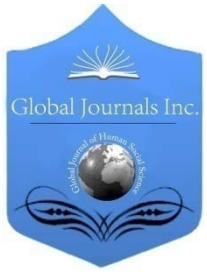
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Modeling the Growth of Ethiopian Inflation and Its Dynamic Behavior over Time

By Habtamu Getnet Altasseb
Erasmus University Rotterdam, Netherlands

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Keywords: *agricultural goods market, inflation, inertia, money market, ppp, long run equilibrium, and vecm.*

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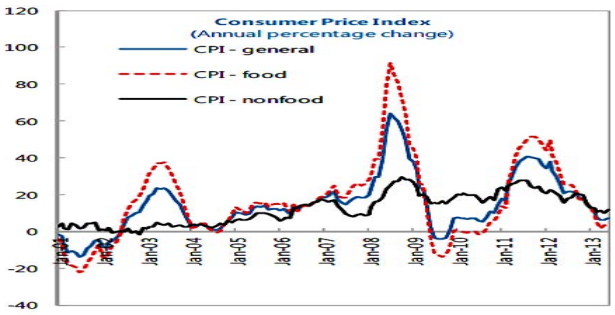
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I. Introduction

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 and 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 would remain 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. 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.



Source: IMF (2013)

Figure I: Inflation Trend and its volatility

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, since2004 the country faced a constantly increasing rate of inflation, which is historically unprecedented as some commentators explained it. The average over all 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.

a) Problem Justification

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).

Author: Erasmus University Rotterdam, International Institute of Social Studies, Kortenarkeade12; 2518 Ax; The Hague, The Netherlands.
e-mail: habtgeto2011@gmail.com

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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 which 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 specific 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 towards the soaring inflation. Most of 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 related macroeconomic conditions
- To examine basic theoretical applications and their validity to explain Ethiopian inflation.
- To investigate into the causes and nature of short-run diverges from long-run trends in inflation.
- To evaluate the effect of the foregoing fiscal and monetary policy measures against inflation and to give some ways forward.

b) Research Hypothesis

1. The domestic agricultural goods market equilibrium substantially determines price inflation in Ethiopia.
2. The quantity theory of money (QTM) holds for explaining price inflation in the long run.
3. The purchasing power parity (PPP) hypothesis holds for explaining price inflation in the long run.

c) 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 main reasons that makeup 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 Quantity theory of Money merely considered the role of money while explaining price inflation. Structuralists widely 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. Apparently, numerous studies in the developing world, including the empirical evidences in Ethiopia, have given prior attention on the monetary theory and applied same while explaining inflation. On the other hand, contemporary studies (Loening et al. 2009; Haji and Gelaw 2012) have taken into considerations the role external sector on the domestic price inflation through

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exchange rate and imported goods channel. Despite the fact that food and agriculture prices remain to be the major constitutes of the overall price indices (Durevall and Ndung'u 2001), numerous evidences have neglected the role of agricultural markets and food supply while explaining price inflation in Ethiopia.

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, the researcher has got consistent conviction that disequilibrium in the agricultural market has its own substantial impact on the general price of goods. Thus, the agricultural market equilibrium relationship is thoroughly investigated in this paper.

Overall, there are scanty studies which have got sound theoretical and empirical orientations on the causes and dynamics of price inflation in Ethiopia. Most do not have sound 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 Structuralists view, Money demand theory and imported inflation theses have had substantial explanations for this study. The empirical results are largely spontaneous and consistent enough to represent those economic theories by means of diverse empirical estimations. Noticeably, theories explaining the domestic agricultural, external market and money market scenarios are found to be very influential grounds for this study.

II. Inflation Models and its Applications To Ethiopia

Until recently literatures on the sources of inflation have got more diverse controversies. Large bodies of economic literature have a range of explanations on the possible sources of inflation and their remedies in diverse macroeconomic context. The foremost theoretical mainstreams emphasize that inflation is the result of continuous interactions in one or more of the monetary (or demand-side) shocks, real (cost or supply-side) shocks, price-adjustment (or inertial) factors and political processes and or factors with varying dynamics interims of the countries' institutional or economic structures.

a) The Supply Side Inflation Model

Ethiopian Inflation is largely connected with the dominant role of agriculture and food (Loening et. al 2009). As agriculture sector constitute the predominant source of food in the agricultural economy, analyzing the possible sources of inflation should feasibly begin with the cost-push inflation perspective (Klugman and Loening 2007). At the outset, agricultural products are broadly categorized in to tradable and non-tradable. Thus, the general prices of agricultural products are mainly composed of the weighted average price of tradable and non-tradable agricultural outputs.

$$P_t^{Ag} = \rho P_t^{TAg} + (1-\rho) P_t^{NTAg} \quad (1)$$

Tradable agricultural products are the main source of foreign exchange revenue through export, which is mainly, determined by the real exchange rate and the world market price. Mathematically,

$$P_t^{TAg} = \delta_1 e_t + \delta_2 P_t^{wP} \quad (2)$$

The non-tradable agricultural products are necessary to basically fulfill the demand for food and industrial inputs. In this regards, the domestic market for agricultural products is principally driven by the demand and supply conditions. Basically, the total agricultural supply (S_t) is composed of domestic production (Q_t), import (M_t) and food aid (A_t).

$$Ag_t^{ss} = Q_t + M_t + A_t \quad (3)$$

The total supply of agricultural outputs is predominantly determined by the productive capacity (productivity in technical terms) in the agricultural sector. Ethiopian agriculture is highly vulnerable to the exogenous shock by virtue of its dependence on the global sources of necessary agricultural inputs (Loening et. al 2009). The domestic market for agricultural products could affect inflation mainly through the supply shock. From the cost push inflation perspective, the general price of agricultural products is largely determined by the cost of agricultural inputs like fertilizer, labor and fuel (energy).

$$Q_t = f(P^{fer}, P^{L}, P^{oil}, P^{NA})$$

Where $P^{fer}, P^{L}, P^{oil}, P^{NA}$ refers to the price of fertilizer, price of agricultural labor, oil price, and the price of non-agricultural products respectively. In this case, Oil price is used as a proxy for the transportation and marketing cost of agricultural products.

$$Q_t = \gamma_1 P_t^{fer} + \gamma_2 P_t^{L} + \gamma_3 P_t^{oil} + \gamma_4 P_t^{NA} \quad (4)$$

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The imports of agricultural products constitute the other prominent source of domestic supply when shortage exists. Thus, agricultural supply may also be affected by one or more of the determinants of import such as the relative price of agricultural products in the domestic and global market, import cost and exchange rate. Mathematically, $M_t = f(P^P, P^{Wp}, P^{oil}, e_t)$

Where, P^P and P^{WP} refer to the relative (domestic and world) price of the imported agricultural products respectively, refers to transportation cost of import proxy by the international oil price and exchange rate respectively. Thus, the standard linear equation representing the demand for import is

$$M_t = \alpha_1 P_t^P + \alpha_2 P_t^{Wp} + \alpha_3 P_t^{oil} + \alpha_4 e_t \quad (5)$$

Generally, the aggregate supply of agricultural products comprises of all the domestic supply, the demand for import and food aid. Hence, the standard linear equations representing the total supply of agricultural products reveal the following

$$Ag_t^{ss} = \gamma_1 P_t^{fer} + \gamma_2 P_t^L + \gamma_3 P_t^{oil} + \gamma_4 P_t^{NA} + \alpha_1 P_t^P + \alpha_2 P_t^{WP} + \alpha_3 P_t^{oil} + \alpha_4 e_t + \varphi_1 A_t \quad (6)$$

As the above total supply equation comprises of both the traded and non-traded agricultural products, thus the domestic supply is netted by deducting the traded over the total supply of agricultural products. Mathematically, $Ag_t^{ss} - X_t = Ag_{nt}^{SS}$

$$X_t = \emptyset_1 P_t^P + \emptyset_2 P_t^{Wp} + \emptyset_3 P_t^{oil} + \emptyset_4 e_t \quad (7)$$

Where, Xt refers to the export of agricultural products, P_t^P and P_t^{WP} refers to the domestic and world price of exported agricultural products P_t^{oil}, refers to the price of oil as a proxy for transpiration cost and e_t exchange rate. Hence, total domestic supply refers to

$$Ag_{nt}^{SS} = \left(\gamma_1 P_t^{fer} + \gamma_3 P_t^L + \gamma_4 P_t^{oil} + \gamma_6 P_t^{NA}\right) + \left[\left(\alpha_1 P_t^P + \alpha_2 P_t^{Wp} + \alpha_3 P_t^{oil} + \alpha_4 e_t\right) - \left(\emptyset_1 P_t^P + \emptyset_2 P_t^{wp} + \emptyset_3 P_t^{oil} + \emptyset_4 e_t\right)\right] \quad (8)$$

The last two terms with in the bracket in equation 8 represent the demand for food import and export of traded agricultural products.

$$\rho\left[\left(\alpha_1 P_t^P + \alpha_2 P_t^{Wp} + \alpha_3 P_t^{oil} + \alpha_4 e_t\right)\right] - (1-\rho)\left[\emptyset_1 P_t^P + \emptyset_2 P_t^{Wp} + \emptyset_3 P_t^{oil} + \emptyset_4 e_t\right](\rho\alpha_1 - (1-\rho)\emptyset_1) P_t^P + (\rho\alpha_2 - (1-\rho)\emptyset_2) P_t^{Wp} + (\rho\alpha_3 - (1-\rho)\emptyset_3) P_t^{oil} + (\rho\alpha_4 - (1-\rho)\emptyset_4) P_t^{oil}$$

On the basis of the purchasing power parity (PPP) assumptions and letting $(\rho\alpha_i - (1-\rho)\emptyset_i) = \varphi_i$, we can have the following external Market equilibrium relationship.

$$\varphi_1 e_t + \varphi_2 P_t^p + \varphi_3 P_t^{oil} + \varphi_4 P_t^{Wp} \quad (9)$$

By Substituting equation 9, instead of the last term in equation 8, we may have the following equation representing the aggregate supply of the agricultural products.

$$SS_t = (\gamma_1 P_t^{fer} + \gamma_2 P_t^L + \gamma_3 P_t^{oil} + \gamma_4 P_t^{NA}) + \varphi_1 P_t^p + \varphi_2 P_t^{Wp} + \varphi_3 P_t^{oil} + \varphi_4 e_t$$

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b) The Money Demand Inflation Model

Monetarist proclaimed that excess money is the predominant factor for wider fluctuations in output and employment in the short run and price level in the long run. Accordingly, expansionary monetary policy aiming to boost output and employment may cause inflationary pressure in the long run. Mankiw (2003) stated that low money supply can be effective for stable output, employment and prices in the economy. It is also widely recognized 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 it is accommodated by excess money supply (Kibritçioğlu 2002).

According to Mankiw (2003), the concept of money supply is fundamentally derived from the QTM. This theoretical framework enables one to explore the long-run relationship between real output/income, the price level and the money stock by means of determining the velocity Y- (M-P). 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 prices level and interest rates, meaning excess demand for non-monetary assets (Bronfenbrenner & D. Holzman 1963).

In the agricultural economy like Ethiopia, where the largest share of the household expenditure is made on food items, the overall inflation is strongly associated with agriculture (food) supply shock (Loening et al. 2009). Thus, the demand for agricultural products is mainly determined by disposable (real) income, the price of food and non-food items and excess money supply. Mathematically, $D_t = f(Y_t, P_t^{nf}, P_t^f, M2_t)$

According to the quantity theory of money (QTM), the Money market equilibrium can be attained when the supply and demand for real money equates i.e. $M^{dd} = M^{ss}$. Accordingly, excess money supply in the economy would pressurize the demand for agricultural products thereby affect the general price level. Hence, disequilibrium in the money market reveals the change in the price of agricultural products. Mathematically,

$$P_t^{Ag} = \gamma\left[(M^{ss} - P) - M^{dd}\right]$$

Where, γ indicates the extent of disequilibrium in the money market or the change in the price of agricultural products in the domestic market. The general demand for real money balance is

$$M - P = \delta_0 + \delta_1 Y_t + \delta_3 r$$

The effect of excess money supply on the general price of agricultural products can be determined as follows.

$$P_t^{Ag} = \gamma\left[(M - P) - \delta_1 Y_t - \delta_2 r)\right]$$

An aggregate demand for agricultural goods in the domestic market is given as follows:

$$D_t = \left(\pi_1 Y_t + \pi_2 P_t^{nf}\right) + \pi_3\gamma\left[M - P) - \delta_1 Y_t + \delta_2 e_t)\right] - \pi_3 P_t^f$$

$$D_t = (\pi_1 - \pi_3\gamma\delta_1)Y_t + \pi_2 P_t^{nf} + \pi_3\gamma(M - P) - \pi_3 P_t^f$$

The domestic goods market equilibrium is determined by the long run relationship between the aggregate demand and supply of agricultural products.

$$P_t = \left[(\pi_1 - \pi_3\gamma\delta_1)Y_t + \pi_3\gamma\left[(M - P) - r\right] + (\gamma_3 + \pi_2)P_t^{nf} - \pi_3 P_t^f\right] - \left[\gamma_1 P_t^{fer} + \gamma_2 P_t^L + (\gamma_4 + \varphi_3)P_t^{oil} + \varphi_1 P_t^p + \varphi_2 P_t^{Wp} + \varphi_4 e_t\right]$$

III. Data and Methodology

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. The country source of data includes 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, external sources of data such as IMF, EDRI, FAO and WWB databases had been prominently used.

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a) Model Specifications 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 the 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 et al. 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

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

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 $\boldsymbol{\varepsilon_t}$ is a K x 1 vector of multivariate random errors (disturbances), having zero mean and covariance matrix $\sum$, which remain normal over time.

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. 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 co integrating 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.

b) 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 co-integrating relationships while allowing for short-run adjustments (Stock 1997). The co-integrating 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;

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

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

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

Engle and Granger (1987) show that if the variables yt are I (1) the matrix $\prod$ in (4.3) has rank 0 <= r < K, where r is the number of linearly independent co-integrating 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, $\prod \mathbf{y_{t-1}}$. Despite various alternative frameworks are developed for estimation and inference in a co-integrated VAR analysis, the Johansen framework (1988 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.

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

The matrix Π can be decomposed as Π=αβ' where α is nxr matrix of speed of adjustment terms, and β is an nxr matrix of parameters which determines the co-integrating 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≤r≤n is the rank of the matrix Π and represents the co-integrating 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), and in the Ethiopian context (Eden 2012; Loening et al. 2009; Haji and Gelaw 2012; Girma 2012; Loening 2007), the study adopted VECM for identifying pertinent theoretical frameworks 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.

Structuralists fundamentally prescribe the role of 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 price index (FPI), oil price index (OPI) and non-food price index (Pnf) (see also Haji & Gelaw 2012; 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. 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 institutions which is supposed to show us a clear picture of the effect of financial constraint on agricultural supply shock and price inflation.

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

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

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

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 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 by the time an 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 ratein the long run.

The third VECM is meant to represent validity of the PPP in explaining the impact of real exchange rate (REER) 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

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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.

$$\Delta P_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1_i} \Delta P_{t-i} + \sum_{i=0}^{k} \alpha_{2_i} \Delta PF_{t-i} + \sum_{i=0}^{k} \alpha_{3_i} \Delta PNF_{t-i} + \sum_{+i=0}^{k} \alpha_{4_i} \Delta Y_{t-i}$$
$$+ \sum_{i=0}^{k} \alpha_{5_i} \Delta M2_{t-i} + \sum_{i=0}^{k} \alpha_{6_i} \Delta XE_{t-i} + \sum_{i=0}^{k} \alpha_{7_i} \Delta Rf_{t-i}$$
$$+ \sum_{i=0}^{k} 8_i \Delta K_{t-i} + \sum_{i=0}^{k} 9_i API_{t-i} + \sum_{i=0}^{k} \alpha_{10_i} FPI_{t-i} + \sum_{i=0}^{k} \alpha_{11_i} OPI_{t-i}$$
$$+ \sum_{i=0}^{k} \alpha_{12_i} \Delta WFP_{t-i} + \sum_{i=0}^{k} \alpha_{13_i} IMP_{t-i} + \alpha_1[(M-P) - \beta_1 Y - \beta_2 R]$$
$$+ \alpha_2[XE + \beta_3 Wp - \beta_4 P]$$
$$+ \alpha_3[P - \beta_5 Rf - \beta_6 FPI - \beta_7 K - \beta_8 OPI - \beta_9 PNF] + \varepsilon_t$$

Where, P, PF and PNF refer to the overall, food and non-food consumer price indices in the domestic economy. Y is the growth rate of GDP (real output), M2 is the growth rate of excess money supply, XE is the nominal exchange rate, RF is an annual rain fall in Millimeter, K is the cost of capital, API I an agricultural production index, FPI is the fertilizer price index, OPI is the global oil price index, IMP is an intermediate import price, R is the real interest rate, WFP and WP refer to the world food and consumer price indices and M-P is the growth rate of real money stock.

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 (α1i – α8i) 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.

IV. Empirical Results and Interpretations

a) Descriptive Analysis

The statistical analysis as shown in table I reveals 33 total observations with significantly varying mean and standard deviation across each variable. Food and non-food consumer prices, real money stock growth, real interest rate, oil price index and Fertilizer price index 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.

Table I: The Result of the Descriptive Statistics

Variables	N	Mean	Std. Dev	Min	Max
P	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

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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

Note: P, PF and PNF refer to the overall, food and non-food consumer price indices in the domestic economy. Y is the growth rate of GDP (real output), XE is the nominal exchange rate, RF is an annual rain fall in Millimeter, IMP is an intermediate import price index, K is the cost of capital, R is the real interest rate, OPI is the global oil price index, FPI is the fertilizer price index, WFP and WP refer to the world food and consumer price indices and M-P is the growth rate of real money stock.

Supply side factors seem to be stable except the highly volatile oil and fertilizer price shock. The intermediate import price index, total annual rainfall and the cost of capital 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.

b) Augmented Dickey-Fuller Unit Root Test

Table II : 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.*
Source: Model Output

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.

c) 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

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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 co-integration is 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 co-integrating 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 co-integrating 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 co-integrating 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 co-integrating relationships in light of the three pertinent theoretical grounds-cost push theory, money demand theory and PPP theory.

i. *The Agricultural Market Equilibrium*

As shown in Table III, the result of the Johanson co-integration test affirmed that there is strong evidence for one co-integrating vector in the system. 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 occurred 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 III : 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)

*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.*

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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 thereby, 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-$\alpha_i$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. 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.

Apparently, Figure II 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.

$$P - 0.27\,FPI - 0.2\,\mathrm{Rf} - 6.86\,K - 2.38\,OPI - 3.72PNF.$$



Source: Model Output

Figure II : The Predicted Agricultural Market Equilibrium Equation

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.

ii. *The Money Market Equilibrium*

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 IV 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 proved that the error correction terms or the

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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 co-integrating vector is well exemplified for valid interpretation of the long-run money demand equilibrium relationship.

Table IV : 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)	

*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.*
Source: Model Output

Similarly, our findings revealed that the coefficient on income is 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. 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 III, 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 inescapable only under the condition of monetary expansion (Nell 2004).

[1] From the theoretical point of view, R is meant for the cost of holding money, which is used to represent the growth rate of inflation.

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Source: Model Output

Figure III : The predicted Money Demand Equilibrium Relationship $(\mathbf{M-P})-\mathbf{0.003Y}$ −0.49R

According to Fisher and Easterly (1990), rapid inflation is always a fiscal phenomenon 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.

iii. *The External Market Equilibrium*

The result of the Johanson co-integration test affirmed that there is strong evidence for the existence of one co-integrating vector in the system. 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 V : Co-integration Analysis of the External sector (PPP)

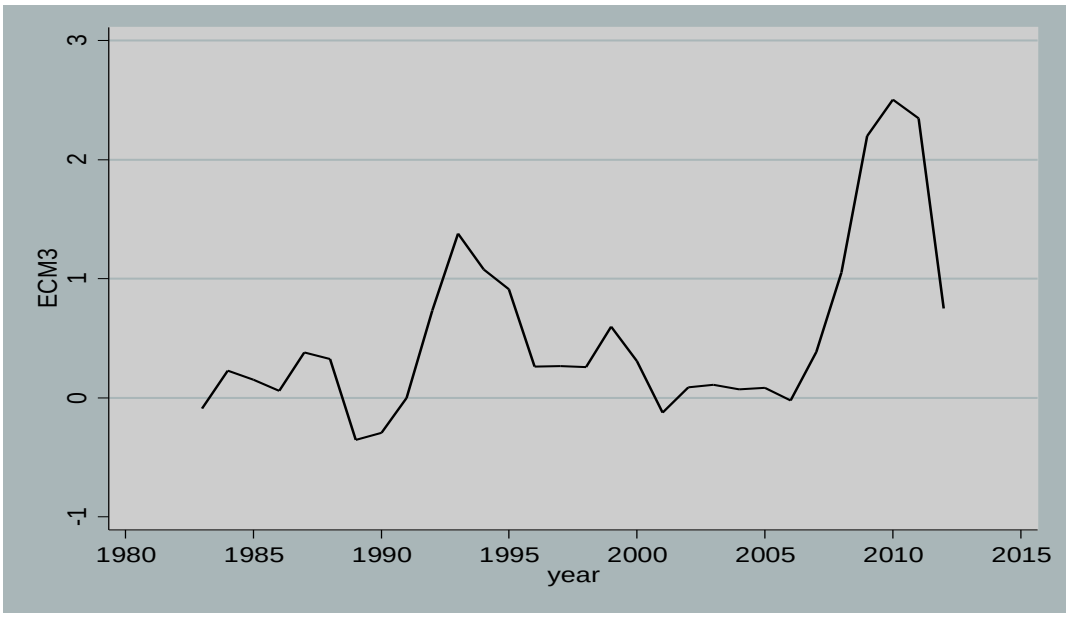
Rank Test			
Null Hypothesis	**r = 0**	**r ≤ 1**	**r ≤ 2**
Eigen Values	-	0.63351	0.19620
Trace statistics	39.0610	8.9478*	2.3957
5% Critical Value	29.68	15.41	3.76
Standardized Eigenvector β_i			
lnXE	**lnWP**	**lnP**	
1.00	8.326776***	-.154018***	
-	(1.053294)	(.380116)	
Standardized Adjustment Coefficient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

Note:
PPP hypothesis strongly recommend variables to be converted in to logarithmic form. Thus, lnXE, lnWP and lnP refer to the logarithmic nominal exchange rate, the foreign and domestic price indices respectively. The co-integrating vector identified in this estimation is r=1.
**** indicates significant at 1percent, ** at 5 percent and * at 10 percent significance level. Values in parenthesis are robust standard errors.*

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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 (2002), 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.

As shown in figure IV, the test for validity of the PPP hypothesis has shown by analyzing stationarity of the series of the REER, which measures the deviation from PPP. It appears that the REER has converged towards its mean, suggesting that purchasing power parity hypothesis seems to be partly 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, meaning that real effective exchange rate has substantial effect on the domestic price inflation.



Source: Model Output

Figure IV : The Predicted External Market Equilibrium Relationship $\boldsymbol{XER + 8.33WP - 0.15P}$

iv. *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. Most coefficients are statistically significant and larger for the food price index. Moreover, the existence of higher inflation inertia (0.18) hints that the non-food price level adjusts slowly back to equilibrium when a shock occurred, whereas food prices immediately overshoots and react much stronger to the shocks(see also Loening et al. 2009). Hence, food price remains to be very vital component of the overall price index.

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Table VI : 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	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

The degree of inertia is another crucial factor for the rise of price 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). 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 the degree of its effect 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) has a

[2] Incorporating agricultural production index (API) in the model is not a good idea as it concurrently affects income and then the demand for goods (see also Loening et al. 2009). Hence, it is must to exclude in the model for the sake of eliminating multicollinearity problem.

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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 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 2008; Haji and 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 Nelso 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 and loaning 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 Structuralists point of view.

As far as the long run relationship is concerned, the error correction terms 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 determinedly enforce the domestic price to respond above its long-run equilibrium level (see also Haji and Gelaw 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.

V. Conclusion and Policy Remarks

Ethiopia has experienced unprecedented and highly volatile inflation growth for longer than two decades. National and international reports pronounced that the country's inflationary pressure had been over the continental average. Until recently, the high level of 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. Structuralists, Money demand and PPP hypotheses. Based on those theoretical insights, the 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, VECM was estimated 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.

The results reveal 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 public reputation by means of

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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.

The study found that the three inflation theories (the agricultural goods market, the Quantity Theory of Money and the Purchasing Power Parity) have given principal inference for explaining the Ethiopian inflation scenario. The results 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 2004), 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, 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 had 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 approaches to successfully combat the recent inflation in Ethiopia.

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