An Investigation into the Causes and Dynamics of Price Inflation in Ethiopia
A Macro-Econometric Approach [1980 – 2012]

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Preface

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List of Acronyms

ACF	Autocorrelation Function
ADB	African Development Bank
ADF	Augmented Dickey Fuller
AIC	Akake's Information Criteria
CPI	Consumer Price Index
CSA	Central Statistical Agency
EDRI	Ethiopian Development Research Institute
EEA	Ethiopian Economic Association
FAO	Food and Agriculture organization
Fevd	Forecast Error Variance Decomposition
FPE	Final Prediction Error
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
HICE	Household Income, Consumption and Expenditure
HQ	Hannan-Quinn Criteria
IMF	International Monetary Fund
IRFs	Impulse response functions
LM	Lagrange Multiplier
M2	Broad Money Supply
MoFED	Ministry of Finance and Economic Development
NBE	National Bank of Ethiopia
PAC	Partial Autocorrelation
PPI	Producers price index
QTM	Quantity Theory of Money
REER	Real Effective Exchange rate
SIC	Schwarz Information Criteria
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WWB	World Bank

Abstract

In the earlier periods, Ethiopian inflation was not a serious problem and had an immense association with agriculture and food supply shock. Major inflationary episodes were happening during conflict, war and drought times. However, the recent inflation trajectory seems a new phenomenon. Since 2004, the economy had been continually facing unprecedented and double digit inflation growth, as some commentators said one of the most affected economy in the world. The nation's inflationary pressure was predominantly attributed to the effect of highly volatile food price. In this instance, the overall aim of this study is to investigate the key sources of price inflation and their dynamic interaction with other macroeconomic indicators involving the structure and or domestic, monetary and external factors.

The empirical strategy in this paper combines two separate estimation methods: the vector error correction model (VECM) and a multi factor single-equation model. The single-equation model, augmented with error correction terms was estimated to identify the relative importance of the key inflationary factors and their dynamic behavior. Using annual data over the past three decades (1980 till 2012), the preliminary test for model specification reveals that all the series are non-stationary in level and stationary in first difference. Subsequently, the Johansen co-integration test affirmed the existence of one co-integrating vector in each error correction representation. Hence, the dynamic model verified the existence of short term adjustments and long-term dynamic relationship among the co-integrated series. More decisively, the post estimation specifications revealed that our VECM are highly parsimonious and appear to be reasonably well specified.

Our main finding reveals that money market, agricultural market and external market determines price inflation in the long run. In the short run, there are several other factors that determine price inflation. Changes in inflation are highly sensitive to the change in money growth, the cost of capital, exchange rate and inertia. Principally, excess money growth has a detrimental effect on inflation. External factors such as the price of Fertilizer, an intermediate goods import, oil and Exchange rate are found to have a significant effect on the domestic price inflation. Out of the domestic supply side factors, the cost of capital largely matters and significantly explain price inflation in the short run. Apparently, the effect of supply side, monetary and external factors are highly significant through their long run cointegrating relationships.

In sum, our result assures that a multipronged approach is very essential so as to successfully combat price inflation in Ethiopia. In view of that, Policies that geared towards concurrently maximizing agricultural growth, flourishing structural rigidities, monetary tightening and stable exchange rate polices may principally ensure stable inflation growth. Beside, effective fiscal management policies may also help to stabilize the effect of external price shock.

Relevance to Development Studies

Recently, inflation has become the most influential subject in the field of development studies. Until recently, ample theoretical and empirical research on the sources and effects of inflation has got considerable serving in this field (Gordon 1976). Until recently, most economists considered the issue of inflation as one of the pertinent economic gauges used to examine macroeconomic stability and societal welfare, and inequality in particular and overall economic status of a given economy in general. Hence, the whole body of inflation related works, become more industrious providing substantial revenue in the field of development studies. Henceforth, this study paper also contributes some new enlightenments by virtue of adding concrete methodological and theoretical insights. Principally, it could have more practical importance for the academic journey in this field. Specifically,

- It helps to fill the gap of knowledge and open ways for subsequent researches to be carried out in wider scope and depth of study.
- It provides information for policy makers to address the root causes of the recent inflation and related macroeconomic uncertainties thereby enable to pass well informed decision.

Key words

Co-Integration Analysis, Money Market, Agricultural Supply Shock, External Market, Structural Rigidities, PPP, Tight Monetary policy, and Vector Error Correction Model

Chapter 1
Introduction

1.1. Background

In recent times, Ethiopia has experienced far-reaching economic growth and development changes. According to the World Bank report (2013), the country has achieved remarkable economic growth averaging 10.6 percent for almost half a decade since 2004, which is twice above the continental average (Mwanakatwe& Barrow 2010). According to the report, the expansion of the service sector and agricultural growth contributed most, while the contribution of the manufacturing sector was relatively modest.

Until recently, Agriculture is the most dominant sector in the Ethiopian economy and remains to be the largest source of economic growth. The mounting infrastructural development supported by the increasing flow of external aid and growing domestic revenue enabled the economy to stimulate the outperforming growth (Mwanakatwe& Barrow 2010). Despite the rapid economic growth and poverty reduction progress, sustained fiscal imbalances and macroeconomic instabilities mainly inflation, had been constantly limiting the bouncing economy (Desta 2008). According to Mwanakatwe& Barrow (2010), huge domestic borrowings financing the mounting public investment programs constitute the most challenging macroeconomic scenarios worsening inflation and deficits in the economy.

Figure 1: Outlook of the Recent Inflation Trend
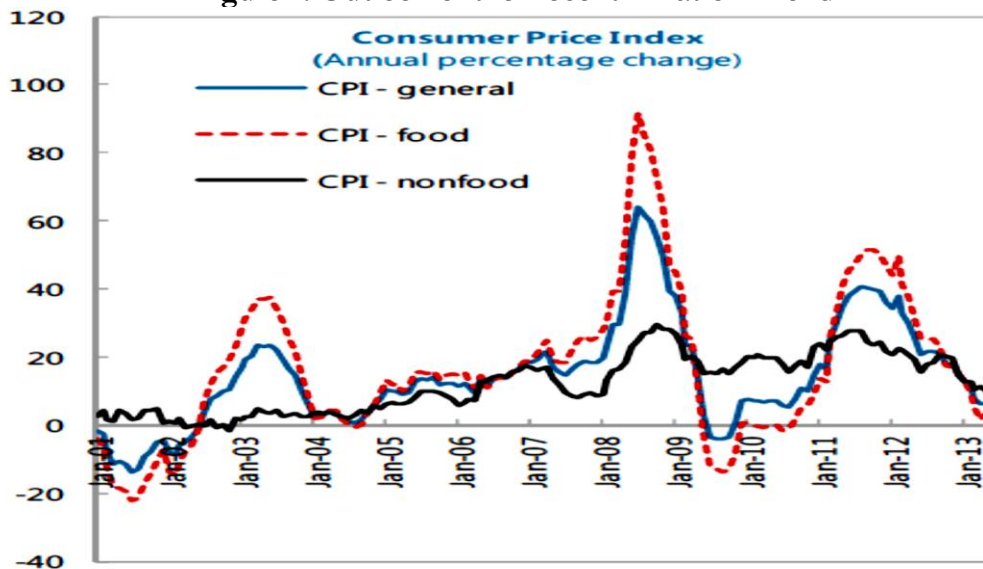
Source: IMF (2013)

The experience of sustained inflation rate in Ethiopia had begun since 2003. The overall inflation rate recorded for the year 2002 indicates below zero (i.e. Deflation). However, since 2004 the country faced a constantly increasing rate of

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inflation, which is historically unprecedented as some commentators explained it. The average overall inflation rate in 2006 was 13.7 percent. This figure rose to 21 percent and 39.8 percent in 2007 and 2008 respectively (CSA 2009). In July 2008, inflation was at its peak of 64 percent, the biggest macroeconomic challenge in the history of the county (Loening et al. 2009). By the end of 2010, the rate has declined to 8.2 percent and then accelerated to 40.6 percent in 2011and started to decline afterwards. Its irregularity and volatility nature has conveyed diversified macroeconomic risks and uncertainties (Eden 2012). Firmly, the seriousness of the problem necessitates sound empirical investigations and policy responses. Thus, the main objective of the study is, thus, to identify the salient sources of the recent inflationary pressure and their dynamic interactions.

1.2. Problem Statement and Objectives

Historically, Ethiopian inflationary experience was moderate and not considered as series as the issue of economic growth. Since 2004, however, the country has experienced high and persistent inflation growth. Several macro-economic stabilization measures and policies were implemented over the past and deemed to be completely failed. The booming economy has yet remained principally constrained by dual macroeconomic problems i.e. Price inflation and low international reserves (Mwanakatwe & Barrow 2010).

Even if no one disputes over the highly volatile inflationary experience in the country except with slight differences in the exact figures, there are enormous disagreements about the real causes of inflation and their magnitude of effects. There existed a number of potential sources as explained by several scholars and researchers. For instance, Government bodies, while expressing their solutions to the prevailing high level of inflation, put certain factors as the basic sources of inflation. They have strong conviction that the sustained economic growth could generate upper price hike i.e. the demand pull inflation. Similarly, the World Bank report in (2013), declared that the main source of inflation in the country is the mounting aggregate demand due to the growth of Private consumption and public investment, out of which the latter has due importance in explaining the recent inflation.

Nevertheless, plenty writers have different views. According to Loening et al. (2009), a large fraction of the county's inflation is explained by foreign price and agricultural supply shocks and money growth. Hassan (2008) argued that the culprits behind the mounting inflation are neither the growing economy nor the Ethiopian peasantry getting richer than before. He rather pointed out a number of responsible factors, including money growth, lower interest rates, the soaring oil prices, war expenditures, declining foreign exchange reserves, budgets and current account deficits and so on.

The African Report posted in August (2003), presented Moller's argument explaining that Ethiopian inflation was mainly attributed to the service sector expansion (the leading sector in the economy), mainly due to the injection of huge liquidity in the financial system. The writer stated that the country should

continue to adopt tight monetary policy to effectively combat inflation. According to Loening et al. (2009), the loosed fiscal stance and external price shocks have left Ethiopia to be more vulnerable to price spikes. According to the IMF and World Bank (2013), fiscal mismanagement and excess government expenditure were found to be the most detrimental factors behind the soaring price inflation in the country.

So far, there is no strong consensus on the key sources of inflation in the country. Some argued that the principal sources of inflation are supply side and external factors; whereas others proclaimed the demand and monetary factors. One of the main reasons is that Ethiopian inflationary experiences are highly divergent over time and is very difficult to explain on the basis of the narrow macroeconomic approach. There are very few rigorous works that could empirically ascertain the relative importance of each of the external, domestic or structural factors contributing to the recent price inflation. Most of the existing studies did not have sound theoretical and empirical grounds enabling to draw justifiable outcomes and policy insights. With this instance, this study intends to fill the aforementioned gap by virtue of applying key theoretical validities and empirical strategies. Therefore, the overall aim of this study is to identify all the key sources of inflation and their dynamic behavior over time (co-movements, interactions and dynamic responses). Specifically, the study intends to achieve the following objectives:

- To analyze inflation trends and interrelated macroeconomic conditions
- To examine basic theoretical applications and their validity to explain the recent inflation scenario.
- To investigate into the causes and nature of short-run diverges from long-run trends in inflation.
- Evaluate the effect of the foregoing fiscal and monetary policy measures against inflation and to give some ways forward.

1.3. Research Questions

- What are the key sources of inflation and its trend over time?
- Which theory does necessarily explain the recent inflation scenario?
- What are the causes and nature of short-run diverges from long-run trends in inflation?
- Do prior monetary and fiscal policy stances has achieved the desired goal or worsen the problem? What policy choice can better combat the recent inflation trajectory?

1.4. Research Hypothesis

1. **Null Hypothesis:** The domestic agricultural goods market does not significantly determine price inflation in Ethiopia.
   Alternative Hypothesis: The domestic agricultural goods market significantly determines price inflation in Ethiopia.

2. **Null Hypothesis**: the quantity theory of money (QTM) does not hold for explaining price inflation in Ethiopia.
   Alternative Hypothesis: the quantity theory of money (QTM) holds for explaining price inflation in Ethiopia.

3. **Null Hypothesis**: The purchasing power parity (PPP) does not hold for explaining price inflation in Ethiopia
   Alternative Hypothesis: The purchasing power parity (PPP) holds for explaining price inflation in Ethiopia.

1.5. Scope and Limitations of the study

Inflation is a multidimensional macroeconomic phenomenon. The ultimate focus of this study is to examine the causes of inflation and its dynamic behavior over time with particular emphasis on the supply-side, demand-side (Monetary), external shock and inertial factors. The study did not consider the effects of non-economic and social-cultural and political dimensions, i.e. the political economy approach to inflation. On the other hand, due to limited data availability and sensitivity nature of the indicators from the general macroeconomic point of view, the study may not carry out a thorough examination of each macro-economic indicator; perhaps principally focus on exploring the causal relationship, dynamic behavior and interaction among the priority and control variables.

The researcher faced a lot of challenges during the study period. One of the very problematic challenges was non-availability of adequate data on the desired macroeconomic indicators and national accounts. The researcher was highly exhausted while gathering the required data for almost half of the study period. On the other hand, the multidimensional nature of the subject would really require some more additional time periods, perhaps the researcher could manage to do better at the expense of other life sacrifications.

Chapter 2

Review of Theoretical and Empirical Evidences

2.1. Inflation Models and their Application to Ethiopia

Literature on the sources of inflation is diverse with numerous controversies. Large bodies of economic literature have a range of explanations of the determinants of inflation and its effect in diverse macroeconomic context. Most agree that the sources vary across countries with varying macroeconomic contexts. The foremost theoretical mainstreams emphasize that inflation is the result of continuous interactions with one or more of the following: Money (or demand-side) shocks, real (cost or supply-side) shocks, price-adjustment (or inertial) factors and political processes and or country specific dynamic institutional or economic structures.

Generally, economists have classified inflation into two broad categories; demand pull inflation and cost push inflation (Asari et al. 2011). The former is when aggregate demand grows faster than the supply, whereas the latter is caused by an increase of one or more of the cost or supply side factors such as the rising wages, input price (domestic or imported), interest rate, taxes, and exchange rate. The demand pull inflation in a full employment economy occurs due to an autonomous expansion of desired export, investment, government and business expenditure followed by competitive price and wage increases (Machlup 1960). Demand pull inflation is not as problematic as the cost push inflation. It can be managed through contractionary (demand, reducing) fiscal or monetary policies whereas, cost push inflation is unlikely to be manageable through similar policy alternatives as concurrent problems like unemployment and lower economic growth would be inevitable (ibid). Cost push theorists fundamentally emphasize "prevention" instead of "curing" so as to concurrently achieve triple economic goals (healthy inflation, and high level of employment and growth) (Selden 1959). Embracing the disequilibrium systems of direct control (negotiation, wage and price fixing, rationing, quotas) are the indispensable mechanisms while tackling cost-push inflation (ibid).

Several hypotheses on the causes of inflation were mainly dominated by the debate between the monetarists and structuralists. To this end, structuralists principally followed the arguments of cost-inflation theories. In this view, inflation is largely accredited to country specific structural rigidities in the dual economic system, i.e. the coexistence of progressive industry and primitive or rigid agricultural or the export sector. In this system, the agricultural sector remains responsive to price increases due to a defective system of land tenure, lack of irrigation, lack of storage and marketing facilities, bad harvest and seasonality on rain (Jhingan 1997).

Monetarists or QTM widely proclaimed that inflation is solely attributed to the money market disequilibrium meaning that money growth generates excessive

demand thereby accelerate inflationary pressure. Some economists declared that the monetary model alone was failing to explain the behavior of inflation in the developing world (Saini 1982). One is because of the money stock endogeneity attributed to monetization of the economy and largely because of the rigid model specification which excludes the impact of the various domestic and external cost factors. Thus, prominent contemporary researchers have developed broaden view of inflation in the developing world. Amongst, Loening et al. (2009), Moriyama, (2008), and Haji & Gelaw (2012) address the role of domestic or structural and external markets in addition to the money market scenario while explaining inflation. Likewise, this study adopted the recent theoretical mainstream assuring that inflation is the result of price adjustment driven by virtue of unbalanced demand or supply (structural disequilibrium) or from the price adjustments in response to exogenous shock (money market disequilibrium).

This chapter briefly describes a simple theoretical framework that could possibly explain the inflation Ethiopian scenario. (i) The structural/cost-push theory explaining the role of the domestic agricultural market sector (ii) the monetary theory and (iii) the external sector theory. All these theories are found to be the most pertinent one in explaining the long run price hike (see also Loening et al. 2009; Haji & Gelaw 2012; and Ubide 1997)

2.1.1. The Structuralists Explanation

The sources of inflation in the developing world are widely believed to be structural (Nell 2004). Fischer & Mayer (1981) stated that investigating inflation in this context has been more commonly referred to the Latin American structural explanation. This perspective mainly emphasizes the relationship between price inflation and the process of economic transformation (Nell 2004). In view of that, sectoral bottlenecks and BOP disequilibrium are the two fundamental factors for the changes in the price of goods. Agricultural supply shock attributed to structural pressure and the BOP disequilibrium are the result of demand and supply structure (ibid). Such economic transformation generates fluctuations in the relative price of goods and services. Due to structural rigidities, inflation in this context is considered as a byproduct of growth and development process (Nell 2004). Essentially, the theory focuses on the shift in demand and supply as a means of change in price.

Generally, the underlying factors behind inflation in this theoretical framework includes low agricultural growth, administered industrial prices (due to input supply deficiency or excess demand due higher industrial employment), and inactive monetary stance (Cardoso 1981). Moreover, the presence of infant industries and oligopolistic market by virtue of inefficient and costly production and imperfect competition respectively overburdens inflation through the price control mechanism. Predominantly, structuralists justify supply rigidities and the inadequate and unstable purchasing power of exports as two major causes of inflation.

In a stagnant agricultural economy like Ethiopia, food supply is highly inelastic thereby prices extremely fluctuate in response to the changing demands (Klugman and Loening 2007). Industrialization and urbanization may possibly change the amount and structure of food and raw materials demand. During the process of industrialization, there is a shift of resource from agricultural to the industrial sector (ibid). The growth of industrial sector demands higher agricultural products. Consequently, price goes up due to supply deficiency since agriculture remains stagnant. By assuming the presence of a passive money supply and oligopolistic market structure, the price of industrial goods cannot have downward spiral in response to supply shocks unless the agricultural sector fulfills the growing demand for industrial input.

Price inflation in Ethiopia is strongly associated with food and agriculture (Loening et al. 2009). In this highlight, structuralists believed that inflation is subject to agricultural supply shock, which is explicitly driven by the supply side factors-rainfall, availability, farm labor, land, agricultural finance and transport facility and or fuel (energy). Since, our agricultural system is mainly dominated by smallholder faming system, which is predominantly undertaken by using family labor, wage is not regarded as a viable supply indicator. Moreover, land availability is not as a big deal as the lower agricultural productivity in Ethiopia (Pender & Gebremedhin 2008). On the other hand, Ethiopian agriculture is highly vulnerable to exogenous shocks by virtue of its dependence on the basic factors of production like finance, fertilizer and fuel (energy) (Loening et al. 2009). Hence, the agricultural supply shock in Ethiopia can be represented as a function of the aforementioned key factors of production (see also Haji &Gelaw 2012; Loening et al. 2007).

2.1.2. The Monetary-Quantity Theory of Money (QTM)

Money supply is one of the notable macroeconomic factors explaining inflation in the developing countries (Saini 1982). Excess money supply arises largely due to huge government spending. By and large, money creation used to finance budget deficit considerably upsurges money supply growth. In this case, the role of money to explain inflation becomes highly instrumental and hence the mechanism used to control money growth can be accentuated through the monetary policy (IMF 2008).

Unlike the structuralists, the monetarist proclaimed that excess money is the dominant factor for wider fluctuations in output and employment in the short run and price in the long run. In view of that, expansionary monetary policy aiming to boost output and employment is assumed to cause inflation. Mankiw (2003) stated that low money supply can be effective for stable output, employment and prices in the economy. It is also widely argued that fiscal and monetary actions can be a source of macro-economic instability. For Monetarists, firm or industry specific cost increases cannot be inflationary unless excess money supply is accommodated (Kibritçioğlu 2002).

According to Mankiw (2003), the concept of money supply is fundamentally derived from the QTM enabling to explore the effect of real money stock in a given economy. The QTM attributed price changes to the changes in the stock of money. An increase in the stock of money generated excess money supply with the given price level and interest rates, meaning excess demand for non-monetary assets (Bronfenbrenner & Holzman 1963). This theory precisely argued that the value of all the goods produced and sold must necessarily be equal to the value of all purchases. In other words, any change in prices must be accompanied by an equivalent proportional change in the quantity of money.

Mathematically, M V = PT, Where M stands for the stock of money supply, V- the velocity of money, P- the general price level, and T stands for transactions undertaken. In this case, MV is same as PT, i.e. the cumulative value of all transactions in a given period of time. Warburton (1951) regarded changes in the quantity of money as the paramount determining force for the change in the price level, partly directly [$\Delta M \rightarrow (\Delta Y$ and $\Delta P)$], partly indirectly [$\Delta M \rightarrow \Delta V, \Delta V \rightarrow (\Delta Y$ and $\Delta P)$]. In this framework, aggregate supply in the goods market is given as; AS = T = Y, while aggregate demand is defined as; AD = (M - V) / P. Now, T may be interpreted to represent the real output, which is determined according to the production function in the long run. Equilibrium in the goods market requires AS = AD, and hence, Classical and neoclassical economists had given their theoretical highlight on inflation through the aforementioned QTM. In view of that, the standard monetary model for explaining inflation is given by Saini (1982).

$$\pi_t = m - \delta_1 y + \delta_2 r$$

Where, π_t is the growth rate of price inflation, M the growth rate of broad money supply, Y is the rate of growth of real income, and r is the growth rate of the cost of holding money or inflation rate. In this case, inflation is exclusively a monetary and demand side phenomenon (Kibritçioğlu 2002).

The long run equilibrium equates the money demand and supply, thereby the QTM holds when the long run change in real output (income) and velocity remains constant (stationary or unchangeable) and hence, price changes proportionally with the change in the money supply. The equation is a simple verification of the ceteris paribus causal relationship, positively in relation to the money growth and negatively with respect to the growth rate of real income and positively to the cost of holding money (inflation rate). In sum, other things remain constant; an excess money causes an excess demand for goods and generate a higher price (Saini 1982).

2.1.3. Imported Inflation Thesis and the Purchasing Power Parity (PPP)

One of the very problematic channels through which domestic price inflation in Ethiopia is affected is the exchange rate pass-through effect. Through this channel, currency depreciation directly affects the domestic price. The extent to

which exchange rate pass-through affects the domestic price inflation mainly depends upon the cost and weight of imported goods (Jombo et al. 2014).

In a small commodity dependent economy like Ethiopia, the process of industrialization demands higher intermediate and capital goods import thereby increases the demand for industrial credit and generate excess money supply (Nell 2004). Awkwardly, an endogenous increase in the money stock can sustain higher wage spiral and the cost of production. On the other hand, the growing demand for capital and intermediate goods import under acute foreign exchange reserve condition directly induce an overriding effect on the BOP and nominal exchange rate (Nell 2004). Subsequently, the BOP disequilibrium occurred by virtue of high import cost relative to export earnings. According to (Argy, 1970; Ghatak, 1995), developing countries like Ethiopia faced a shortage of foreign exchange earnings for the reason that exports of primary agricultural commodities have low income elasticities than the demand for import (Nell 2004). Moreover, lack of demand for exports of primary agricultural commodities contributes to deterioration of the terms of trade and a shortage of foreign exchange earnings.

Under a floating exchange rate regime (with similar situations in Ethiopia), a short run shock in the foreign sector drifts into the domestic inflation and the fiscal imbalance (Mishkin 1995). Beside, import substitution and export promotion policies may also have a harmful effect on the composition of trade balance over time. Within this policy framework, exchange rate devaluation can transmit its impulse into the cost of domestic production and finally to the price rise (Jombo et al. 2014). At the outset, adopting exchange rate devaluation and import restrictions, regardless of maintaining the BOP equilibrium would obviously overblow domestic inflation (Catao & Terrones 2005). In sum, for the reason that supply is strongly rigid owing to the structural factors and inadequate purchasing power of exports (which prevents sufficient food imports), increasing demand for agricultural products induce higher prices.

On the other hand, an oligopolistic industrial structure principally compels to maintain the constant mark up by transferring a higher cost of import into the prices of final goods. Subsequently, the expanding the gap between domestic and foreign inflation exerts a negative impact on the BOP, necessitating another devaluation route and execrated inflation rate (Nell 2004). Under the accelerated inflationary condition, monetary authorities following accommodative policies to improve income and employment would further pressurize an excessive money supply and larger fiscal imbalance thereby result an upward inflation spiral (ibid). In view of that, the author suggested that an underlying policy stance, aiming to reduce the effect of monetary transmission through the exchange rate channel is to transform the economic structure and reducing the dependence on import.

Although domestic policies are believed to be significant for REER variations, plenty empirical works have given due attention to the effect of nominal devaluations arising from expansionary monetary policies (ibid). The policy would affect the REER through changes in the domestic price level, the nominal exchange rate, or both. Numerous monetary models of the exchange rate and BOP demonstrate a one-to-one relationship between the exchange rate and

domestic prices, i.e. Purchasing Power Parity (Sahminan 2002). It is a theory used to estimate the equilibrium real exchange rate. It is determined by the relative price change and provides an evidence for the relative exchange rate change between two currencies over time (Chinn 2006). According to this theory, price level changes as an overriding determinant of exchange rate movements. Though the simple PPP hypothesis has found to be more debatable and widely considered a weak model, particularly in the developed world, a recent study by Cashin, Céspedes, and Sahay (2002) developed a long-run equilibrium exchange rate model for commodity exporting countries and found that in many commodity-dependent low-income countries real commodity export prices and real exchange rates move together in the long run (Koranchelian 2005).

In recent years, policy discussions have included increasing attention to real effective exchange rate stability and correct exchange rate alignment as crucial conditions to improve economic stability in the developing countries. Several models have also been developed to determine the equilibrium real exchange rate in developing countries. Edwards (1989, 1994) made an attempt to build an equilibrium real exchange rate model in the developing country context. Contemporary Economists like Loening et al. (2009) and others also adopted this model in the Ethiopian context, where in the real, or inflation adjusted, exchange rate plays a central role to explain imported inflation. Apparently, there are ample evidences with wider scopes while measuring price and or real exchange rates. Hence, following Chinn (2006), a standard representation of the PPP hypothesis to measure the extent of deviation in the REER from the long run PPP level and its price transmission effect can be given as follows;

$$\mathbf{R}EER = \mathbf{lnx}e - \mathrm{ln}wp + \boldsymbol{lnp}^{*}$$

Where REER, is the real effective exchange rate, lnXe is the logarithmic nominal exchange rate defined in units of home currency per unit of foreign. lnP and lnP* refer to the logarithmic domestic and foreign price respectively.

PPP implies that the real exchange rate will revert to its mean, although it may deviate from its mean for several years at a time (ibid). The most common econometric application to prove or disprove the PPP hypothesis is based on the analysis of the time series properties of the REER (Rogoff 1996). While the series of REER remains to be stationary and reveal the instantaneous mean convergence, it gives us an evidence to reject the null against the alternative hypothesis stating that PPP is workable enough to explain price inflation.

2.2. Review of Empirical Evidences on inflation in Ethiopia

Table 1: Review of Empirical Evidences on the Ethiopian Inflation Scenario

AUTHOR	STUDY SUBJECT	EMPIRICAL STRATEGIES AND MODEL SPECIFICATION	PERIOD OF STUDY	DYNAMIC SOURCE OF INFLATION	
				SHORT-RUN	**LONG-RUN**
Loening et al. (2009)	**Inflation Dynamics and Food Prices in an Agricultural Economy**	**Co-integration Analysis & Error Correction Models (VECM)**	1997-2008	**M2(+), Q(+) & I (+)**	**Xe(+), FP(+) & WP (+)**
Findings and policy remarks	- Excess money supply affects food inflation only in the short run - Mainly stress on the importance of the agricultural output gap - Focus on policies favoring foreign exchange appreciation and improve agricultural performance. - As food staple growth was found to be the key determinants of inflation, the author suggested that monetary and exchange rate policies need to take into account the cereal sector.				
Eden (2012)	**Modeling Inflation Volatility and its effect on economic growth.**	**TGARCH and Co-integrated VAR Model and granger causality test**	1991-2011	**Y(-), Q(+)& M2(+)**	**Y(+), Xe(+), WFP(+)**
Findings and policy remarks	- Inflation is highly related to agriculture and food in the economy. - Found strong asymmetric effect of inflationary shocks on inflation uncertainty - GDP growth affects inflation positively in the long run and negatively in the short - Inflation granger causes inflation uncertainty positively and inflation uncertainty granger causes output growth negatively. - NBE should restore public confidence via sound credible policy instruments.				
Girma (2012)	**Relationship between Inflation and Economic Growth**	**Co-integrated VAR model, VECM and Granger causality test**	1980-2011	**Y(-) & M2 (+)**	**Y(-) & Xe (X)**
Findings and policy remarks	- Economic growth was severely affected by drought (in 1985) and war times (1991/2) which resulted in high levels of inflation. - Economic growth Granger-causes inflation. Whereas Inflation does not have any significant effect on economic growth in the short run. - Increase in money supply results in a high inflation, whereas an increase in exchange rate does not have a significant effect on inflation. - Inflation and economic growth respond significantly to their own shocks. - In order to tackle inflation, GDP should increase from non-inflationary sources. - As Ethiopian Inflation is highly driven by the price of food staples, policy measures to enhance agricultural growth have an immense importance to tackle inflation.				
Ayalew (2007)	**Explaining the Current Sources of Inflation in Ethiopia.**	**Vector Error-correction model (VECM)**	1997-2006	**M2(+), Y(+), I (+)**	**M2(+), Xe(+)**
Findings and policy remarks	- Inflation is affected by real GDP, money stock, foreign prices and exchange rate. - The coefficient of lagged inflation in the food price equation implies the existence of inflation inertia in Ethiopia i.e. Inflation persistence could be highly observed. - Money supply is the basic determinant of inflation in Ethiopia. - A monetary shock, such as contraction of domestic credit, would decrease price level.				
Loening (2007)	**Inflationary expectations In Ethiopia**	**Parsimonious Error Correction model**	1995-2006	**M2(+), Xe (+) & Q(-), I(+)**	**I(+)**

Findings and policy remarks	• Accommodative monetary policy triggered the mounting inflation rate, and inflation expectation was also found to be an important factor of inflation. • Strong inflation inertia was observed and money supply triggers price inertia • Found that structural factors (price regulations and market inefficiency) aggravate inflation through its effect on the inflexible price formation and have a causal effect on inflation inertia thereby weaken the effect of monetary policy. • Tight monetary policy is necessary but not a sufficient condition for controlling inflation… additional measures are needed such as transparency and credibility of monetary policy, and reducing structural barriers that affect the price formation and market efficiency.				
Siefu (2011)	Multivariate Time Series Analysis of Inflation	Co-integrated VAR Model (VEC), Granger's causality tests and FEVD technique.	2000-2010	FP, NFP,	CPI
Findings and policy remarks	• The study confirms the existence of short term adjustments and long-term dynamics • The change in FPI precedes the change in CPI, FPI granger causes NFPI & CPI • FPI used to forecast CPI and NFPI in the long run, whereas NFPI should not be used to forecast FPI, at 5 percent significance.				
Ahmed (2007)	Structural Analysis of Price Drivers in Ethiopia	Micro-analysis, based on accounting equation, not on an econometric model.	1997–2006	M2(+) & Q(-)	M2(+)
Findings and policy remarks	• The recent food inflation is owing to the growth of money stock. • Structural changes such as increasing bargaining power of farmers and monetary expansion are the main reasons for inflation in Ethiopia. • Monetary expansion is largely dictated by credit expansion. Credit expansion was largely explained on the public side, by a decline in foreign finance flow, including a reduction in foreign aid. • Private sector credit was also found to be largely expanded, due to the negative real interest rate and increased investment demand.				
Haji &Gelaw (2012)	Determinants of the recent soaring food inflation in Ethiopia	Johansen's co-integration test and Vector Error Correction Model	1997-2010	M2 (+), Xe (+), OP (-), WFP & WP	M2 (+), Q (-), OP (-) & WFP
Findings and policy remarks	• The result of this study completely rejected the government's claim that the recent inflation is a non-monetary phenomenon. • Hence, the study found that monetary phenomena remain an important and significant factor in explaining the soaring food inflation. • World grain and fertilizer price, oil price index, non-food price index, shocks in the goods and money markets, exchange rate depreciation and inertia are found to be the prominent sources of inflation. • Recommended stabilization and prudent fiscal policy as the most strategic solution to properly manage the recent food inflation.				
Temesgen (2013)	Determinants and Impacts of Inflation	Granger Causality Model Approach	1998-2010	M2(+), OP (+), Xe(+)	Y(+)
Findings and policy remarks	• Found a bi-directional causality between money growth and inflation and unidirectional causality between currency devaluation and inflation. • Inflation has a feedback effect on money growth, thereby generate a self-sustaining inflationary process.				

Note: Real output growth (Y), Broad money supply (M2), Nominal exchange Rate (Xe), World food Price (WFP), WP (World Commodity Price), OP (Oil Price), Food Supply (Agricultural supply) Shocks (Q), Food price (FP), Non Food price (NFP), and inertia (I). (+) sign in parenthesis indicates the positive and significant effect on inflation, (-) is negative and significant effect on inflation and (X) indicates no significant effect.

2.3. Basic Theoretical and Empirical Gaps

At the outset, quite many empirical evidences on Ethiopian inflation have rejected the Philips curve hypothesis (Girma 2011; Haji and Gelaw 2012; Loening et al. 2009; Eden 2012). One of the pivotal reason that makes the Phillips curve hypothesis inapplicable is due to the existence of large informal markets and absence of well organized labor-market system. Thus, there should not have sound link and meaningful relationship among aggregate demand, unemployment and wage increases, which are the key subjects of inflation in this hypothesis.

Monetarists and QTM merely considered the role of the money while explaining price inflation. On the other hand, structuralists proclaimed that money should not be the only source of inflation, particularly in the developing world stating that monetary policy cannot be fully effective under structural rigidities. In this spectrum, numerous studies in the developing world, including the empirical evidences in Ethiopia, have had prior orientation on the monetary theory and applied same while explaining inflation. However, contemporary studies (Loening et al. 2009; Haji and Gelaw 2012) have taken into considerations the role of monetary and external sector on the domestic price inflation through the exchange rate and imported goods channel. Numerous studies have neglected the role of agricultural markets and food supply while explaining inflation in Ethiopia. Contrarily, food and agriculture prices remain to be the major constitutes of the overall price indices (Durevall and Ndung'u 2001).

In the country where the lion's share of the household expenditure is vested on food items, food and agriculture are bound to affect the domestic price inflation to a large extent as the monetary factors do. Unlike most empirical investigations in the Ethiopian inflation scenario, we have got consistent conviction that disequilibrium in the agricultural market is highly likely have significant impact on the general price of goods. Thus, the agricultural market equilibrium relationship is thoroughly investigated in this paper.

In view of that, there are very few studies in Ethiopia which have got sound theoretical and empirical orientations. Most had been conducted on the basis of shallow theoretical and empirical grounds. Conveniently, this study intends to explore key theoretical foundations in view of concurrently explaining the empirical results. On the basis of which the agricultural goods market (Structural explanation), monetary and PPP/imported inflation theories have supposedly had more practical explanations for this study. Moreover, empirical outputs had been consistent enough to represent those theories by virtue of taking into account multidimensional indicators from the broader macroeconomic point of view. Noticeably, theories explaining the domestic agricultural and external market and money market scenarios are found the very influential grounds in this study.

Chapter 3
Measures, Trends and Determinants of Inflation in Ethiopia

3.1. Ethiopian Inflation and its Measurement

Until recently, there are several definitions and concepts given to inflation. Originally, the neoclassical economists' defined inflation as a galloping rise in prices due to excess money quantity, whereas for Keynesians inflation occur when money supply exceeds faster than the full employment level (Jhingan, 1997). Even though several alternative meanings and concepts have been given in different theoretical mainstreams, it has been widely accepted that inflation refers to a sustained increase in the general price level, alternatively it is meant to refer to a depreciation of the monetary unit or a fall in the purchasing power of money (Bronfenbrenner & Holzman 1963).

On the basis of the magnitude of its effect, inflation is categorized in various forms. One is the slow price growth, i.e. less than 3 percent per annum, which is said to be creeping inflation. This type of inflation is considered unproblematic and also pertinent for economic growth (Jhingan, 1997). The second type of inflation is called as walking inflation (a rate of 3 to 10 percent price growth). This type of inflation can be used as a signal for an urgent policy measures to be taken before it reaches to running inflation (at a rate of 10 to 20 percent), which is regarded as unhealthy and very problematic if it persists for a long period. Lastly, the severe rate of inflation, which is above 20 percent per annum, is said to be, Hyperinflation (ibid).

3.1.1. Price Indices Development in Ethiopia

CPI in Ethiopia is measured by the Central Statistical Agency (CSA) through undertaking two round Household Income, Consumption and Expenditure (HICE) surveys in every five years. The two HICE surveys have been conducted in the rural and urban populations of about 21,688 households. The result of the survey is overweighed to represent the goods and services bought and consumed at country level households. More precisely, CPI indicates the weighted average measure of prices of goods and services. Each of the prices of goods and services has different weightage measured by dividing the total expenditure of households on a particular goods by the total expenditure spent on all goods and services. The weights of the goods included in the basket are determined by the result of HICE survey, which is used to indicate the economic importance of each goods and used to reflect the varying consumption pattern across different geographical environment and population. The weights might remain same or revised depending on the result of the succeeding survey.

3.1.2. The Components of CPI and Calculated Weights

The major items included in the Ethiopian CPI and their corresponding weights are shown in Table 2. The 2006 CPI data reveal that 57 percent of the household expenditures are spent on food items. In the 2006 base year, the share of food out of the total households' expenditures has declined from 57 to 60 Percent, whereas the share of non-food expenditure has increased from 40 to 43 percent. The third largest expenditure in the basket comprises of house rent, construction materials, water and fuel and power (21 percent). All the other goods and services constitute only 22 percent. Hence, food price remains to be the major influential sub index in the overall price indices.

Table 2: Components of the 2000 and 2006 Based CPI and weights

S.N	Components	Base year Weights	
		2000	**2006**
1	**Food**	**0.6008**	**0.5701**
2	**Non-Food**	**0.3992**	**0.4299**
2.1	Beverages	0.0201	0.0202
2.2	Cigarettes and Tobacco	0.0051	0.0048
2.3	Clothing and Footwear	0.0926	0.0832
2.4	House Rent, Construction Materials, and Fuel	0.1544	0.2056
2.5	Furniture, Furnishing, and household Equipment	0.0494	0.0375
2.6	Medical Care and Health	0.0120	0.0111
2.7	Transport and Communication	0.0199	0.0249
2.8	Recreation, Entertainment and Education	0.0101	0.0109
2.9	Personal Care and Effects	0.0092	0.0083
2.10	Miscellaneous Goods	0.0264	0.0234
	Total	100 %	100 %

Source: CSA and NBE

As the CPI is the relative cost of a fixed basket of goods in the current year as compared to the base year, it seems to be invalid over time. It has got sizable deviations because the components in the basket and the corresponding weights could slightly differ across different base year. In this regards, the latest baskets are more diversified and robust than the old ones as weights of each item reflect relatively more accurate estimates. One of the fundamental reasons for using different base year indices is due to substantial variations in the basket of items is due to changes in the household consumption pattern. Some of the factors responsible for the changing consumption patterns in Ethiopia are the changes in preference and taste, income, new product development, substitution effects, and the decline in marginal utility (CSA 2009).

3.1.3. Alternative Measures of Inflation in Ethiopia

3.1.3.1.   The Consumer Price Index (CPI)

CPI refers to the monthly or annual percentage changes in the price of a fixed basket of goods and services. The Ethiopian CPI is the most widely used measure of inflation, which is determined on the basis of precise representation of the weighted price index by Laspeyres formula- as follows;

$$CPI_t = \left[\frac{\Sigma W_i \left(\frac{P_t}{P_o}\right)}{\Sigma W_i}\right] \text{x } 100$$

Where, P_t *and* P_0 refer to the price of a particular commodity-i in the current period-t, and in the base year respectively whereas W_i is the weight associated with commodity i. Formula is meant to represent the cost of buying goods and services by using base year quintiles and estimated weights across the whole HICE survey period and hence, there is no need to update the weights monthly or even annually.

3.1.3.2.   Producer Price Index (PPI)

It measures the general price level at the producer stage. These are generally the prices charged by the producers at the level of their first commercial transaction i.e. the wholesale prices charged at the first link in the distribution chain. These prices are easy to obtain and monitor. The construction and interpretation of this index are broadly the same as that of the consumer price index.

3.1.3.3.   GDP Deflator (GDPF)

The GDP deflator is measured by dividing current price GDP by constant price GDP. It tends to evaluate the general price rise for the whole goods and services produced in the economy based on the measure of nominal and real output growth. Nominal GDP refers to output measured at the current price, whereas Real GDP indicates the value of output at a constant price. Mathematically, the GDP deflator is represented as the ratio of nominal to Real GDP.

$$GDPF = \frac{\text{NOMINAL GDP}}{\text{REAL GDP}} \text{ X } 100$$

3.1.4. Inflation Rate, Consumer prices (annual %)

Inflation, as measured by the change in the consumer price index refers to an annual percentage change in the cost of a fixed (monthly or yearly basis) basket of goods and services bought and consumed by the consumers. Inflation rate in Ethiopia is widely measured by using the Laspeyres formula as follows;

$$\pi_t = \frac{(CPI_t) - (CPI_{t-1})}{(CPI_{t-1})} \text{ X } 100$$

Where: t = given year, and price level can be either CPI or GDP deflator.

Figure 2: Alternative Measures of Inflation in Ethiopia (Annual %)
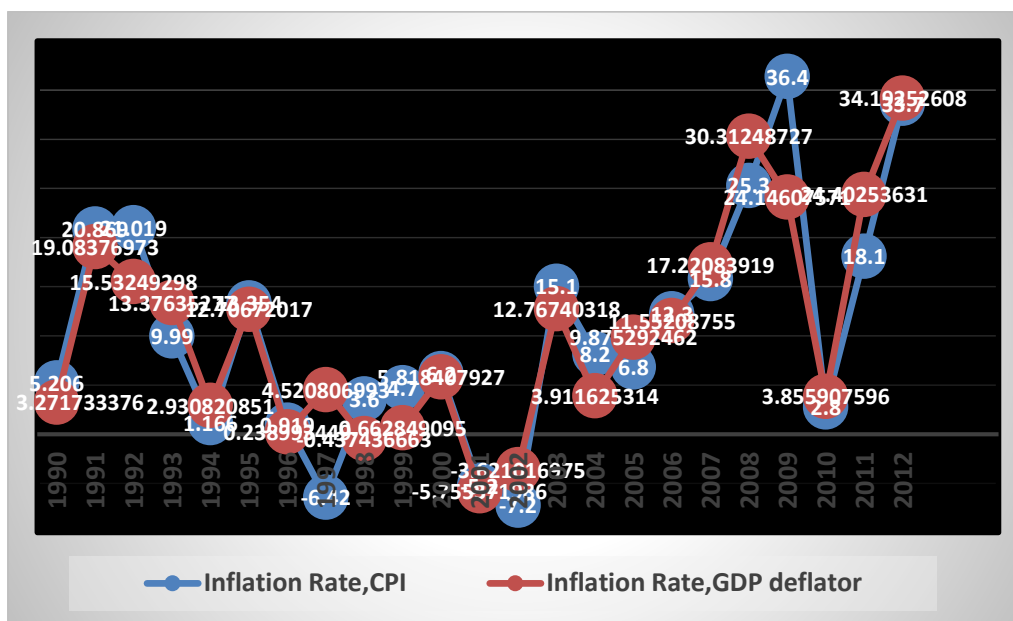
Source: Own illustration based on NBE and WWB data

As shown in figure 1, we can see that there is some sort of deviation in between the two alternative measures of inflation, the main reason for this is GDP deflator reflects prices of all goods and services produced in the country, whereas the CPI reflects only the prices of a representative basket of goods and services purchased by consumers. Moreover, CPI uses a fixed basket of goods and services whereas the GDP deflator compares of the price of currently produced goods relative to price of goods in the base year. Hence, CPI often overstates inflation because it consists of a fixed basket of goods and services (the basket never changes, thus weights are fixed), on the other hand GDP price deflator has weights that change annually in the context of Ethiopia.

3.2. Brief overview of Ethiopian Inflation Trend

Economists widely argue that inflation is the general rise in the price of goods and services. Latterly, it is widely regarded as key macroeconomic gauge used to get an in-depth insight into the overall status of a given economy. According to the classical and neoclassical economists, stable inflation provides a nurturing 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). In view of that, this section provides an imperative clue on the behavior of inflation in Ethiopia and other key macro-economic indicators and their dynamic behavior over time in the wider sense.

3.2.1. Annual Inflation Trend: Overall, Food and Non-food Inflation

Inflation in Ethiopia is widely measured by using the change in consumer prices and are composed of food and non-food items with varying weights. Since food items constitute the lion's share of the total household expenditure, it is found to be the most influential sub index in the overall inflation.

Figure 3: Inflation (overall, food and non-food), % change in CPI
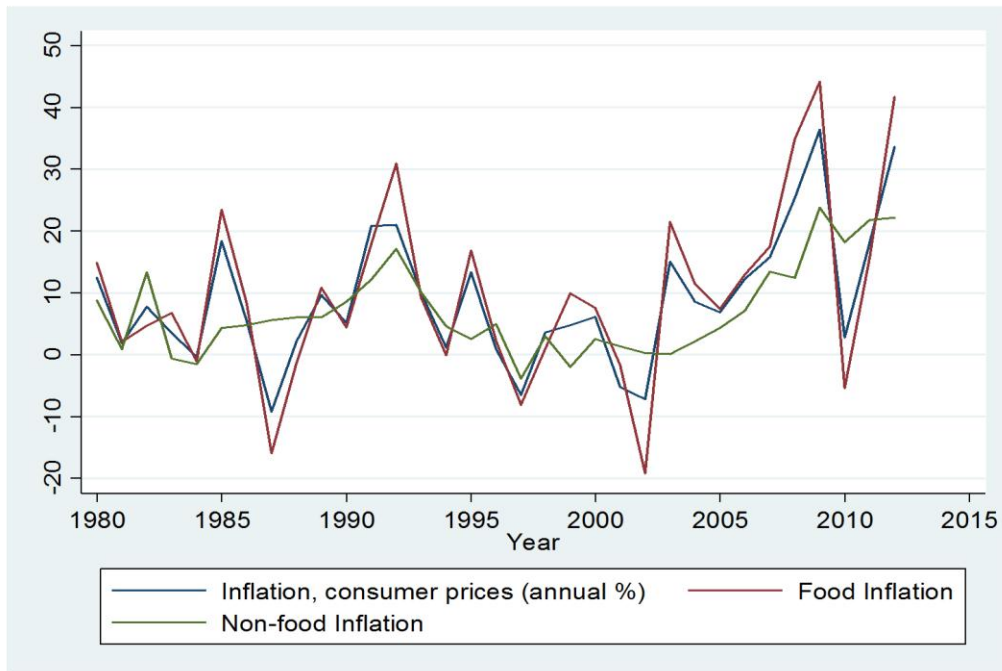
Source: Author's own illustration based on IMF and CSA data

Historically, the presence of unprecedented and highly volatile inflation has been dated no longer than 3 decades. Evidences reveal that the average annual inflation rate during 1980 to 2003 was 5.6 percent. The major inflationary episodes were occurred during conflict, war and drought times (see also Loening et al. 2009; IMF 2008; Loening 2007; Eden 2011). The rate of inflation during 1985 was radically rose up to 18.4 percent. During this period, inflation was primarily driven by the agricultural supply shocks owing to severe weather conditions. The high level of inflation (21 percent) was recorded during the war period with Eritrea in 1991 and 1992. Afterwards, it was dramatically declined, particularly in 1996 and

1997, which was about 0.92 percent and -6.42 percent (deflation) respectively. During 1998 to 2000, the rate was recorded as 4.8 percent on average.

In between 2001 and 2002, the country experienced an average deflation rate of -19.2 percent due to significant food price decline and improved agricultural production due to favorable weather (better rainfall) and the government's effort to support agriculture through credit and fertilizer provision, involvement to set price and expanding market access (NBE 2004). Since 2004, however, the country experienced two digit inflation rates (averaging 17.49 percent), which was one of the most affected economies in Africa (Durevall et al. 2010).

As far as the relationship between overall inflation, food and nonfood inflation is concerned, the trends reveal overall inflation is highly integrated or almost identical with the food inflation; perhaps it does not have a clear association with the nonfood inflation. Unlike the non-food price movement, food price has exceeding growth and regarded as the most volatile one. Food inflation has constantly increased from 21.5 percent in 2003 to 35 percent in 2008 and reached at its climax rate, 44.2 percent in 2009. During this period, food inflation was abnormally hiked and rose above the non-food inflation mainly due to global food and oil price shock.

In countries where food has a large weight in the CPI, such as Ethiopia, food supply shock severely impacts inflation (Durevall and Ndung'u 2001). The non-food inflation rate before 2008 was recorded below 20 percent. In 2009, it reached a peak of 24.6 percent. Generally, the Non-food Inflation appears relatively stable and increased at a slower pace than Food inflation. Food price was dramatically deflated to -5.4 percent in 2010 due to strong fiscal and monetary policy interventions and lower international food prices and then began to soar faster than non-food prices in 2011. In 2012, food inflation remains highly volatile and grown up to double digits mainly due to shortage of rainfall, which factor out drought expectation and then price rise. As agriculture is the cornerstone in the Ethiopian economy, the sector remains to be the major source of food and nonfood crops (Loening et al. 2009).

In view of that, food inflation in the early periods was predominantly associated with agricultural supply shock, market inefficiency and structural rigidities (Eden 2012; Loening et al. 2009; Desta 2008). Our commodity dependent economy has been highly constrained by the effect of exogenous shocks, particularly oil and fertilizer prices. In view of that, the IMF and World Bank pointed out some major factors responsible for inflation in Ethiopia money growth and fiscal mismanagement (large government expenditure, and sustained budget deficit). Others also argue that structural bottlenecks constraining agricultural production, poor infrastructural development (costly transportation and communication system), malfunctioning oligopolistic market are considered the major factors determining inflation in the country.

3.3. Inflation and the key Macroeconomic Indicators

3.3.1. Monetary Aggregates, and Real Interest Rate

As shown in figure 4, inflation tends to move along the movement of excess money growth. Beside its oscillating movement, money supply revealed a very high growth rate, which is almost above the volatile inflation rate and constantly increasing after 2002. Generally, money growth during the major inflation episodes revealed above 20 percent. The trends reveal that money supply and inflation rates are highly integrated. The concurrent growth in the money supply and inflation rate may exhibit the key role of money in explaining the current inflation episodes in Ethiopia (IMF 2008).

Figure 4: Trends of M2 growth, Real Interest Rate and Inflation
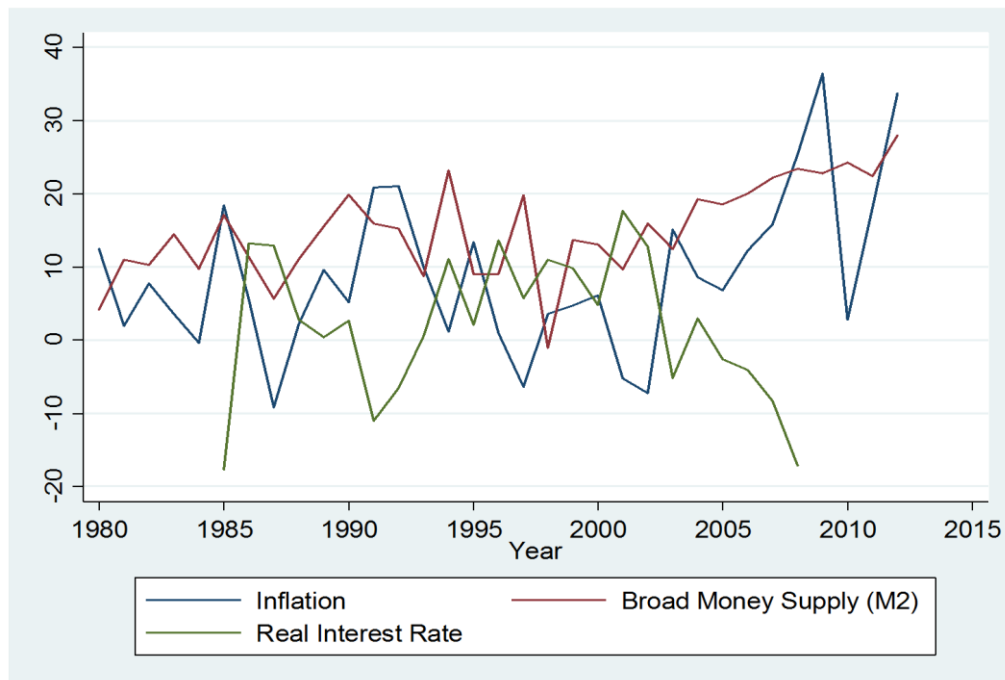
Source: Author's own illustration based on WWB and IMF data

During the normal economic circumstances, money supply comprising of currency in circulation, demand and savings and time deposits has remained typically lower than 15 percent. Since 2003, however, the rate of money growth had been escalating along with the soaring inflation rate. It rose up from 15.93 percent in 2002 to 20 percent in 2006. Evidences reveal that Ethiopian monetary policy was loosely accommodative during high price spikes (Loening et al. 2009). During these periods, deposit and lending interest rates were very low and the real interest rate remains negative (IMF 2013). The negative interest rates and the diminishing purchasing power of 'Birr' have been enormously discouraging to hold cash, and hence people have got an economic orientation to invest in real goods to minimize the cost of holding money. According to the IMF country

report inflation does not only degrade the money transaction demand but also largely diminish the credibility of reserving money as a stock of value (IMF 2008).

Monetary economists widely proclaimed that money growth would be high as long as high and persistent inflation exists. According to Desta (2008), it is not only the relaxed fiscal and monetary stances that aggravate inflation, but also the underdeveloped financial intermediaries have their own contributions. The NBE had been forcing those actors to maintain mandatory reserves in demand and time deposits. Consequently, the real interest rate has been slightly declined, thereby significantly reduced inflation (7.9% in 2013, compared to 39.2% and 15.6% in 2011 and 2012 respectively). Besides, the relatively stable global commodity and oil price may have its own contribution. From this we can infer that the recent inflationary pressure seems to be mainly driven by the monetary expansion (Loening & Takada 2008).

According to the IMF (2008), Ethiopian economy should continue with tightening monetary policy to realize conducive macroeconomic environment for growth. Yet, it may be vague from the theoretical point of view to boldly conclude that the monetary factor alone can explain the recent inflation in Ethiopia. Evidence reveal that several alternative binding constraints (mainly structural and institutional factors) have been determinedly limiting the effectiveness of monetary policies thereby uphold persistent inflation growth (see also Loening 2007).

3.3.2. Excess Liquidity

Excess liquidity is when the growth rate of money exceeds the growth rate of the economy (Klugman 2007). In other words, surplus of money arises when real money stock exceeds the real output growth in the economy. If excess liquidity grows over time, it develops a potential inflationary force. The overwhelming capital inflows from foreign debt, FDI and aid resulted in excess liquidity thereby produced significant inflationary risks. As shown in figure 4, excess liquidity and inflation are strongly correlated. For the whole period under study, excess liquidity reveals continuous erratic movement as similar as inflation with almost parallel magnitude of changes over time.

The excess liquidity has been mainly attributed to the scale up of government spending and monetization of persistent budget deficits by means of debt and foreign aid. Evidences reveal that the loosed fiscal and monetary conditions, together with the underdeveloped financial system may be in charge of the release of excess liquidity. For the last decade since 2003, excess liquidity has shown an upward spiral whereas inflation was extremely volatile. During this period, the average liquidity growth rate and inflation rose up to 11.84 percent and 14 percent respectively. The contemporary factors in charge of the excess liquidity are found to be monetization of the fiscal deficit, the increasing banking sector together with the expansion of alternative financial products like mobile banking and other outreach services by the booming microfinance schemes (IMF 2008).

Particularly over the last two decades, Ethiopian economy experienced five conspicuous spikes of inflation (such as 1984-1985, 1991-1992, 2003-2004, 2008-2009 and 2012), due to the excess liquidity flowing into the financial system. The Ethiopian banking system upholds excess liquidity and banks hold about two fold reserves in the NBE as required (Saxegaard, 2006; IMF, 2008).

Figure 5: The Patterns of Excess Liquidity (Real Money Stock- output) And Inflation
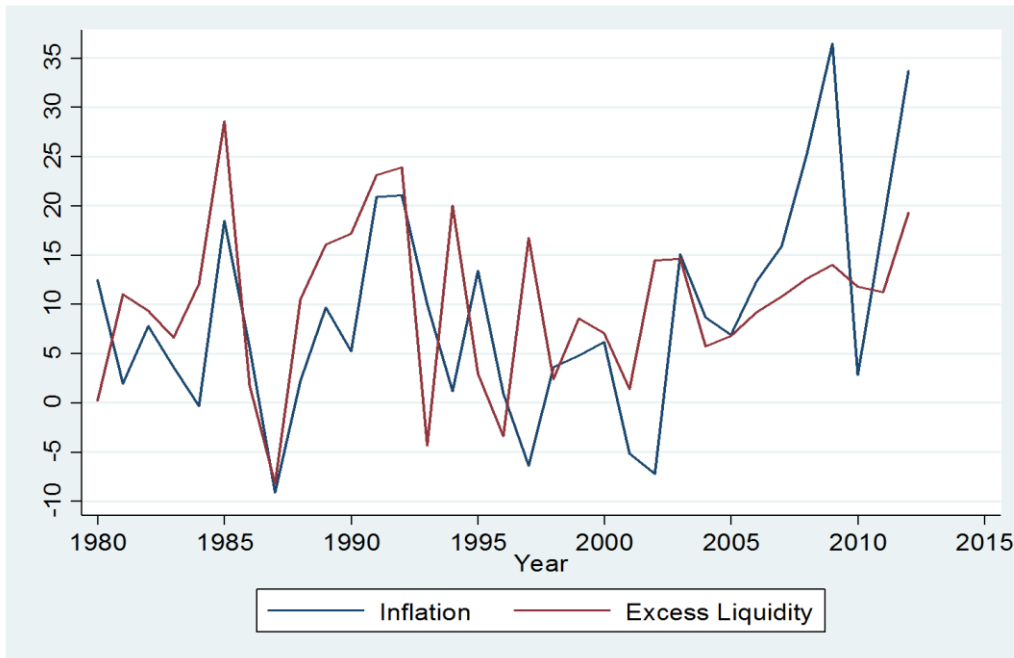
Source: Author's own illustration based on data from CSA AND NBE

According to Saxegaard (2006), excess liquidity is highly likely to deteriorate the effectiveness of monetary policy to regulate the demand condition and stabilize the macroeconomic environment. In other words, the bank's unreserved effort to stimulate aggregate demand by means of increasing liquidity could not have been operational. Even if the NBE had taken several policy measures to control the mounting liquidity, the bank's efforts to maintain the balance of money and GDP growth have not yet been effective enough to reduce the mounting inflation. Hence, under excess liquidity conditions, the monetary policy transmission mechanism would never be viable for stabilization purposes (Nissanke and Aryeetey 1998).

3.3.3. The Growth of Output and Monetary Factors

Until recently, there is no strong consensus weather inflation is positively or negatively related to economic growth. From the Keynesians perspective, there is a short run tradeoff between output and the change in inflation (Gokal and Hanif, 2004; Girma 2011). Most proclaimed that moderate inflation is very vital for economic growth and vice versa. In Ethiopia, the major inflationary episodes have been observed during the period of drastic economic growth. In the 1980s,

inflation grew two fold faster than GDP (2.3 percent). During this period, inflation was profoundly related to agricultural supply shock. Due to the listless economic performance, there was a significant output gap owing to the meager agricultural production and productivity (IMF 2008).

Figure 6: The Patterns of Inflation, Money supply and Output Growth
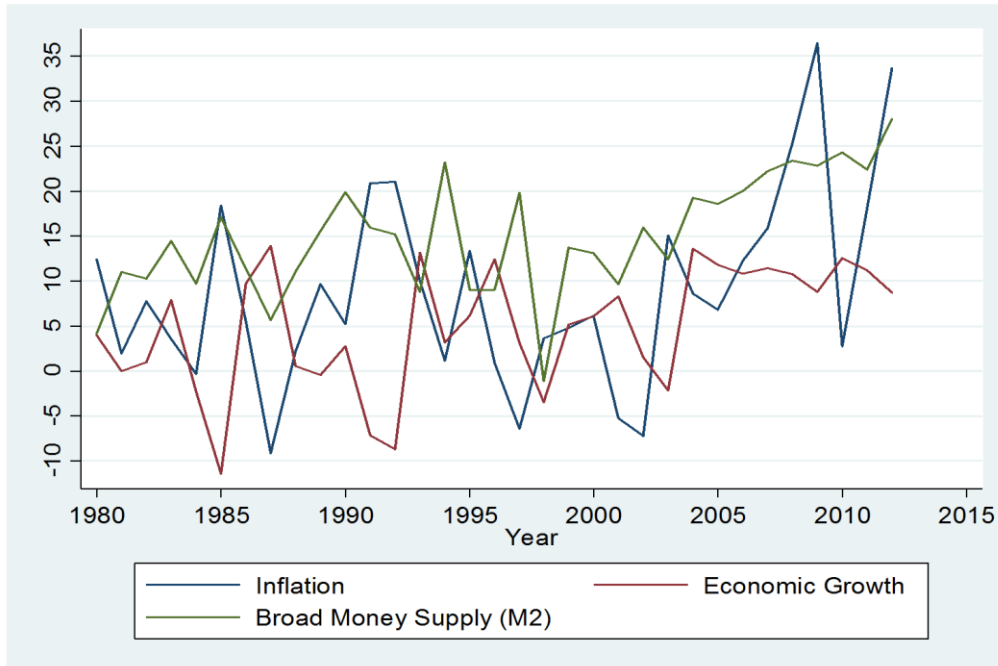
For about a decade since 1990, Ethiopian economy experienced several adverse conditions, particularly, war and political instability in the 1991 and severe drought in 2003. Hence, the economy was immensely wounded and GDP remained below zero in those periods (-8 percent, and -2.16 percent respectively). Since 1995 to 2002, GDP grows faster than the rate of inflation. Generally, the growth rate of the economy before 2003 comprises of 2.6 percent on average, which is lower than the average inflation i.e. 5.6 percent. Almost for the whole study period, the average inflation rate rose up faster than economic growth. The average money growth amounts 12.3 percent. Since 2002, Money has grown faster than GDP meaning that money growth exceeds beyond the economic capacity to offset, thereby trigger unstable macroeconomic environment mainly inflation. According to Meier (1995), so long as money creation exceeds the non-inflationary limit, money supply overtakes the real output growth and scales up inflationary pressure (see also Loening et al. 2008).

From 2004 to 2008, the average economic growth achieved was about 11.69 percent, which was highly remarkable in the continent. This incredible economic performance was due to the expansion of agriculture and the service sector, state led investment progress and infrastructural development. Since then, however, the economy is highly constrained by the soaring inflation, largely in 2008 and 2012. As a matter of fact, real economic growth was constantly declined to around

23

7 percent in 2012; remarkably lower than the average growth rate in the preceding five consecutive years (8.4 percent on average). In view of that, Tadese (2012) stated that the country's economic growth will be further constrained by the shortage of external financing, uncertain demand, and the threatening business environment.

Particularly for the last decade, Ethiopia had a strong commitment to improve agricultural production and productivity. Fostering structural and or institutional pitfalls (particularly expanding farmers' access to credit, flourishing market information and storage facilities) could improve the farmers to produce better agricultural output there by thriving better market linkages and distribution efficiency. Hence, if the recent inflation is solely attributed to supply side factors, there may not have a good economic reason to believe that inflation increases despite improvements in the agricultural production. Hence, Ethiopian inflation is unlikely to be solely explained by a unimodal approach (IMF 2008). Apparently, monetary and nonmonetary (Production and marketing inefficiencies) factors may have concurrent effects on inflation. Likewise, IMF (2013) and Loening et al. (2009) stated that despite monetary phenomena matters a lot, some supply-side factors can also explain the recent surge in food prices in spite of the betterment of agricultural harvests.

3.3.4. The Velocity of Money

The velocity of money refers to the frequency in which currency has been spent on goods and services. In other words, it is the speed at which one unit of currency is transacted. It helps to measure the speed of money in circulation necessary to determine appropriate monetary targets and effective interest rate (IMF 2008). Thus, the velocity of money can be regarded as a crucial financial spectacle enabling to deeply explore the savings and spending pattern, the degree of monetization, financial deepening and inflationary phenomena as well (Ayalew 2007). As there is no any independent measurement of the velocity of money, this paper adopted the definition of velocity as the ratio of nominal GDP to real money aggregates i.e. an economic equation that showcases the relationship between money supply, velocity of money, the price level and an index of expenditures. It represents a founding principle used by the QTM, which relates money growth with prices.

As shown in figure 7, the movements of velocity and inflation are strongly correlated characterized by unidirectional and volatile movement. The velocity has experienced an unprecedented rise, thereby cause inflation to rise with parallel magnitude of changes over time. One of the main reasons for the higher pace of money was the increase of short run consumption and decline in savings and the booming investment. On the other side, the flow of money has been concentrated to specific beneficiaries or markets without being circulated to the general population. Hence, the erratic velocity is bound to put pressure on price inflation as there was very low demand for the national currency.

Figure 7: The movement of Velocity and Inflation growth rate
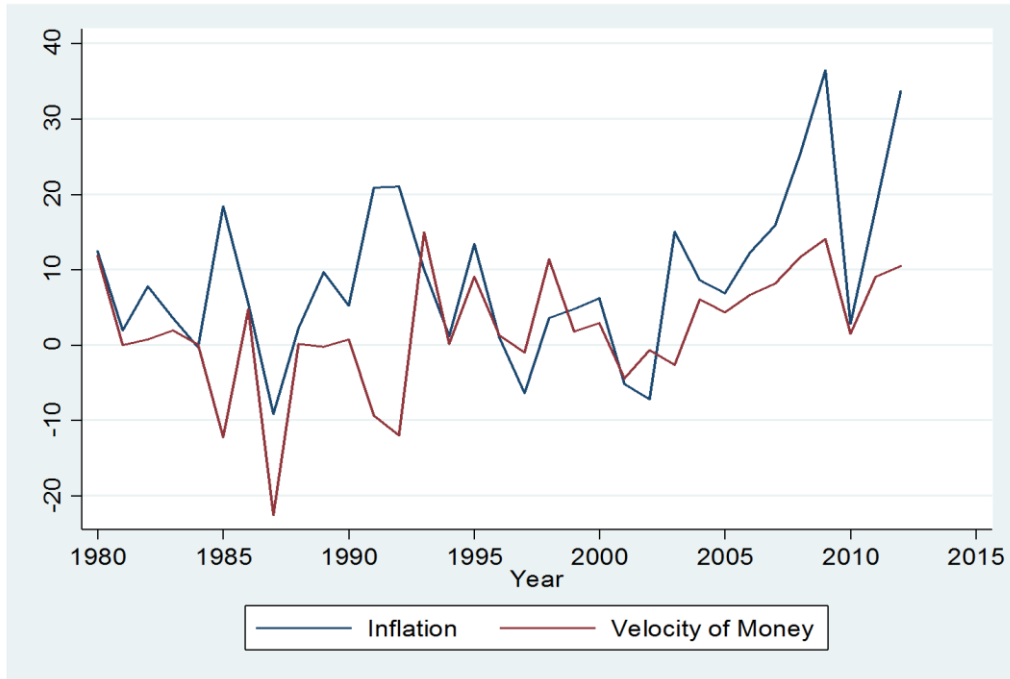
Source: Author's own illustration based on IMF and NBE

While inflation becomes persistently high, holding money for transactions became increasingly costly, which leads to raise the velocity of money. According to the IMF (2013), inflation does not only degrade the money transaction demand but also diminish the credibility of reserving money as a stock of value. Some of the factors accountable to the sustained rise in the velocity of money in Ethiopia may be monetization of the fiscal deficit, the increasing banking sector together with the expansion of alternative financial products like mobile banking and other outreach services by the nonbanking financial institutions for instance, the booming microfinance schemes.

3.3.5. Deficit Financing, Exchange rate, and Trade Balance

The budget deficit is commonly understood as a condition under which government expenditure (total spending) surpasses the total revenues. In most developing countries, deficit is usually financed through foreign debt, printing of money or by selling government bonds (monetization of debt). The latter is not possible in Ethiopia due to the underdeveloped financial market system. Unlike other African countries, Ethiopia is not fortuned to have solid natural resource bubble. Hence, the main source of government revenue is foreign debt, aid, and very limited tax and foreign exchange earnings.

Several evidences, including our analysis reveal monetary phenomena are part parcel of the recent inflation. In other words, the surge in the money supply due to higher credit expansion and net foreign assets exceeded the level best to maintain stable inflation. The latter is out of control of the NBE. On the other

extreme, the recent inflation may reflect monetization of the fiscal deficit (Durevall and Sjö 2012). Hence, using tight fiscal and monetary condition alone may not bring satisfactory changes in order to circumvent the rising inflation. Thus, it would be necessary for the government to tackle budget deficit and monetization problems as well. The Budget deficit reveals a downward declining trend. In the past two decades, Ethiopian economy faced persistent deficits due to repeated conflict/war, increasing military expenditure and drought conditions.

Figure 8: The Movement of Exchange rate, Trade Balance, and Budget Deficit
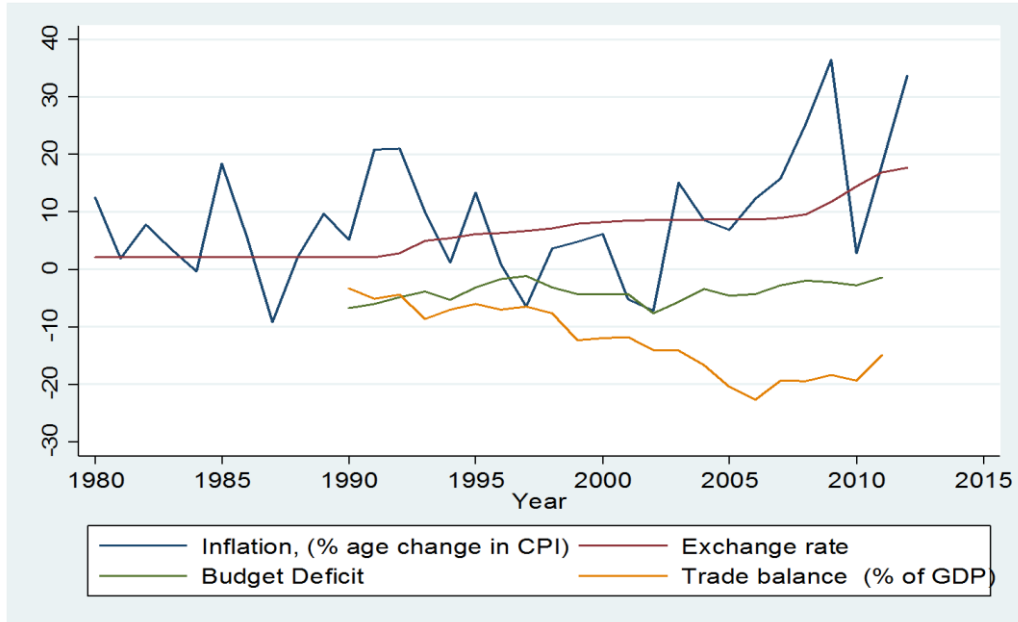
Source: Author's own illustration based on IMF and FAO data

Despite the successive economic growth, the government's budget scheme has failed to improve a Fiscal deficit. The average deficit (as percent of GDP) for the three consecutive five year period since 1990 encompasses -1.22, -1.85, -4.27 and -4.66 percent respectively. In other words, the deficit has been growing on average by 51 percent, 130 percent and 9 percent from the previous five consecutive years. Underprivileged agricultural growth and export performance (large foreign exchange shortfall), and limited domestic resource are the principal factors in charge of the sustained deficit growth. Moreover, the infant private sector development and lower FDI may also have its own effect.

The exchange rate trend reveals an upwards movement reflecting steady depreciation over time. More recently, the pace of depreciation revealed an upward spiral over time. Changes in the rate of nominal depreciation can be a decisive factor through the cost transmission channel. To this end, the negative trade balance and foreign exchange reserves, and a weak external demand conditions are the utmost constraining factors behind Ethiopian price inflation (ibid). Hence, the foreign price shock is an important source of variability in the Ethiopian economy.

3.3.6. Structural Rigidities

As agriculture is the backbone of Ethiopian economy, failure to improve its production and productivity may immensely harm the overall economic growth, export performance, external balances and inflation as well. That is why significant decline in GDP growth was recorded during bad weather and drought conditions. In those periods, supply side factors were highly detrimental in the overall economic performances. Hence, failure in the agriculture production was the most dominant factor for the unfavorable macro-economic environment.

As shown in figure 11, the role of the service sector has been gradually increasing while the share of agriculture steadily declines over time. From 2004 to 2009, the share of agriculture in the overall GDP was declined on average by 3 percentage points. On the other hand, the share of the service sector had been grown to 10 percentage points in the last five consecutive years; perhaps the growth of industry remains stagnant (only 14% GDP contribution). Hence the service sector has been gradually dominating the economy principally due to the development of financial intermediation, public administration and retail business.

Figure 9: Real GDP growth and contribution by sector
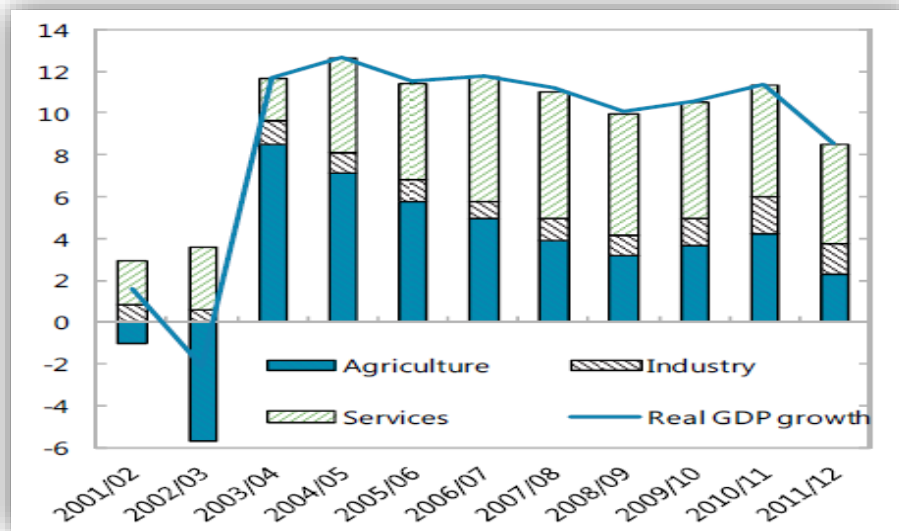
Source: IMF computation (2013)

During the 90s, several structural reforms were adopted including liberalization of most price regulations and significant tariff reduction (Average tariff was reduced from 41.6 to 17.5 percent in mid-1990), devaluation of exchange rate (Birr was devalued by 59 percent in 1992), and lifting up of quantitative import restrictions in 1993. Moreover, tariffs were substantially reduced from 230 to 35 percent in 2003; thereby import-to-GDP ratio could steadily grow over time (IMF 2013). It was the very decisive moment to orient the stagnant economy in to the global market. However, the period was warmly trembled by various external risks and uncertainties (such as conflicts, war and droughts) and could not be worth

feeding. Several evidences (for instance, IMF 2007, Loening et al. 2009 and Ayalew 2007) have lately witnessed the vivid improvements in agricultural production principally due to government commitment to support agriculture (better access to credit, storage facilities, marketing information and income) and favorable weather conditions. However, until recently agricultural productivity remains low as compared to the growing food and raw material demand.

As service and industrial sectors are major consumers of agricultural products in Ethiopia, service sector expansion and industrial progress are highly likely to widen an output gap unless agricultural supply grows to the least equivalently. During 2003 to 2012, the robust economic growth and the service sector expansion are the two most striking factors behind the rising output gap (IMF 2013). Even if the government had been implementing numerous agriculture development programs, the sector remains unproductive due to inimical factors disfavoring production and marketing, particularly, the underdeveloped financial market, the retarded private sector development, and poor infrastructural facilities (Lenin et al. 2007). Until recently, Ethiopian economy has been mainly dominated by the declining role of agriculture, which is followed by ramping service sector. According to the 2012 estimates of CSA and NBE, the relative share of agriculture, service and industry accounts for 45.1%, 44.4% and 10.6% respectively. Agriculture remains highly vulnerable to the foreign price shock and bad weather conditions (Loening et al. 2009).

Considering the prevailing structural constraints, the Government of Ethiopia has formulated the five-year (2010/11-2014/15) development plan i.e. Growth and Transformation Plan (GTP), which is geared towards fostering the malfunctioning economic structure. The policy has broader objective of enhancing agricultural productivity and marketing efficiency by means of technology adoption, flourishing access to financial services; improving access to and quality infrastructure and improving regional integration (Bulbula 2011).

In sum, without concrete structural and institutional reforms, it is highly unlikely to stabilize price inflation in the agricultural market. The economy has been demanding further structural reforms like liberalization of the financial and foreign exchange market, private sector development and industrial transformation. At the outset, much attention should be given to infrastructural development (road, telecommunication, and power supply), which is believed to be the backbone of privatization, industrialization, efficient market operation and economic transformation in general.

Chapter 4
Data and Methodology

4.1. Data Sources and Description

The data used in this research paper comprises of annual time series data from 1980 till 2012. It is mainly composed of secondary and tertiary data. Country source of data, principally includes both the Government and non-Governmental organizations, particularly the Ethiopian Central Statistical Agency (CSA), Ministry of Finance and Economic Development (MoFED), National Bank of Ethiopia (NBE), and Ethiopian Development Research Institute (EDRI). As the data collected in most of the government offices were not well organized and consistent over time, most of the research data were collected from the external sources particularly IMF, EDRI, FAO and WWB databases. On the basis of the theoretical and empirical literatures reviewed, the following variables are found to be viably important to explain the recent inflation scenario and described as follows.

Table 3: Description of the Variables

Variables	Description
P	Overall, Consumer Price Index
PNF	Non-Food, Consumer Price Index
PF	Food, Consumer Price Index
FPI	Global Fertilizer Price Index
Y	Real GDP Growth Rate
M2	Broad Money Supply Growth
M − P	Real Money Stock, M2
XE	Nominal Exchange Rate
IMP	Intermediate Imports Price Index
R	Real Interest Rate
Rf	Average Annual Rain Fall (MM)
K	The Cost of Capital
OPI	Global Oil Price Index
WFP	World Food Price Index
WP	Foreign Producer Price Index

4.2. Model Specification and Empirical Strategy

Univariate time series analysis involves a single variable which is composed of past values of the variable itself and the current and past random error terms. Whereas Multivariate time series technique consists of two or more variables through which the VAR framework is meant to explain dynamic interactions and co-movements of variables. In this regard, co-integrated VAR and its associated

analytical tools (IRF, FEVD) are known to be the powerful toolkits in time series analysis (Box, G. E., Jenkins, G. M., & Reinsel, G. C. 2013). In the VAR framework, each of the underlying variables in a multivariate system is regressed by a constant, by its own lags and p lags of each of the other variables in the VAR system. The VAR model where case n>2 and k>1, that is a general VAR model containing K variables and p lags is

$$\mathbf{y_t} = \mathbf{v} + \mathbf{A_1 y_{t-1}} + \mathbf{A_2 y_{t-2}} \dots + \mathbf{A_p y_{t-p}} + \mathbf{\varepsilon_t} (4.1)$$

Where, $\mathbf{y_t}$ is a K x1 vector containing K variables in the system, $\mathbf{v}$ is a K x 1 vector of parameters, $\mathbf{A_1}$ to $\mathbf{A_p}$ are K x K matrices of parameters, and $\mathbf{\varepsilon_t}$ is a K x 1 vector of multivariate random errors (disturbances), having zero mean and covariance matrix $\sum$, which remain normal over time.

One of the very importance of applying co-integrated VAR framework is to interrogate the short run dynamics of a set of integrated series with the long run equilibrium (ibid). In this system, the presence of a co-integrating vector is regarded as long-run equilibrium relationship. The short run dynamics are usually determined by means of discarding existing trend in the variable using differencing approach. The bad side of this approach is that important information regarding the long run association of the variable (which economic theories have a lot to say) can be discarded while losing the trend. Sims, Stock, and Watson (1990) recommend against differencing even if the variables contain a unit root. The main argument against differencing is that it "throws away" information concerning the co-movements in the data, such as the possibility of cointegrating relationships. This paper is, thus, highly concerned to overcome this problem of a simple VAR framework by means of employing co-integrated VAR model in the form of Error correction representation.

4.3. The Multivariate VECM Specification

A vector error correction (VEC) model is a restricted VAR framework designed for use in a non-stationary series that are known to be co-integrated (ibid). The VECM has co-integration relations which are built into a specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustments (Stock 1997). The cointegrating term is also known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

Generally, the VECM relates the change in the dependent variable to the change in independent variables and the long-run relationship. If variables are co-integrated i.e. I (o), all terms in the VECM are stationary. When the variables are co-integrated, the corresponding error correction must be included in the system (ibid). By doing so, one can avoid misspecification and omission of important constraints. Based on the Engle and Granger procedure, a vector of $\mathbf{y_t}$ (as specified in equation 4.2) can be represented in a VEC form as follows;

$$\Delta y_t = \pi y_{t-1} + \pi_1 \Delta y_{t-1} + \pi_2 \Delta y_{t-2} + \ldots + \pi_p \Delta y_{t-p} + \varepsilon_t \quad (4.2)$$

Where: π_j are n x n coefficient matrices with elements π_{jk}, π is a matrix with elements such that one or more of the $\pi_{jk} \neq 0$ and εt is an n x 1 vector with elements ε_{ij}. Using some algebra, we can rewrite

$$\Delta y_t = v + \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \quad (4.3)$$

Engle and Granger (1987) show that if the variables yt are I (1) the matrix $\prod$ in (4.3) has rank0 $<=$ r $<$ K, where r is the number of linearly independent cointegrating vectors. If the variables are co-integrated, $0 < r < K$ and (4.3) shows that a VAR in first differences is mis-specified because it omits the lagged level term, $\prod y_{t-1}$.

Despite, various alternative frameworks are developed for estimation and inference in a co-integrated VAR analysis, the Johansen framework (1988, 1991, and 1995) has got an immense importance particularly in comparative studies. He could overcome some limitations of the Engle and Granger procedure in the aforementioned representations (equation 4.3) and is based on the maximum likelihood estimation as follows.

$$\Delta y_t = v + \alpha \beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \Gamma_3 \Delta y_{t-3} + \varepsilon_t \quad (4.4)$$

The matrix Π can be decomposed as $\Pi = \alpha\beta'$ where α is nxr matrix of speed of adjustment terms, and β is an nxr matrix of parameters which determines the cointegrating relationships matrix of long- run coefficients. The columns of β are interpreted as long-run equilibrium relationships between variables. The matrix α determines the speed of adjustment towards this equilibrium. Values of α close to zero imply slow convergence and r, $0 \leq r \leq n$ is the rank of the matrix Π and represents the cointegrating vectors in the system which can be determined using the Johansen Maximum Likelihood method. Johansen defines the two matrices α and β, both of dimensions n x r, where r is the rank of π. They tell us the extent to which each of the variables in xt adjusts to a shock in order to revert to the equilibrium relationship.

Like most other empirical studies on the sources of inflation in sub Saharan African context (Fielding et al., 2004; Mikkelsen and Peiris, 2005), and in the Ethiopian context (Eden 2012; Loening et al. 2009; Haji and Gelaw 2012; Girma 2011; Loening 2007), the study adopted VECM for identifying pertinent theoretical alignment explaining the dynamic relationship among the variables in to consideration. In doing so, the empirical strategy in this paper combines two separate estimation methods: the vector error correction model (VECM) and a multi factor single-equation model.

As most macroeconomic indicators are non-stationary and are I (1), an error correction representation is the most appropriate model in order to explore the short run and long run impacts, responses and co-integrating adjustments of each integrated variable in the system. It is also an important tool for policy analysis. Specifically, following Johansen and Juselius (1990) and Johansen (1995), a vector of I(1) endogenous variables that are integrated of order r =1 were explicitly estimated on the basis of the three fundamental theoretical frameworks discussed in chapter II. On the basis of which, the models were meant to identify the three possible long run co-integrating equilibrium relationships as hypothesized by the structural theory, money demand theory and PPP theory.

$$\mathbf{ECM_1 = \delta_1 P - \delta_2 Rf - \delta_3 FPI - \delta_4 K - \delta_5 Opi - \delta_6 Pnf}$$

$$\mathbf{ECM_2 = (M - P) - \emptyset_1 Y - \emptyset_2 R} \tag{4.5}$$

$$\mathbf{ECM_3 = \omega_1 lnxe + \omega_2 lnWP - lnP}$$

Structuralists fundamentally prescribe the role of the supply side constraints in determining the domestic agricultural market disequilibrium. This hypothesis is precisely presented in the first VECM comprising of Rain fall *(Rf),* cost of capital (K), fertilizer (FPI), oil price (OPI) and the price of non-agricultural commodity (Pnf) (see also Haji &Gelaw2012; Loening et al. 2009). The agricultural system in Ethiopia is mainly dominated by smallholder farming system which is predominantly undertaken by the use of family labor. Hence, wage has no real importance to be included in the model. Apparently, while we consider wage in the model, the Johanson co-integration test reveals no co-integration in the Agricultural market equilibrium relationship. Hence, using wage as one of the supply side factors would entail meaningless result. Alternatively, as rural finance is the decisive factor for agricultural production and productivity in Ethiopia, the cost of capital is the lending rate of rural financial institution which is supposed to show us a clear picture of the effect of financial constraint on agricultural supply shock and price inflation.

The role of money supply and demand has also been clearly represented in the second VEC model, which is fundamentally derived from the QTM, where (M-P) refers to real money stock, Y is the output and R is the real interest rate which is also regarded as the cost of holding money (inflation). The long run Equilibrium relationship is maintained when aggregate money demand equates the aggregate supply. Hence, inflation is regarded as the result of any disequilibrium adjustment towards the change in real money growth, income and interest rate in the long run.

The third VECM is meant to represent the validity of PPP in explaining the impact of real exchange rate on the domestic inflation. In this regards, Structuralists explicitly verified that external disequilibria cannot be removed through exchange devaluations alone. Hence, imported inflation (captured by the relative price differences) is considered to evaluate the impact of imported input

cost on the domestic inflation and BOP (Cardoso 1981), which is mathematically represented in the form of ECM3, where lnxe, lnWP and lnP indicate the logarithmic nominal exchange rate, foreign price and domestic price indices.

Even if, it is not theoretically justifiable, but there are some econometric technical reasons to combine all the variables and estimate a multiple factor single equation Model. Principally, most macroeconomic indicators are strongly interrelated and have significant effects on inflation. Understandably, this estimation has got meaningful interpretation from the broader macro-economic point of view (see also Loening et al. 2009; Haji and Gelaw 2012). The main purpose of this estimation is, therefore, to examine the relative importance of each of the long run co-integrating relationship as justified by theory in determining price. Thus, a multiple factor single equation model augmented with error correction terms is estimated as follows.

$$\Delta P_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1_i} \Delta P_{t-i} + \sum_{i=0}^{k} \alpha_{2_i} \Delta PF_{t-i} + \sum_{i=0}^{k} \alpha_{3_i} \Delta PNF_{t-i} + \sum_{+i=0}^{k} \alpha_{4_i} \Delta Y_{t-i}$$

$$+ \sum_{i=0}^{k} \alpha_{5_i} \Delta M2_{t-i} + \sum_{i=0}^{k} \alpha_{6_i} \Delta XE_{t-i} + \sum_{i=0}^{k} \alpha_{7_i} \Delta Rf_{t-i}$$

$$+ \sum_{i=0}^{k} 8_i \Delta K_{t-i} + \sum_{i=0}^{k} 9_i API_{t-i} + \sum_{i=0}^{k} \alpha_{10_i} FPI_{t-i}$$

$$+ \sum_{i=0}^{k} \alpha_{11_i} OPI_{t-i} + \sum_{i=0}^{k} \alpha_{12_i} \Delta WFP_{t-i} + \sum_{i=0}^{k} \alpha_{13_i} IMP_{t-i}$$

$$+ \alpha_1 [(M - P) - \beta_1 Y - \beta_2 R] + \alpha_2 [XE + \beta_3 Wp - \beta_4 P]$$

$$+ \alpha_3 [P - \beta_5 Rf - \beta_6 FPI - \beta_7 K - \beta_8 OPI - \beta_9 PNF] + \varepsilon_t$$

The terms in brackets represent the error-correction terms and its parameter α_{1-3} shows the speed at which price inflation adjusts for any disequilibrium in the goods market, the money market and external market respectively i.e. the amount of disequilibrium transmitted in each period into the rate of inflation. The parameters of the variables ($\alpha 1i - \alpha 8i$) reveal the short run dynamic relationships among the variables. A significant and positive sign on a lagged current inflation α_{1_i} indicates the presence of inflation inertia, owing to indexation and or expectations i.e. when past inflation positively affects the current one. The estimate of the parameter β_i reveals the long run relationship towards the goods market, money market and external market disequilibrium.

Chapter 5
Empirical Analysis: Results and Interpretation

5.1. Descriptive Analysis

As a usual and the foremost practice in most empirical investigations, descriptive analysis is used to get thorough insight into the nature of a given data and is an important source of clue for meaningful interpretation of the time series analysis.

Table 4: Descriptive Statistics

Var	Obs	Mean	Std. Dev	Min	Max
CPI	33	100.02	69.53	32.81	306.32
PF	33	124.21	62.97	79.71	330.37
PNF	33	96.39	64.93	47.63	268.72
Y	33	4.935	6.83	-11.41	13.87
XE	33	6.412	4.42	2.07	17.71
Rf	33	1156.25	242.41	140.6	1567.9
IMP	33	93.20	26.21	52.47	152.15
K	33	12.56	3.23	7.25	22.00
R	33	1.79	10.59	-17.67	17.64
OPI	33	69.09	51.84	19.54	196.31
FPI	33	102.85	60.23	55.67	340.65
WFP	33	115.52	26.97	85.66	175.43
WP	33	132.29	31.49	89.8	202.2
M-P	33	6.09	9.72	-13.6	26.25

Source: Own Estimation

The statistical analysis as shown above reveals 33 observations with significantly varying mean and standard deviation across each variable. Food and non-food consumer prices (PF & PNF), Real money stock growth (M-P), real interest rate (R), Oil price index (OPI) and Fertilizer price index (FPI) have shown a relatively larger mean and higher dispersion. Particularly, the growth rate of output and real money stock and interest rate exhibit higher dispersion larger than their mean value. It may give us some intuitive clue justifying the existence unstable macro-economic environment, particularly in the monetary conditions. Supply side factors seem to be stable except the highly volatile oil and fertilizer price shock. The import price index (IMP), total annual rainfall (Rf) and the cost of capital (K) typically reveal lower dispersion from their mean. Apparently, the average growth rate of the real money stock reveals significantly higher than the real output growth. This may be an indication of excess money supply beyond the economic capacity to offset at a normal economic circumstance.

5.2. Augmented Dickey-Fuller Unit Root Test

Despite the fact that all the evidences, including visual inspections of the series, ACF and PAC verified non-stationary behavior of all the series in level, but stationary in first differences, it is duly important and necessary to test the behavior of each series by means of formal tests for the existence of unit root i.e. Augmented Dickey-Fuller (ADF) tests. Once we have established the correct specification for the ADF using the F-type test, we have applied a general to specific approach while establishing the optimum number of lag lengths. The lag structure in the ADF was chosen by using the Akaike information criterion (AIC) and Schwarz Bayesian Criterion (BSC) and residuals were tested for the higher order serial correlation using the Breusch-Godfrey test. Finally, the ADF test reveals the following results.

Table 5: Stationarity test for the explanatory variables

Explanatory Variables	Stationarity in Level		Stationarity in First Difference	
	Test Stat.	P-Value	Test Stat.	P-Value
Consumer Price	1.089	1.0000	**-5.447***	0.0000
Food Price Index	1.462	1.0000	**-3.581**	0.0315
Non-Food Price	2.113	1.0000	**-8.534***	0.0000
Real Output Growth	-3.071	0.1133	**-8.495***	0.0000
Real Interest Rate	-1.660	0.7682	**-6.310***	0.0000
Cost of Capital	-0.111	0.9483	**-6.389***	0.0000
Annual Rain Fall (MM)	-3.478	0.0418	**-6.755***	0.0000
Excess Money Growth	-0.055	0.9936	**-10.157***	0.0000
Nominal Exchange Rate	-0.943	0.8226	**-3.013***	0.0029
Real Money Stock	-5.356	0.0000	**-9.232***	0.0000
World Fertilizer Price	-1.575	0.8022	**-6.651***	0.0000
Intermediate Import Price	-1.196	0.6754	**-5.151***	0.0000
World Oil Price	1.258	0.9964	**-9.857***	0.0000
World Food Price	-0.060	0.4763	**-5.606***	0.0000
Foreign Price Index	2.297	0.9851	**-4.610***	0.0000

Note: *, ** and * indicates rejection of the null hypothesis of non-stationarity at the 10 percent, 5 percent and 1 percent significance level respectively.

According to the Augmented Dickey-Fuller unit root test, the null hypothesis for a unit root test is stated as a given series is I (1) against the alternative I (0). In other words, the series contains unit root against the alternative, which does not contain unit root respectively. On the basis of which, one can definitely proclaim that all the series in levels has failed to reject the presence of unit root hypothesis. Precisely speaking, the ADF test for the entire series in level exhibits insignificant even at 10 percent significance level, which indicate all the variables contain unit root in their level. After first differencing, the ADF test reveals highly significant for all the variables and hence clearly rejects unit roots suggesting that all the series in first difference are stationary.

5.3. The Johansen Co-integration Analysis

Since our empirical investigation consists of I (1) variables that are modeled in three separate dynamic system, we used the Johansen co-integration analysis to test for the presence of long run co-integration in the domestic agricultural market, money demand and external market scenarios. The result of the analysis revealed that each market could have at most one co-integrating relationships. According to Stock and Watson (1988), the co-integrating rank (r) refers to the number of common trends, or co-integrating relationships in some or a combination of all of the series in the system.

Identification of lags is the first and foremost task while performing co-integration analysis or fitting co-integrating VECM. In this context, Akaike information criteria (AIC) and Schwarz information criteria (SBIC) were found to be more robust. Accordingly, the number of lags identifying the order of each cointegration are three in the agricultural market, one lags in the money and external market equilibrium. Following lags specification for the order of co-integration, it is necessary to determine the number of cointegrating equations in the system so as to correctly specify the VAR model (i.e. a VAR in levels, VAR in first differences or VECM) fitting a given set of data. This can be done by using the Johansen multiple trace test procedure and a method based on minimizing either of the two different information criteria. On the basis of which, the co-integration test was made separately, representing equilibriums in the three markets and the results are presented along with the cointegrating vector in table 6, 7 and 8.

According to the results of all the co-integration tests, we strongly reject the null hypothesis of no co-integration (Ho: r = 0 against the alternative hypothesis, H1: r = 1, 2, and 3) and fail to reject the null hypothesis of at most one cointegrating relationship. Thus, the Johanson co-integration analysis asserted that there could have a total of three co-integrating equations in the entire system. In this respect, we can firmly conclude that the Ethiopian inflation scenario can be worth explained through the three long run co-integrating vectors. Hence, neither a VAR in level nor indifference are appropriate for estimating inflation model. The main problem associated with VAR in difference is it discards (filters out) the relevant information on the long- run relationship (co-movements) of the variables. Having determined that there is at most one co-integrating equations in each market, we proceed to estimate the parameters of each cointegrating relationships in light of the three pertinent theoretical grounds-cost push theory, money demand theory and PPP theory.

5.4. Econometric Results of the three Long Run Equilibrium Structure

5.4.1. The Agricultural Market Equilibrium Relationships

As shown in Table 6, the result of the Johanson co-integration test affirmed that there is strong evidence for one cointegrating vector in the system i.e. $P - 0.27\ FPI - 0.2\ Rf - 6.86\ K - 2.38\ OPI - 3.72PNF$. Evidence found that the domestic price is highly sensitive towards the long run agricultural supply shock. There is positive and highly significant relationship between price inflation and the supply side factors. This implies that price goes high in the long run whenever a shock occured in those factors of production. The coefficient for the cost of capital reveal very large, meaning that agricultural finance is the major bottleneck of the agricultural production and productivity and price shock in Ethiopia.

Table 6: Co-integration Analysis in the Domestic Agricultural Market

Rank Test					
Null Hypothesis	**r = 0**	**r ≤ 1**	**r ≤ 2**	**r ≤ 3**	**r ≤ 3**
Eigen Values	-	0.740	0.486	0.471	0.36358
Trace statistics	107.29	**65.50***	44.88	47.21	11.1596
5% Critical Value	94.15	68.52	47.21	29.68	15.41

Standardized Eigenvector β_i					
P	**FPI**	**Rf**	**K**	**OPI**	**PNF**
1.00	.268132***	.208045***	6.8588***	2.3834***	3.7218***
-	(.1130837)	(.0099464)	(.919198)	(.1689979)	(.1241675)

Standardized adjustment coefficient α_i					
.0952309	-.0099386	-10.45591	.0177774	-.1231737	.1072613*
(.0623426)	(.2711041)	(1.475695)	(.0156976)	(.1929297)	(.0588873)

Source: Model Output

Note: the VEC includes three lags on each variable. Standard errors are in parenthesis. ******* indicates significant at 1 percent, ****** significant at 5 percent and ***** significant at 10 percent.

As Ethiopian economy is highly vulnerable to external shocks (Loening et al. 2009), the mounting cost of agricultural production (mainly global oil and fertilizer price) has been limiting agricultural supply threby trapped reasonable price formation in the domestic market. Those external shocks have had long run disequilibrium effects in the domestic market through which the short run price adjustment significantly affects price inflation. That is why the adjustment parameter-α_i matrix (the amount of disequilibrium transmitted in to inflation), reveal negative, explicitly attesting the need to reduce the cost push factors in order to maintain stable long run price inflation. The wage is not found to be a

viable indicator for the reason that Ethiopian Agriculture is largely dominated by smallholder farming system , which is prominently undertaken by the use of family labor. Our model indicates existence of long run co-integration if and only if wage is eliminated from the system. Instead, the cost of capital is found to be the most decisive factor.

Figure 10: The Predicted Agricultural Market Equilibrium Equation
$$P - 0.27\,FPI - 0.2\,Rf - 6.86\,K - 2.38\,OPI - 3.72PNF.$$

Source: Model Output

Apparently, Figure 10 provides an evidence of the existence of stable, long run equilibrium relationship between the domestic price and the supply side factors. Until 2005, it is highly likely that the supply side factors could work properly to explain the Ethiopian inflation scenario, yet the puzzle seems very different after that. As the co-integrating vector has appeared unstable since 2006, it seems the recent inflation trajectory emanates not only from the supply side factors, but might also be provoked by the monetary and external factors. Apparently, this evidence strengthens the fact that the recent inflation episodes differs from the past as it was occurring during the period of bumper harvest and progressive agricultural growth (Loening et al. 2008; IMF 2008). Therefore, we have strong evidence to conclude that price inflation in the long run is significantly explained by the agricultural market disequilibrium. Thus, we reject the null hypothesis in favor of the alternative stating that agricultural supply and demand relationship in the domestic agricultural market significantly determines price inflation in Ethiopia.

5.4.2. The Money Market Equilibrium Relationship

Most economic theories (Monetarists, QTM and Heterodoxies) proclaimed that price inflation is widely attributed to excess money stock growth. In view of that, several studies proved that monetary factors are highly workable in the Ethiopian context (IMF 2008 and 2013; Durevall and Ndung'u, 2001; Haji and Gelaw 2012; Desta 2008; Durevall, D. and B. Sjö2012 and Simpasa et al. 2011)

Table 7: Co-integration Analysis in the Monetary Sector (Money Market)

Rank test			
Null Hypothesis	**r = 0**	**r ≤ 1**	**r ≤ 2**
Eigen Values	-	0.52949	0.30967
Trace statistics	32.6347	10.7702*	0.0234
5% critical value	29.68	15.41	3.76
Standardized Eigenvector_ β_i			
M-P	**Y**	**R[1]**	
1.00	-.0027299***	-.4864705***	
-	(.00103536)	(.091538)	
Standardized Adjustment Coefficient _α_i			
-1.479455***	-14.79138	-.2596104	
(.1593436)	(12.4589)	(.2082483)	

Source: Model Output

Note: The VAR includes one lags on each variable. Standard errors are in parenthesis. *** indicates Significant at 1percent, ** at 5 percent and * at 10 percent significance level.

Table 7 presents the long-run relationship between the price level, real income and the real money stock (M−P) as justified by the QTM. The Johanson co-co-integration analysis reveals that income and the real interest rate are integrated with money growth thereby affect prices in the long run. In this case, evidence proved that the error correction terms or the disequilibrium adjustment parameters for real income and interest rate requires negative feedback necessary to adjust towards the long run equilibrium, but remains to be statistically insignificant. However, the adjustment parameter for real money stock is highly significant, which can be firmly regarded as endogenous. Thus, the cointegrating vector is well exemplified for valid interpretation of the long-run money demand equilibrium relationship. Similarly, our findings revealed that the coefficient on income is $\gamma = 0.003$, which is highly consistent with economic theory (QTM) suggesting that the velocity of money and real output remains zero (unchangeable) in the long run through which the growth of money supply results proportionate increase in the level of price inflation or deflation.

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[1] From the theoretical point of view, R is meant for the cost of holding money, which is used as an explicit representation of the growth rate of inflation.

In this case, the growth rate of real money stock revealed significantly higher than real output growth, meaning that too much money is chasing fewer goods in the economy. Hence, it is possible to infer that inflation has been growing proportionately with the growth rate of the real money stock. In addition, as the adjustment parameter for real output do not have significant disequilibrium adjustment, it may clearly undermine the role of demand pull inflation in explaining the recent price inflation in Ethiopia (see also Haji and Gelaw 2012).

Figure 11: The predicted Money Demand Equilibrium Relationship
$$(M - P) - 0.003Y - 0.49R$$

Source: Model Output

Figure 11, reveals very strong evidence for the existence of stationary and robust long run equilibrium relationship in the money market. The stationary money demand relationship reveals no change in the velocity of money. Hence, we can possibly infer that the quantity theory of money strongly holds, meaning that the growth rate of money supply is same as the growth rate of inflation.

Apparently, structuralists did not deny the fact that sustained inflation is unescapable only under the condition of monetary expansion (Nell 2004). According to Fisher and Easterly (1990), rapid inflation is always a fiscal phenomena which is virtually impossible to get well managed or stabilized without reducing the persistent budget deficit. Apparently, the money supply endogeneity may demonstrate the likelihood that the large fiscal deficit and aggressive credit expansions could drive the excessive money supply growth (Saleh and Harvie 2005). According to Nell (2004), inflation may also be driven by the external shocks in foreign prices or the exchange rate depreciation while money supply is partly endogenous. Hence, the monetary transmission mechanism may principally work through the exchange rate channel.

5.4.3. The External Market Equilibrium Relationship

The result of the Johanson co-integration test affirmed that there is strong evidence for the existence of one cointegrating vector in the system i.e. $XER + 8.33WP - 0.15P$. The long run co-integrating vector revealed external prices have a significant and positive relationship with the REER and the domestic price. The disequilibrium adjustment parameter reveals highly significant and negative, commending the need to appreciate nominal exchange rate in order to maintain stable long run inflation.

Table 8: Co-integration Analysis of the External sector (PPP)

	Rank Test		
Null Hypothesis	**r = 0**	**r ≤ 1**	**r ≤ 2**
Eigen Values	-	0.63351	0.19620
Trace statistics	39.0610	8.9478 *	2.3957
5% Critical Value	29.68	15.41	3.76
Standardized Eigenvector β_i			
lnXER	**lnWP**		**lnP**
1.00	8.326776*******		-.154018*******
-	(1.053294)		(.380116)
Standardized Adjustment Coefficient α_i			
-.1232031*******	-.0004999		.1284246*******
(.0368616)	(.0139268)		(.0327619)

Source: Model Output

Note: PPP hypothesis strongly recommend variables to be converted in to logarithmic form. Thus, lnXER, lnWP and lnP refer to the logarithmic nominal exchange rate, the foreign and domestic price index respectively . According to the Johanson test for co-integration, the co-integrating vector identified in this estimation is r=1. Standard errors are in parenthesis. ******* indicates significant at 1 percent, ****** at 5 percent and ***** at 10 percent significance level.

For the reason that Ethiopia is one among the non-oil producing county, but also fundamentally due to non-competitiveness of the economy, foreign price shocks revealed highly exogenous. Evidence indicated that Ethiopia has been adopting floating exchange rate and the economy is highly vulnerable to external price shock (Loening et al. 2009). According to Bleaney and Fielding (1999), adopting a floating exchange rate in the developing economy would result about 10 percent higher inflation growth. Apparently, the highly significant disequilibrium adjustment averred that the domestic price hike may possibly emanate through the exchange rate transmission mechanism in response to the exogenous price shocks.

Figure 12: The Predicted External Market Equilibrium Relationship
$$XER + 8.33WP - 0.15P$$

Source: Model Output

As shown in figure 12, we test the validity of PPP by analyzing the stationarity of the REER, which measures the deviation from PPP. Apparently, the series of REER seems to converge towards its mean, suggesting that purchasing power parity hypothesis seems to be partially maintained in the long run. The necessary condition to hold the PPP hypothesis is that it must display reversion towards its own means (Menzie 2005). Hence, there is some evidence rejecting the null hypothesis of non-mean reversion against the alternative of mean reversion. Hence, we can possibly reject the null hypothesis in favor of the alternative stating that PPP holds in Ethiopia, meaning that the real effective exchange rate significantly determines the domestic price inflation in Ethiopia.

5.5. The Short Run Dynamic Multivariate Analysis

In this section, we develop a multi-factor single equation model for food, non-food and overall price inflation. The model consists of the agricultural market, money market and external market error correction terms. As inflation is affected by several factors in the short run, it would be more valuable to explicitly consider all the pertinent factors in the model (see also Loening et al. 2009; Haji and Gelaw 2012). Hence, the multivariate error correction model explicitly addressed the effect of the supply side factors, monetary and external factors. The three column presents outcome of the dynamic model in which the dependent variable is overall price, food and non-food price inflation. In both cases, the sign of the variables and their level of significance are similar. However, there are notable differences in the magnitude of the coefficients of each variable across the three price inflations.

Table 9: The Dynamic Short Run Relationship[2]

Lagged Explanatory Variables	Overall CPI	Food Price	Non-Food Price
Consumer Price	.1990483***** (.0704615)	-	-
Food Price Index	-	.0823039 (.1123407)	-
Non-Food Price	-	-	.1861729****** (.0883595)
Output Growth	.3169462 (.6556175)	.4806353 (.6705263)	.3118665 (.2502094)
Cost of Capital	6.9814******* (2.66809)	6.807059****** (2.728762)	2.187625****** (1.018248)
Annual Rain Fall (MM)	-.0295946***** (.0158293)	-.0172018***** (.0161892)	-.0117962***** (.0060411)
Nominal Exchange Rate	-2.793473****** (3.174557)	-6.804015 (3.246747)	-.5545398****** (1.211536)
Excess Money Stock Growth Rate	3.460043******* (.9521303)	.0111472******* (.9737819)	.5360621******* (.3633703)
Fertilizer Price Index	.3349849****** (.2131399)	.8235923******* (.2179867)	.2669651******* (.0813425)
Intermediate Import Price Index	.0564665******* (.2424207)	.0223275******* (.2479334)	.1861927******* (.0925173)
Oil Price Index	.109185****** (.2514456)	.6985354******* (.2571635)	.5324492******* (.0959615)
World Food Price Index	-.1701222 (.4054021)	-.7245421***** (.414621)	-.3895503****** (.1547174)
Foreign Price Index	1.548174****** (.7725674)	.0646383 (.7901357)	.6662553****** (.2948421)
Ecm1	-1.143312******* (.3429858)	-.9161571******* (.3507853)	-.2402604***** (.1308968)
Ecm2	2.258849******* (.4289167)	.5163286 ******* (.4386703)	.713123******* (.1636914)
Ecm3	-2.740281****** (.1239972)	-.8111887****** (.1268169)	-.2545166****** (.4732221)

Note: values in parenthesis are Standard errors. *** indicates Significant at 1percent, ** at 5 percent and * at 10 percent significance level.

Source: Model Output

Most coefficients are significantly large for the food price index. Moreover, the existence of higher inflation inertia (0.18) hints that the non-food price level

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[2] According to Loening et al. (2009), incorporating agricultural production index in the model is not a good idea as it concurrently affect income and then the demand for goods.

adjusts slowly back to equilibrium when a shock occurred, whereas food prices immediately overshoots and react much stronger to shocks (see also Loening et al. 2009). Hence, food price remains to be very vital component of the overall price index

The degree of inflation inertia is another crucial factor for inflation. Lagged price inflation parameters are used to capture inflation expectations related to new news, policy changes and sudden shocks in the supply side factors (Ng and Ruge-Murcia 2000; Osborne 2005). On the basis of which, the lagged coefficients in the overall, and non-food price reveal robustly significant meaning that inflation inertia is highly observed and its degree is relatively very large for the overall price inflation. A one percent increase in the overall, food and non-food prices in the previous year will increase the price of same in the following year by 0.2, 0.1 and 0.19 percent respectively. We can possibly infer that in the short run, a change in the price inflation is highly sensitive to the changes in indexation or expectation. Several evidences also depict that inflation inertia are highly workable in Ethiopia (IMF 2008; Loening 2007; Haji & Gelaw 2012; Loening et. al 2009). Credible measures and stabilization policies would have an immense importance to dampen the growing risk of inflation expectations.

As far as the supply side factors are concerned, the evidence reveals that fertilizer and oil prices could have very strong and significant effect on food and non-food price. As they constitute the two major external supply side factors, the effect of agricultural supply shock is mainly originated through these factors and also through the exchange rate pass through effect (Loening et al. 2007). Noticeably, the cost of capital is highly significant and effective in all the price indices. This evidence certainly proved that high cost of capital (indicator for the shortage of agricultural finance) have a substantial obstacle in the Ethiopian agricultural production and price inflation. On the other hand, evidence reveals that rainfall does not have a significant effect on price inflation because either its effect may not be realized in the short run or have a long run effect through the agricultural supply shock, that is why the error correction term for the agricultural supply shock becomes strongly significant. In sum, except rain fall all the supply side factors are highly significant in the domestic price inflation.

There is strong evidence stating that an intermediate import and foreign price indices have a strongly significant effect on the domestic price inflation. This may certainly justify the fact that Ethiopian economy has been highly dependent on the intermediate goods import. Contrarily, the world food price does not have a significant effect on the overall inflation. The main reason is that the progressive agricultural growth has possibly undermined the effect of world food price shock. This is also consistent with the findings of Loening et al. (2007).

As far as the effect of real output growth is concerned, our evidence strongly asserted that it does not have a significant effect on price inflation. The positive sign may simply indicate the fact that the major inflationary episodes has occurred during the period of drastic economic growth. This evidence certainly rejects the government's claim to explain the cause of recent inflation in favor of the demand

pull inflation hypothesis (see also Girma 2012; Desta 2009; Haji & Gelaw 2012) as it is also proved in the money market equilibrium relationship.

The coefficient on excess money growth reveal larger and highly significant in the overall price inflation. Money growth seems to matter a great deal of all the possible sources of price inflation. Both inflation theories (monetarist and structuralists) have got a strong conviction that monetary expansion is part and parcel of most inflationary episodes, particularly, when the money stock become partly endogenous (Pinga and Nelson, 2001; Yeldan, 1993). Prevailing evidences verified that Ethiopian inflationary pressure is predominantly affected by monetary expansion (Simpasa et al. 2011; Loening et. al. 2009, IMF 2013 and Haji and Gelaw 2012). Ethiopia followed an accommodative monetary policy during high inflation episodes (Loening et al. 2009). Hence, the accommodative monetary policy can be one of the reasonable factors for inflation. The main reason to find that excess money did not cause food inflation is that monetary policy may not be effective due to market inefficiency in the oligopolistic agricultural market structure (Klugman 2007); perhaps the undergoing agricultural reforms and structural constraints may also exert pervasive hindrances behind reasonable price formation in the agricultural market, which would have blocked the effect of ongoing monetary policy to combat the rising price inflation. This is also theoretically consistent from the structuralist point of view.

As far as the long run relationship is concerned, the error correction term in the agricultural supply shock and real money stock growth rate are highly significant. The highly significant parameters of the error correction term in the supply side and monetary factors may possibly indicate price overshooting meaning that an exogenous shock on the supply side and monetary factors determindely enforce the domestic price to respond above its long-run equilibrium level (see also Haji and Gila 2012). This strengthens the evidence in favor of the supply side and monetary factors as the main determinant of domestic long run price inflation. On the other hand, the error correction representation for the external sector also reveals significant effect on the domestic price inflation. This implies that the imported inflation thesis is also highly workable to explain the long run price inflation through the exchange rate pass through effect.

Chapter 6
Conclusion and Some ways foreward

Ethiopia has experienced unprecedented and highly volatile inflation episodes for longer than two decades. National and international reports pronounced that the country's inflationary pressure was grown above the continental average. Until recently, the high uncertainty and volatility nature has brought unreserved attention among several writers and researchers. In view of that, the study found three basic theoretical approaches that could feasibly explain the sources of inflation in Ethiopia i.e. Structuralist, Money demand and PPP hypotheses. Based on those theoretical insights, our analysis included several macro-economic determinants particularly the supply side factors, policy variables (monetary, fiscal and exchange rate policies) and external factors as well. By using annual data over the past three decades, VEC model was applied to identify the salient sources of inflation and their dynamic behavior over time. The pre-estimation and post estimation specifications asserted that our models are highly parsimonious and appear to be reasonably well specified.

Our finding reveals that Changes in the average inflation rate are highly sensitive to the changes in indexation or inflation expectation and largely to the changes in money supply growth. The response of inflation from its own shock is positive and strongly significant, meaning that inertial factors remain largely workable in Ethiopia. The credibility of putting money as a stock of wealth had been considerably declined. The share of Currency in circulation and money growth had been substantially increasing over time, thereby adding extra pressure on the general price level. In this regards, the NBE and commercial banks need a strong commitment to build a public reputation by means of adopting credible monetary policy and fiscal stances pertinent to combat the growing risk of inflation expectation. Monetary policy plays an important role beside structural rigidities are profoundly affecting its effectiveness. Thus, further measures to stabilize the domestic agricultural goods market through flourishing the distribution channel (transport and communication) could have paramount importance to have well managed price shocks.

Our main findings demonstrated that the three inflation theories (the agricultural goods market, the Quantity Theory of Money and the Purchasing Power Parity) are highly applicable in Ethiopia. Our result evidently rejected the null hypothesis in favor of the alternative stating that those theories are highly workable and have strongly explanatory power on the long run inflation. However, the insignificant effect of real output growth and the present-day developments in agricultural performance could markedly undermine the role of the demand pull hypothesis in explaining the recent inflationary pressure. As similar as the findings in South Africa (Nell 2001), in Kenya (Durevall and Ndung'u 2001) and Uganda (Simpasa et al. 2011), our empirical evidence reveals that money supply is endogenously determined. Hence, under the conditions of structural rigidities, the effect of tight monetary policy and financial development alone may not help much to stabilize the recent price inflation. For this reason,

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even if the Government of Ethiopia frequently adopted monetary tightening and strict price regulation, inflation has yet remained to be unresolved. Flourishing structural rigidities and institutional pitfalls can have paramount importance not only for tackling supply side problems, but also enable to activate the effectiveness of monetary policy as well.

In sum, A large fraction of Ethiopia's inflation is explained by the supply side and monetary factors. Virtually, money supply growth, owing to the prevailing public credit expansion has a large and significant effect on inflation for the reason that the money growth continually eroded the value of the nation's currency. External shocks have also a detrimental effect on the domestic price through the exchange rate pass through effect. The growing trade imbalances due to high foreign price shock had been profoundly affected the macro-economic stability via imported price inflation. The external shock transmission mechanism is also prominently provoked by the effect of exchange rate depreciation. Hence, carefully designed monetary and stable exchange rate policies can promptly improve the balance of trade, thereby enable to manage the domestic price shock. Moreover, the malfunctioning oligopolistic market, fiscal mismanagement and monetization of the fiscal deficit could also have concurrent effects on inflation. To conclude, our results markedly asserted the need to apply the aforementioned multimodal approach to successfully combat the recent inflation in Ethiopia.

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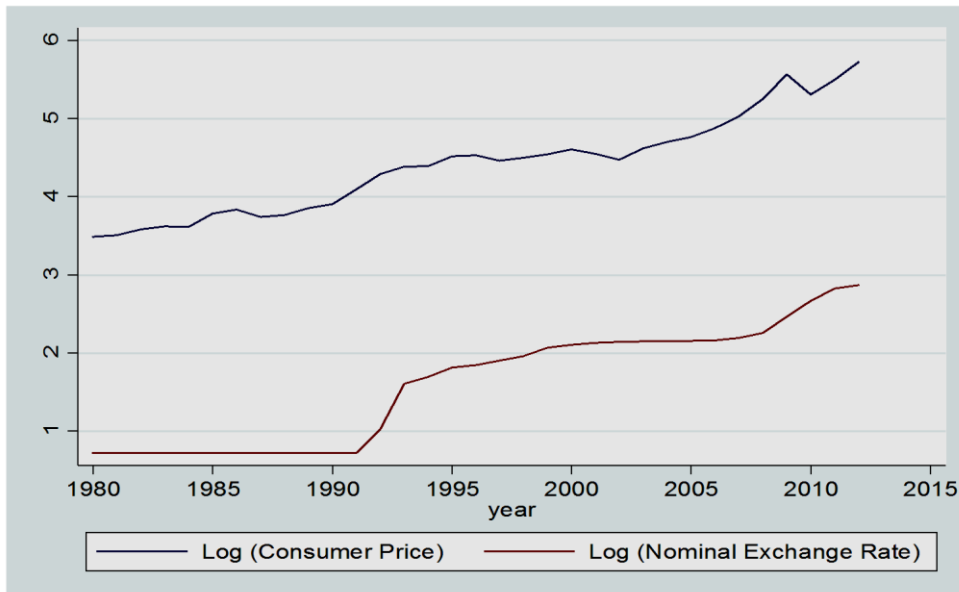
Appendices

Appendix 1: The series of co-integrated variables

Figure 13: The Long run velocity as a proof of PPP assumptions

Source: The External Market Equilibrium (PPP) Model Output

Figure 14: The series of co-integrated variables in the PPP relationship

The stochastic trend exhibits some co-integration and co-movement in between the logarithmic domestic price and nominal exchange rate while deviating from the long run PPP.

Figure 15: The Series of Integrated Variables In the Money Demand Relationship
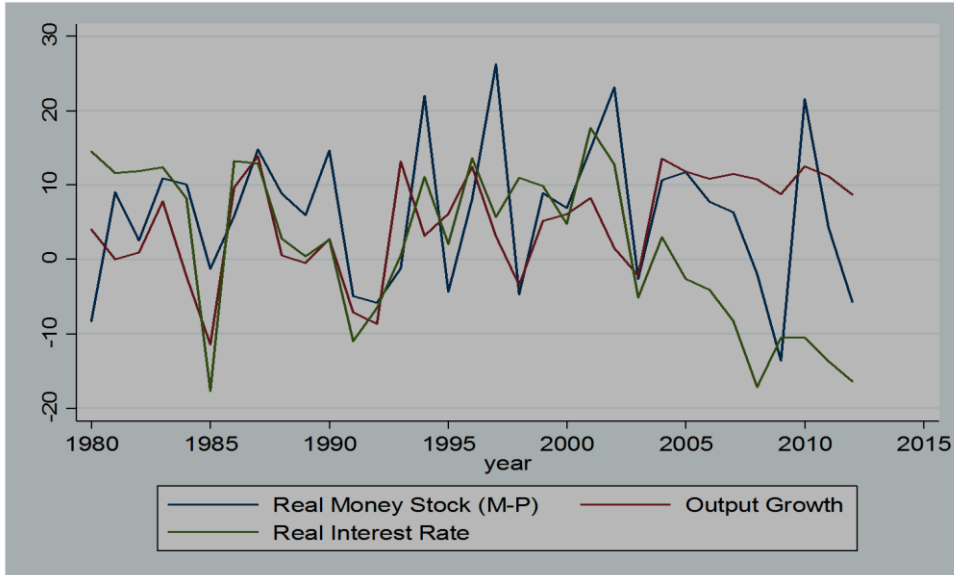
Figure 16: The series of integrated variables in the Agricultural market
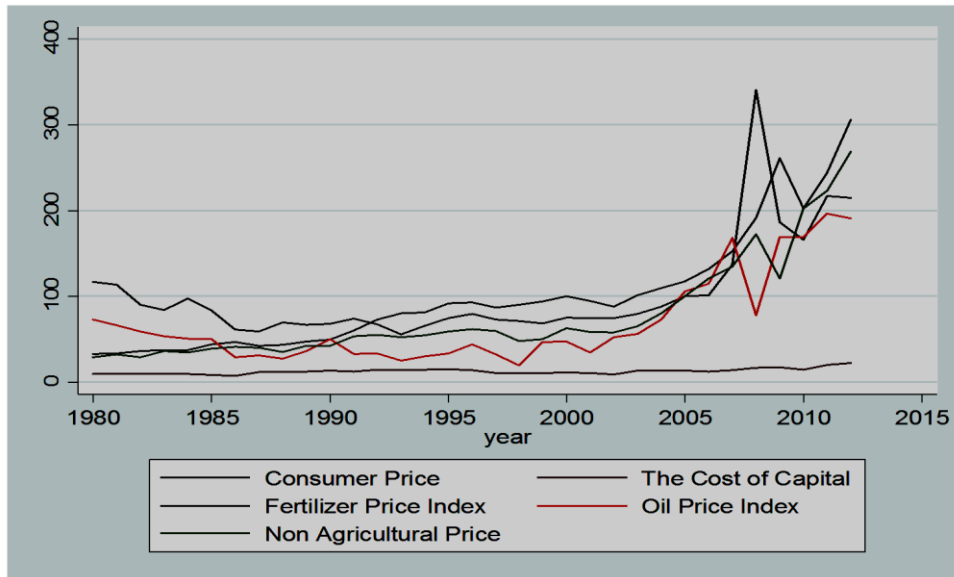
Note: the variables in the agricultural goods market exhibit certain arbitrary and discontinuous erratic co-movements over time. Whereas, the series in the external market equilibrium reveal clear association in between the dometic price and the relative exchange rate in such a way that both series steadily moves upward and also reveal parallel co-movements overtime. Generally, all the series in the three distinct market scenario reveal some sort of co-integration and or linear association among the co-integrated variables.

Appendix 2: Post Estimation Specifications

1.1. Stability Test to Check Mis-specification of our Model

According to the stability test to check whether we have identified an appropriate number of co-integrating equation in our model and as a check for model misspecification, the companion matrix in a VEC with K endogenous variables and r cointegrating equations reveal a K- r unit eigenvalues. While the process is stable, the moduli of the remaining r eigenvalues has to indicate lower than unity.

Figure 17: Eigenvalue Stability Condition (ECM1, ECM2 & ECM3)
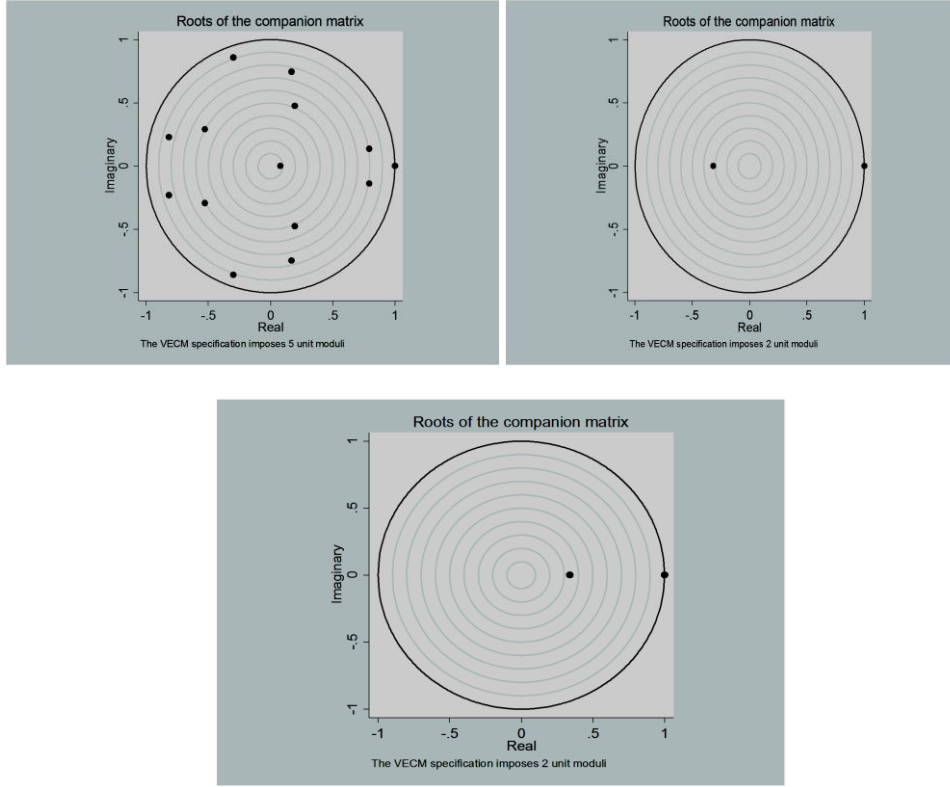
Source: Model output

According to the vecstable graph as shown below, the eigenvalues of the companion matrix reveal that none of the remaining r=1 eigenvalues appears close to the unit circle. For the reason that only one eigenvalue is on the unit circle (none of the others are close to the unit circle), we can infer that the number of cointegrating vector (equation) identified in our models (i.e. one co-integrating vector in each model) are correctly specified and hence it is possible to draw the conclusion our estimated VECM is appropriately stable and hence correctly specified. Firmly, the stability check does not indicate that our model is mis-specified.

1.2. LM Test for serial Autocorrelations in the residuals

**Table 10: Lagrange Multiplier Test of Residual Autocorrelation**

Lags	ECM1		ECM2		ECM3	
	Chi2	Prob>chi2	Chi2	Prob>chi2	Chi2	Prob>chi2
1	48.1889	0.80425	2.7646	0.97290	5.1000	0.82550
2	35.7969	0.47818	4.0325	0.90926	4.9910	0.83509
3	30.6579	0.72040	2.4462	0.98229	9.0543	0.43228
4	40.5946	0.27496	7.8609	0.54822	5.5974	0.77944

Source: Model output of the three co-integrating vectors

According to the LM test presented above to check appropriateness and fitness of models having identified one optimal lags in each VEC model, there is no autocorrelation in the residuals rather comprising of much higher p-value of 0.8, 0.9 and 0.8 respectively in ECM1, ECM2 and ECM3 meaning that we fail to reject the null hypothesis of no autocorrelation at the specified lag order. Hence it is possible to draw the conclusion that our models are accepted and correctly specified.

Appendix 3: The Long Run Forecasts and Impulse Response Functions (IRF) in the agricultural Market

Figure 18: Long Run Forecast in the Agricultural Market Equilibrium
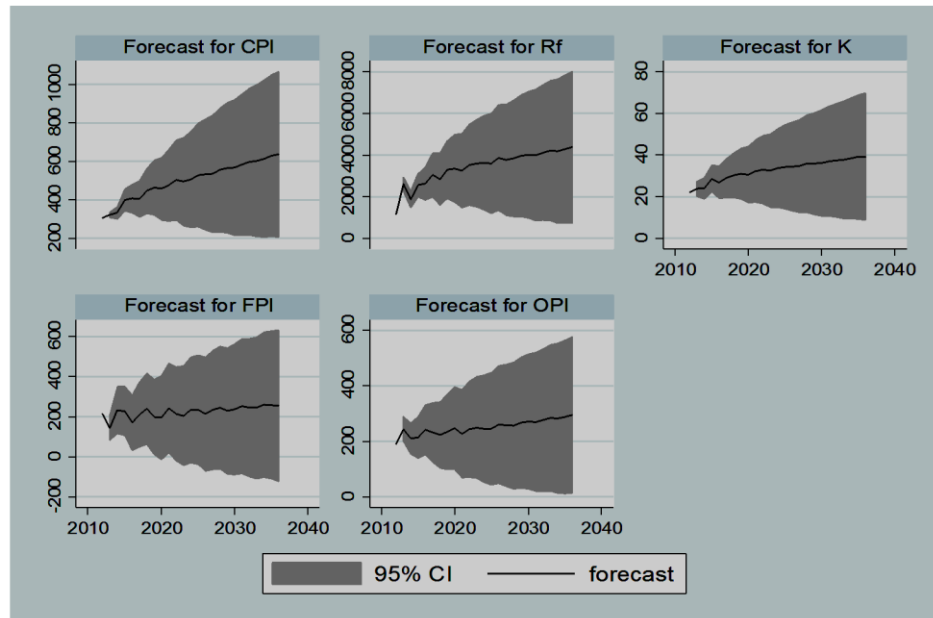
Source: The Agricultural Market Equilibrium Model Output

Co-integrating VECMs can also be used to produce forecast of both the variables in level and their first differences. The variances of the forecast errors for the variables in level in a cointegrating VECM diverges to infinity as the prediction horizon increases, whereas the forecast error of the first difference remains finite because all the variables in the model are stationary. Hence, as expected, the widths of the confidence intervals grow over the forecast horizon. The growth rate of price inflation is unlikely to decline over time however; fertilizer price is projected to remain stable over time. The cost of capital, oil price will have to steadily increase over time.

**Figure 19: IRF in the Agricultural Market Equilibrium Relationship**
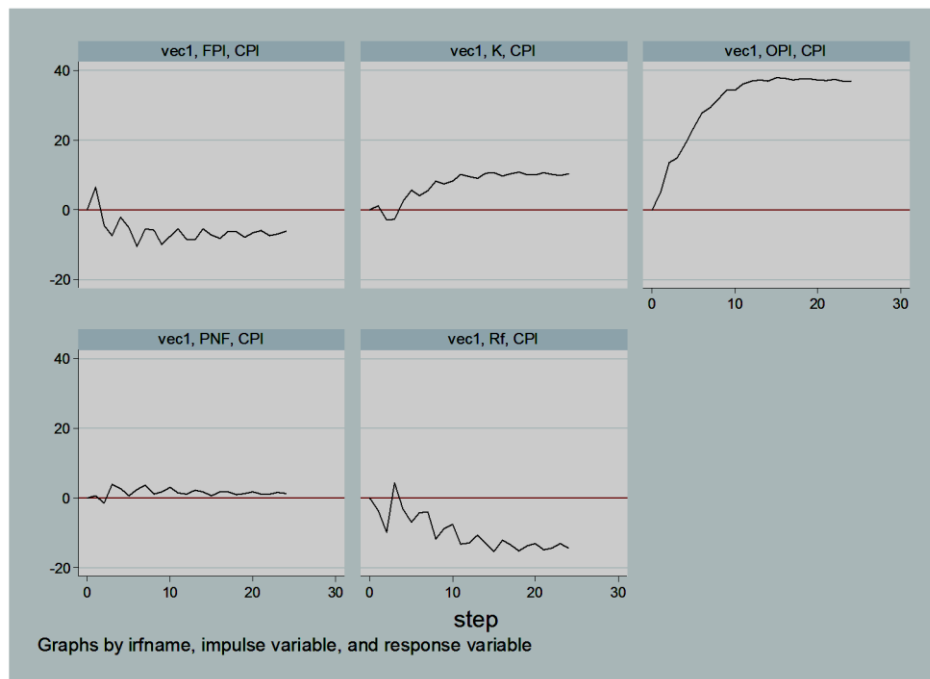
Source: The Agricultural Market Equilibrium Model Output

While, using IRFs in a cointegrating VECM, the effects of I (1) variables are not mean reverting, and hence the effect of a shock do not always die out (converge to zero) as the time from the shock gets larger and larger. Depending up on the dynamic interaction between the variables, the effect of a shock in one variable can be either transitory (when the effect of a shock dies out over time) or permanent (if the effect of a shock does not die out over time).

As shown in Figure 5.4 it is clear that the response of inflation on the impulse of fertilizer price and rainfall indicates highly volatile which remain below the zero line meaning that each standard deviation shock in these indicators lead to a decline in the average inflation rate. Price of nonagricultural goods has relatively smaller effect and will remain to be stable in the long run. However, the response of inflation on the impulse from oil price index is largely effective up to 10 years and above in the future. After that it gradually shows almost stable responses. The response of inflation from the impulse on the cost of capital reveal gradually rising and will remain stable after 10 years.

Appendix 4: Long Run Forecasts and IRF in the Money Market Equilibrium
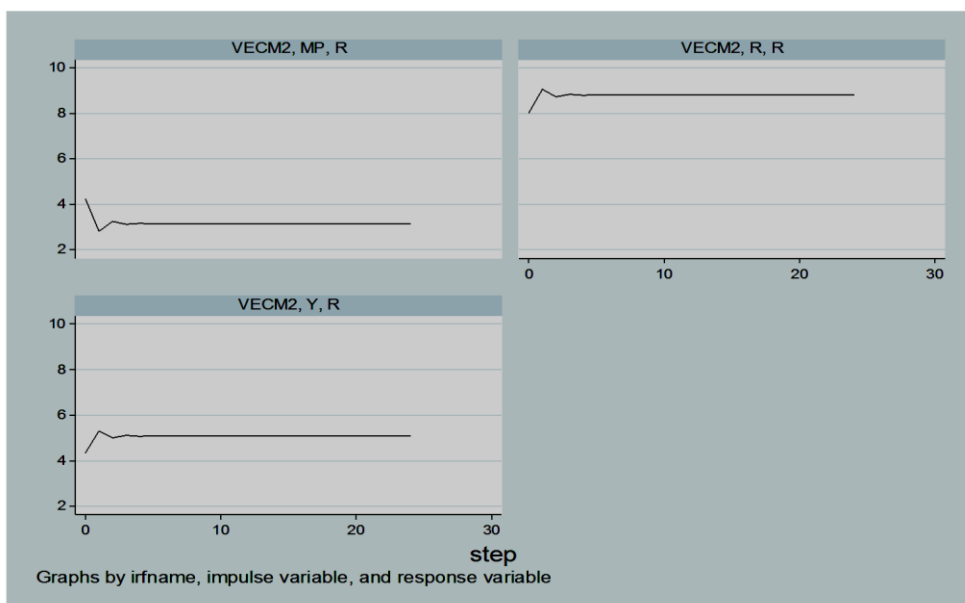
Figure 20: The Long run Forecast in the Money market equilibrium
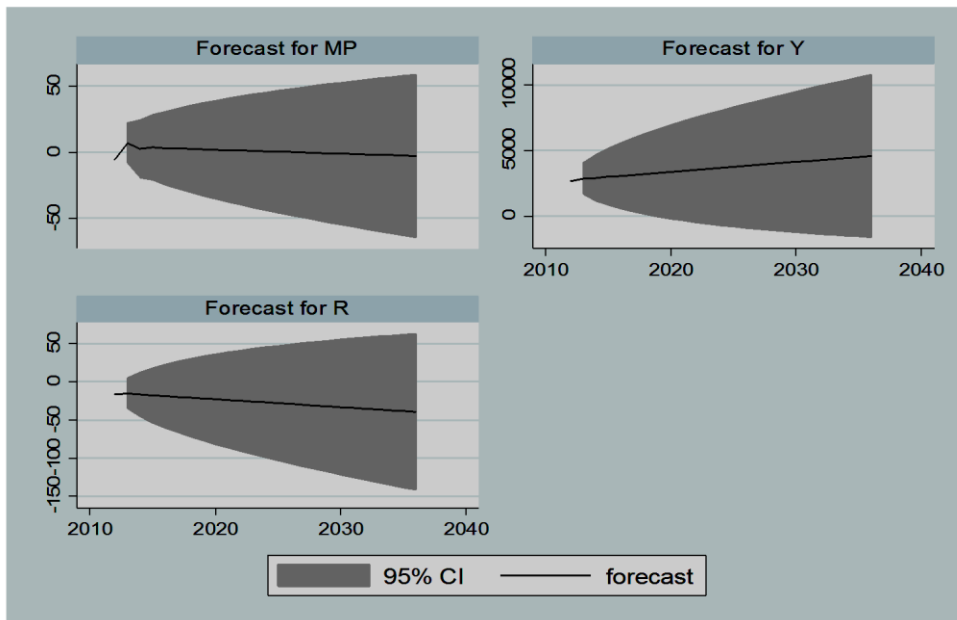
Source: The Money Market Equilibrium Model Output

Absolutely, the long run forecast in the money demand relationship indicates the decline in the growth rate of real money stock, and the real interest rate. The long run forecast for the real output growth rate indicates it will have to steadily increase over time.
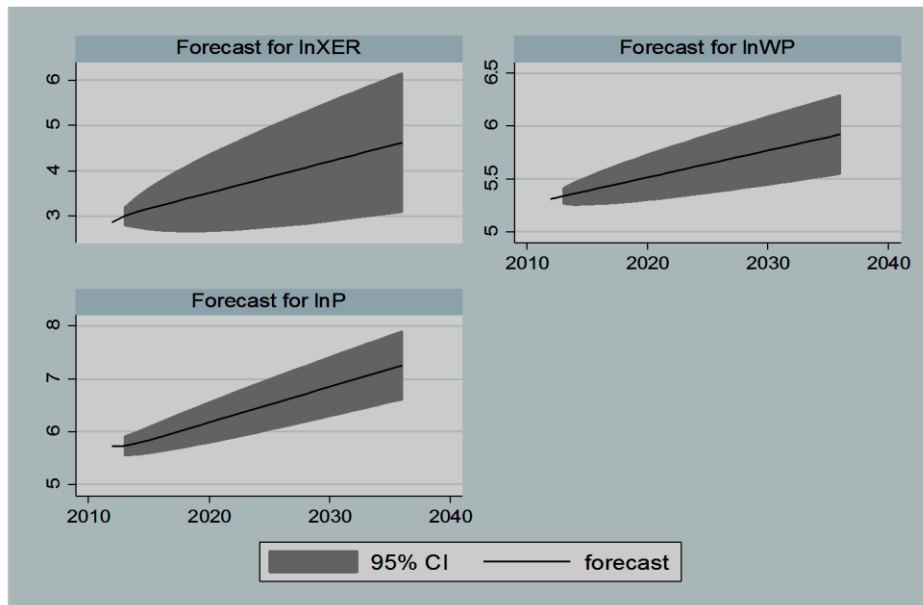
Figure 21: Impulse Response Functions in the Money market

Source: The Money Market Equilibrium Model Output

Appendix 5: The Long Run Forecasts and IRF in the PPP Equilibrium
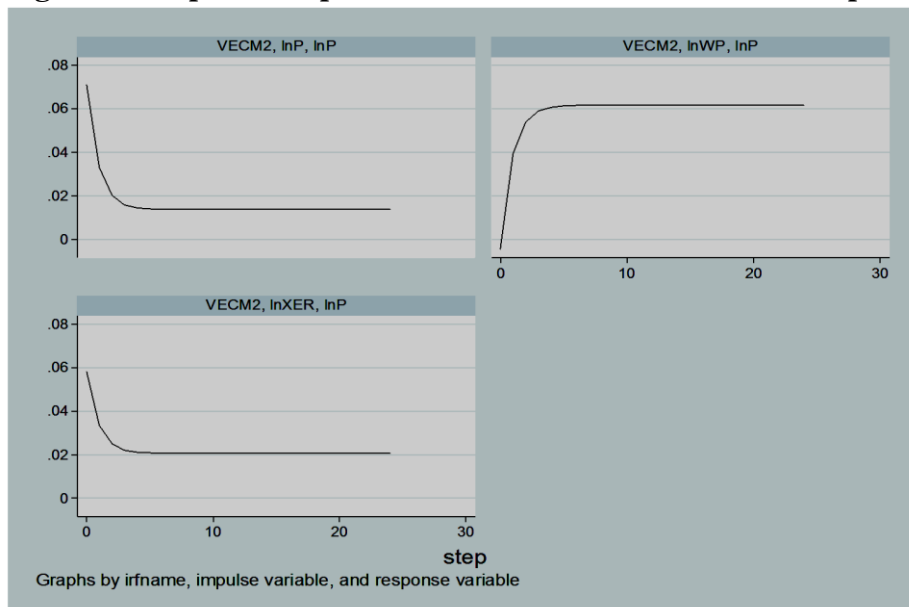
Figure 22: Long run Forecast in the PPP Relationship

Source: The PPP Equilibrium Model Output

The forecasts for real effective exchange rate reveals that all the indicators are expected to increase over time. In the long run, price inflation in Ethiopia is highly sensitive to the change in real exchange rate. Nominal exchange rate will have been unceasingly adjusts over the relative change in the foreign price and domestic price.

Figure 23: Impulse Response Functions in the PPP relationship

Source: The PPP Equilibrium Model Output