.520382

VEC specification imposes 4 unit root(s).



4.2.9. Residual Normality Test

Jaque – Bera statistics can be used to test for residual normality test, which hypothesis that the null says residual is normally distributed and alternative hypothesis is that residual is not normally distributed or it is vary with time. Therefore, by using this statistics, we are fail to reject the null hypothesis that says the residual is normally distributed rather accepting the null. So, the residual of this model is normally distributed. (Refer to appendix VI)

4.2.10. Multicolinearity Test

Multicolinearity refers to the case in which two or more explanatory variables in the regression model are highly correlated, and make it difficult to isolate their individual effects on the dependent variable. Using VIF test, the mean of variance inflation factor is below ten, which is

6.79. Therefore, is no multicolinearity problem in the model that is the rule of thumb, which says if VIF < 10, the model does not have multicolinearity problem meaning no exact linear relationship exists between any of the explanatory variables. (Refer table 11 below)

Table 11. Multicolinearity by using variance inflator factor (VIF)

Variable	VIF	1/VIF
LNM2	12.99 0.076972	12.99 0.076972
LNOBB	6.70 0.149333	6.70 0.149333
LNRGDP	5.09 0.196311	5.09 0.196311
LNRER	2.38 0.420399	2.38 0.420399
Mean VIF	6.79	

CHAPTER FIVE

CONCLUSIONS AND Policy Implications

5.1. Conclusions

The study has investigated determinants of inflationary experience in Ethiopia for the period 1974/75-2014/15 using annual time series data. In empirical analysis, Augmented Dickey Fullers (ADF) and Phillips Perron (PP) unit root test were used in testing the stationarity of the variables. The result show that consumer price index, broad money supply, real gross domestic product, real effective exchange rate and overall budget deficit are found to be integrated of order one meaning become stationary after first difference. Therefore, the study proceeds to lag length selection in which two-lag order is selected and then look for the existence or otherwise of co integrating vectors in the variables. The result of Johansen cointegration test shows that all variables are co integrated; meaning there is long run relationship among variables. Thus, the finding indicates that a co-movement in the variables. Since, there is one co integration test exist among variables in the long run, the study apply vector error correction model to investigate long run static equation of the model and to analysis short run dynamic of the model.

The long run model on empirical findings of determinants of inflationary experience in Ethiopia confirms that, broad money supply, real gross domestic product and overall budget deficit are statistically significant determinants of inflation with positive sign. Among the aforementioned variables, only one year lagged overall budget deficit are found to be the determinant of inflationary experience in Ethiopia in the short run with 38% speed of adjustment converge to the long run equilibrium per year.

Different diagnostic tests were taken place to check for the validity of the model. These are autocorrelation LM test, serial correlation test, heteroscedasticity test, multicollinearity test, residual normality test, model stability test (recursive coefficient test, cumulative sum test, cumulative sum of square test) and VEC stability condition check are tests used in this study.

5.2. Policy Implications

Based on the analysis and the findings of the study the following policy implications are suggested to curb inflation in the Ethiopian economy. The growth of money supply should be continually be kept in control, given its long run potential and magnitude of exerting inflationary pressure on the economy of the country and also the monetary authority takes into consideration the inflationary effect of money supply so as to ensure stable price level, which is one macroeconomic policy objective. The growth of real gross domestic product should be keep on with single digit inflation rate since it is fine and even essential for economic growth and proportionate the growth of real GDP with inflation growth rate. The structure of the government expenditure should be well coordinated and distributed to the key sectors of an economy with strict supervision in order to avoid the continual problem of over spending and over estimation of projects execution cost which may cause imbalances in price stability. There should be a high sense of transparency in the fiscal operations to bring about realistic budget deficits. A well-recorded budget should be channeled to productive investments such as road construction, electricity provision, water supply and so on that would serve as incentives to productivity through the attraction of foreign direct investment, in other to reduce the occurrence of inflation in Ethiopia.

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Appendices

Appendix I: Autocorrelation LM test

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/23/16 Time: 13:02
Sample: 1974 2014
Included observations: 38

Lags	LM-Stat	Prob
1	22.88901	0.5840
2	22.04055	0.6334
3	32.30310	0.1494
4	32.10311	0.1551
5	42.48149	0.1159
6	21.41596	0.6692
7	34.59758	0.0957
8	45.09390	0.1816
9	16.64513	0.8943
10	15.91619	0.9173
11	15.61067	0.9259
12	32.69498	0.1389

Probs from chi-square with 25 df.

Appendix II: Multicolinearity test

Variable	VIF	1/VIF
LNM2	12.99 0.076972	12.99 0.076972
LNOBB	6.70 0.149333	6.70 0.149333
LNRGDP	5.09 0.196311	5.09 0.196311
LNRER	2.38 0.420399	2.38 0.420399
Mean VIF	6.79	

Appendix III: Heteroscedasticity test

Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.074000	Prob. F(15,22)	0.4289
Obs*R-squared	16.06350	Prob. Chi-Square(15)	0.3778
Scaled explained SS	12.28086	Prob. Chi-Square(15)	0.6577

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/23/16 Time: 12:38
Sample: 1977 2014
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.140724	0.155736	-0.903609	0.3760
LNCPI(-1)	-0.042598	0.034815	-1.223549	0.2341
LNM2(-1)	0.150643	0.050703	2.971083	0.0071
LNGDP(-1)	-0.041387	0.019385	-2.135033	0.0441
LNREER(-1)	0.031335	0.039389	0.795535	0.4348
LNOBB(-1)	0.003382	0.004961	0.681760	0.5025
LNCPI(-2)	0.018152	0.045402	0.399810	0.6932
LNCPI(-3)	0.023155	0.040076	0.577775	0.5693
LNM2(-2)	-0.119458	0.069960	-1.707528	0.1018
LNM2(-3)	-0.027911	0.052576	-0.530863	0.6008
LNGDP(-2)	0.035675	0.025346	1.407504	0.1733
LNGDP(-3)	0.008506	0.022309	0.381263	0.7067
LNREER(-2)	-0.030199	0.047609	-0.634320	0.5324
LNREER(-3)	0.012614	0.029402	0.429033	0.6721
LNOBB(-2)	-0.002668	0.005349	-0.498803	0.6229
LNOBB(-3)	0.000321	0.005386	0.059584	0.9530

R-squared	0.422724	Mean dependent var	0.008036
Adjusted R-squared	0.029126	S.D. dependent var	0.014718
S.E. of regression	0.014502	Akaike info criterion	-5.333529
Sum squared resid	0.004627	Schwarz criterion	-4.644019
Log likelihood	117.3370	Hannan-Quinn criter.	-5.088206
F-statistic	1.074000	Durbin-Watson stat	2.248104
Prob(F-statistic)	0.428924		

Appendix IV: Serial Correlation test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.235641	Prob. F(2,24)	0.3085
Obs*R-squared	3.547570	Prob. Chi-Square(2)	0.1697

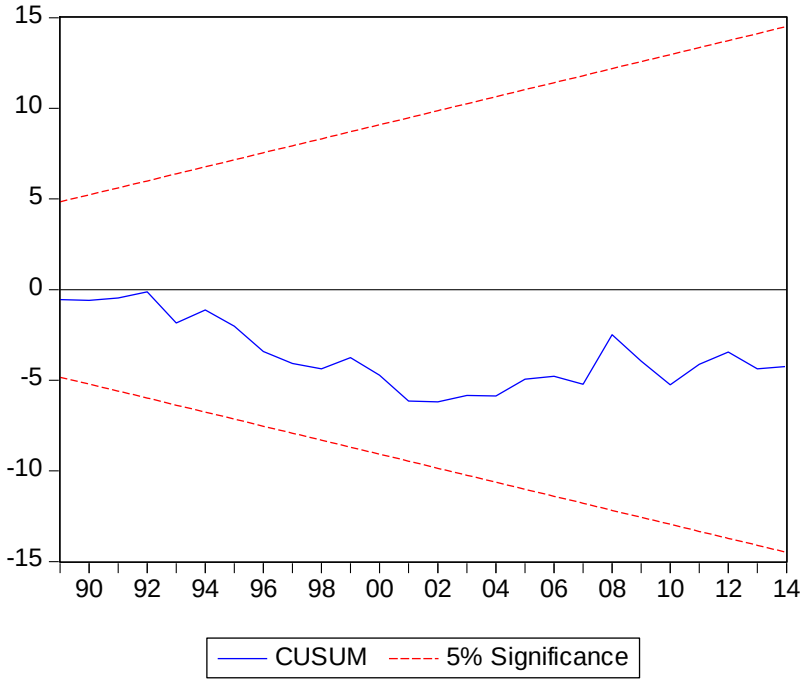
Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 05/23/16 Time: 12:52
Sample: 1977 2014
Included observations: 38
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.164348	0.200665	0.819017	0.4208
C(2)	0.427204	0.472790	0.903582	0.3752
C(3)	-0.027977	0.412537	-0.067817	0.9465
C(4)	-0.044773	0.363139	-0.123294	0.9029
C(5)	-0.096216	0.380397	-0.252936	0.8025
C(6)	0.094319	0.160749	0.586748	0.5629
C(7)	0.059235	0.149010	0.397524	0.6945
C(8)	-0.049042	0.198551	-0.247001	0.8070
C(9)	0.166298	0.257075	0.646886	0.5238
C(10)	-0.063208	0.062472	-1.011775	0.3217
C(11)	-0.038723	0.042597	-0.909038	0.3724
C(12)	-0.008472	0.055554	-0.152498	0.8801
RESID(-1)	-0.679231	0.558959	-1.215171	0.2361
RESID(-2)	-0.185507	0.452786	-0.409702	0.6857

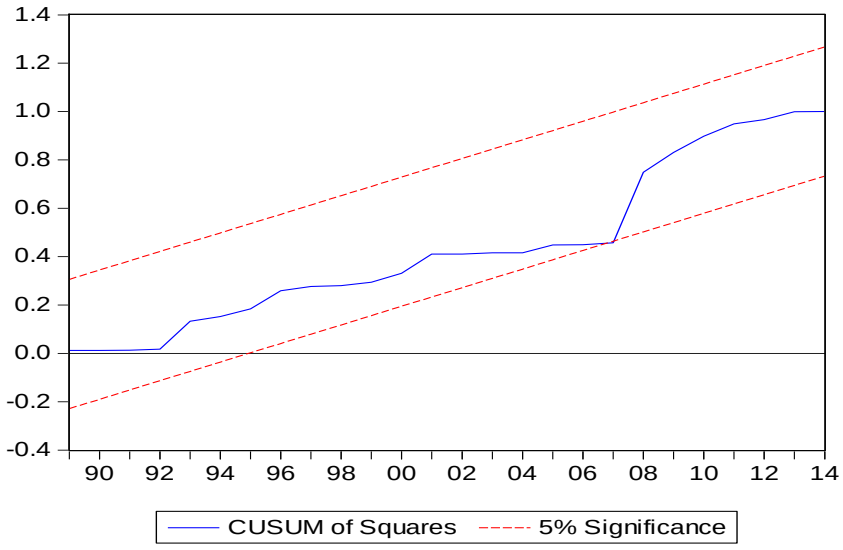
R-squared	0.093357	Mean dependent var	9.36E-16
Adjusted R-squared	-0.397741	S.D. dependent var	0.090846
S.E. of regression	0.107404	Akaike info criterion	-1.347135
Sum squared resid	0.276853	Schwarz criterion	-0.743814
Log likelihood	39.59556	Hannan-Quinn criter.	-1.132478
F-statistic	0.190099	Durbin-Watson stat	2.033645
Prob(F-statistic)	0.998383		

Appendix V: Model stability test

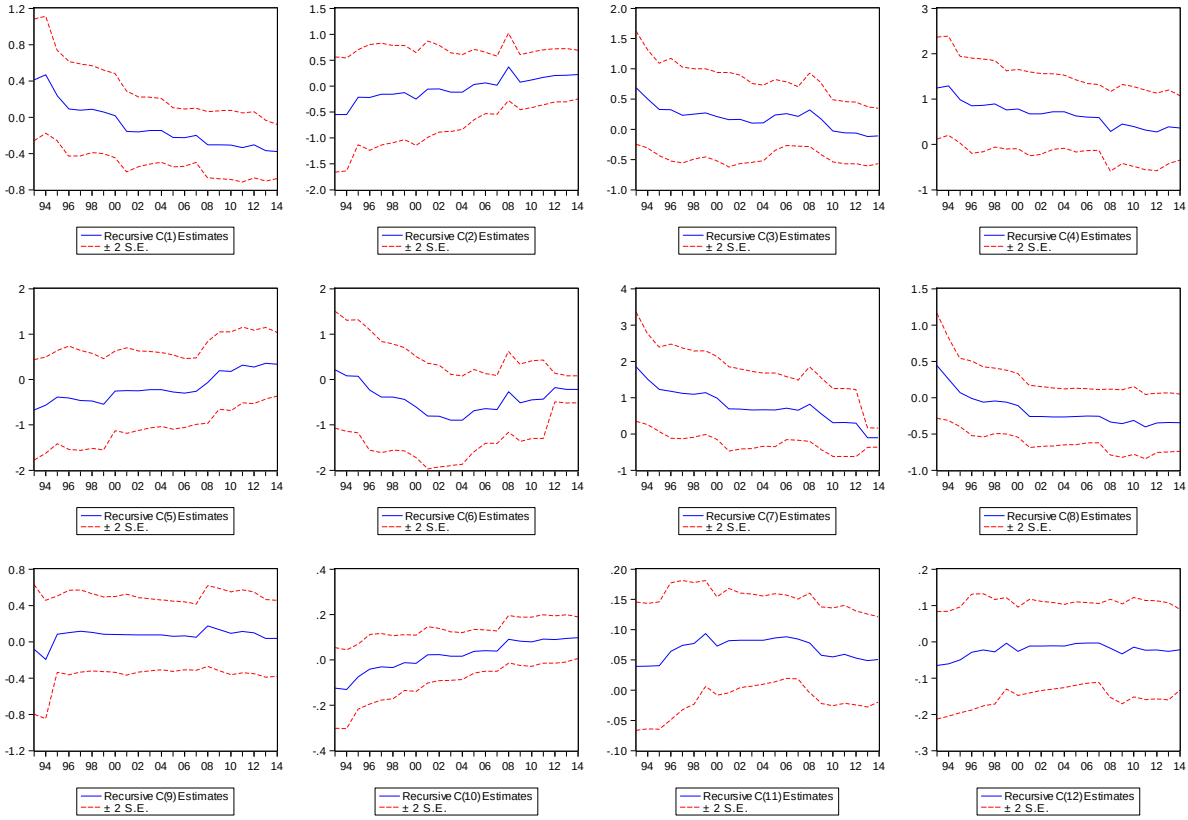
a. By using cumulative sum test



b. By using cumulative sum of square test



c. By using recursive coefficients test



Appendix VI: Residual Normality Test

H0: Residually is normally distributed

H1: Residual is not normally distributed

Component	Jarque-Bera	df	Prob.
1	3.778800	2	0.1512
2	2.911277	2	0.2333
3	2.337061	2	0.3108
4	4.737585	2	0.0936
5	2.109046	2	0.3484
Joint	15.87377	10	0.1033