DYNAMICS OF FOOD PRICE INFLATION IN EASTERN ETHIOPIA: A MESO-MACRO MODELING

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Abstract

High inflationary pressure especially in food price has been a top agenda in many developing countries since the last decade as it has been hindering their socio-economic development. Though Ethiopia is achieving an encouraging economic growth in recent years, the occurrence of galloping inflation mainly since 2005 is retarding its progress and causing high welfare loss. The very step to struggle this problem is documenting the real causes of inflation. So far, there are only few attempts to document the macroeconomic determinants of general inflation in Ethiopia. Specially, empirical works on meso level price dynamics and focus on certain items are scant. This study is, therefore, designed to assess the macro-meso derivers of food price dynamics in Dire Dawa administration and Harari regional state based on qualitative data collected through key informant interview and quantitative monthly data from January, 2001 to September 2012. A result from Vector Error Correction Model (VECM) revealed that, in the long run, money supply, real income and international food and oil price hikes increase domestic food inflation while rise in exchange rate (depreciation or devaluation) was found to decrease inflation. Inflation expectation, smuggling, rise in world oil price and exchange rate are also documented to impact food price inflation of the study area in the short run. Pursuing conservative monetary policy, promoting competitiveness in the market and reducing the cost of making business would help to mitigate the galloping inflation in the study area.

Key words: Price Dynamics, Inflation, Error Correction Model, Smuggling
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1. Introduction

The rapid rises and volatility of food prices, now days, are at the top agenda of the international community. The people of developing countries, particularly, are highly exposed to food insecurity as they are financially incapable to afford basic food crops. Yonas and Mans (2012) indicated that the high food price inflation has been the most adverse economic shock that has continued to adversely affect the Ethiopian economy where significant proportion of households had to adjust food consumption in response.

Arguments continued as to what caused the recent global food price hike. Generally, several factors such as increase in aggregate demand, shortage of supply, environmental calamities, population increase, diversion of agricultural products usage for non-food purpose, rapid economic growth (mainly in emerging economies), market structure and investment (traders' speculation, market barriers to new entrants, unfair competition, etc), an alarming increase of oil price, etc are claimed for the skyrocketing prices. However, FAO (2008) rejects the claim that emerging economies have been a reason for the food price explosion, since domestic production in countries like China and India has been growing correspondingly during the same period. Rather, the use of agricultural products, in particular maize, wheat, vegetable and oil, for purposes other than food such as feedstock and bio-fuel production has been the most important factor behind the rise of global food. Thus, as stated by Marco *et al* (2011), lack of clarity as to what exactly causes such a spike in price is still a challenge to reinforce sound policies in the course of taking corrective actions. Hence, a further study to identify the real causes of food inflation is still essential.

In Ethiopia, inflation was not a concern until 2002/03 (Alemeayehu and Kibrom, 2011), but afterwards began to increase at an alarming rate. Similar trend is also observed in food price inflation. For instance, the annual average food inflation rate between July 2011 and June 2012 was 36.9% and in October 2012 compared to October 2011 was 30.4% (CSA, 2012).

Several factors have been claimed for the soaring food inflation in Ethiopia. Jema and Fekadu (2012) argue that monetary developments are seminal factors for high food inflation in Ethiopia. World Bank (2007) and IMF (2008) argue that excess aggregate

demand generated by expansionary monetary policy were key driving factors, calling for forceful policy tightening. EDRI (2007), on the other hand, pinpointed internal and external factors such as international commodity price increase, enticing economic performance, increase in money supply and injection of cash into the rural economy, behavioural changes in farmers, and increased local purchases by institutions and agricultural cooperatives are accountable for the recent inflation. Ahmed (2007) has also put the increase in aggregate demand as a preceding reason for food inflation due to high demand for food. Agricultural production dependency on erratic rainfall (Alemayehu and Kibrom, 2011), alarming increase in demand, poor harvest, higher fertilizer, transportation costs; and world oil price hiking (Loening *et al*, 2009), are also mentioned as major causes for food price inflation. However, there is no agreement between academicians, researchers and the government on the real factors responsible to the hiking price of food items in the nation.

Food inflation has been soaring throughout the country and the regional distribution of food inflation took the same pattern as the general inflation (Alemayehu and Kibrom, 2011; John *et al,* 2009). Eastern Ethiopia is one of the food insecure parts of the country sharing similar food inflation phenomena. As official reports of the NBE indicate, Dire Dawa Administration and Harari regional state experienced highest inflation rates and high price instability between 2008 and 2010. The average annual food inflation rate, as reported by the NBE in 2008/09, was 47.3% and 57.3% for Dire-Dawa and Harari regional state, respectively. This indicates that the area is vulnerable to high food price inflation. This area is the inlet and outlet of many exports and imports of the country and dominantly consumer of imported and packed items. To continue the envisaged economic growth, searching for the real causes of inflation is a first step one has to do in order to propose an outright solution to the problem.

In these debatable sphere of reasoning, studying the causes of food price dynamics at meso level, a rarely studied panorama, is very important. The purpose of this study is, therefore, to identify the macro-meso factors causing the food price inflation and volatility in Eastern Ethiopia, particularly in Harari Regional State and Dire-Dawa Administration. To be able to describe the dynamics of prices for major food items across time, four food categories, namely, cereals, pulses, fruits and vegetables, and bread and other prepared foods are considered. However, in modeling the food inflation of the selected regions, it is not only prices of these items but the general food price index is taken in to account. The study area is an area where smuggled products

and imported packed foods are highly marketed and consumed and Khat is predominantly produced and commercialized.

The official trade has been unattractive in the area especially to small-scale traders found in the border areas due to structural and policy related problems. The requirements of this type of trade are beyond the reach of small-scale traders (the main actors in the area). These factors led the people in the area to stick to alternative markets, i.e., unofficial cross-border trade. This is undertaken beyond the government's control and thus freed from considerable size of costs. As a result, the study area is well known in its practice of illegal trade so that dozens of smuggled products are supplied to Dire Dawa and Harar markets. Some studies estimate the volume of this trade to be far greater than the recorded trade (Maruye 1992). The main food items that are supplied in this channel and destined to the eastern region are rice, edible oil, spaghetti, sugar, and wheat flour (Tegegne and Alemayehu, 2002). This tends to increases the domestic food supply and expected to trim down the food price in the area.

The impact of such special attributes of the region on food inflation is explored using the meso-macro modeling where the Vector Error Correction Model and monthly data ranging from January, 2001 to September, 2012, were employed and the long-run and the short run food price drivers are identified.

2. Objectives of the study

Based on the context of the research problems, the study is meant to address the following objectives.

- To investigate the dynamics of food price in a disaggregated category overtime.
- To analyze the nature of the grain market in the study area
- To model the meso-macro determinants of food price inflation
- To examine the effect of smuggling on food price.

3. Theoretical View on the Determinants of Inflation

Most of the theories developed to explain causes of inflation in a macroeconomics context are on the basis of the aggregate demand (demand pull) and cost-push theories (Ball and Doyle, 1969).

The demand-pull theory states that inflation results from a rise in aggregate demand. Accordingly, factors that influence demand-pull inflation including increases in money supply, government spending and the price level in the rest of the world are expected to have similar effect on inflation.

On the other hand, under the cost-push theory, inflation is seen as the result of decreases in aggregate supply which may be due to an appreciation in wages or the price of raw materials. Such increases lead to higher production costs, hence the term 'cost-push' inflation. Keynesians believe inflation is a result of income disturbances and shocks to the economy, like oil price increases, while the Monetarists believe that inflation occurs because of excess demand and inappropriate monetary responses to economic situations i.e 'too much money chasing too few goods'.
In addition, structural factors such as weather conditions, policies aimed at protecting certain industries or just trading policies, may also influence the rate of inflation. If there's a hurricane, which damages food supply and infrastructure, then, prices of goods and services will definitely shoot up. Also, in protecting certain industries, cheaper goods and services may not be allowed into the country, which results in higher prices for certain goods and services. This shows that inflation may be a consequence of weather conditions and trading or protection policies. Frisch (1977) devised another approach to understanding the inflationary process under the Structuralist model of imported inflation. This model shows that a country's dependence on external markets may bring about inflation, since heavy reliance on external variables is expected to motivate upward pressure on domestic prices. Laryea and Sumaila (2001) also argued similarly that price of tradable goods is determined in the world market and depends on foreign prices and on the exchange rate. Further, the Scandinavian model developed by Branson and Myhrman (1976) adds unemployment rate and expected inflation to the determinants of inflation. Formal theoretical models for showing interaction among inflation and its determinants in the context of developing countries can be seen in Laryea and Sumaila (2001).

4. Methodology

4.1 Nature and Source of Data

The study mainly utilized secondary data obtained from the CSA, NBE, IMF and World Bank. A monthly time series data ranging from the January 2001 to September

2012 were employed. In order to investigate the dynamics of food price in disaggregated category overtime, four main food categories, namely, cereals, pulses, fruits and vegetables, and bread and other prepared foods were selected. For quantitative analysis, secondary data on different variables obtained from different sources was used. These variables include Domestic Consumer Food Price Index (DFCPI), Money Supply (M2), exchange rate (EXR), World Food Consumer Price Index (WFCPI), Gross Domestic Product (GDP), World Oil Price (WOP), and meso level variables including expected inflation (EXP), smuggling (SMUG) and non-food domestic consumer price index (NFDCPI). The datasets for DFCPI, NFDCPI, raw data to compute SMUG and EXP are obtained from the central Statistical Agency (CSA) of Ethiopia, the datasets for M2 and EXR are obtained from the National Bank of Ethiopia (NBE), annual GDP data which was used to compute the monthly one is obtained from the World development indicators (WDI), and the datasets for WFCPI and WOP are obtained from the International Monetary Fund (IMF).

The unusual variable that we hypothesize to affect food price in this study is smuggling. This variable was approximated by the imported cooking oil price difference between the study area and Oromia, which is analogous to the case of black market exchange rate premium measure of Barro (1996). Price differences of imported items in two areas can be taken as a good proxy for smuggling as long as transportation and other transactional costs are proved to be similar. The formal suppliers of imported oil to Harari-Dire Dawa region include legal importers based in Addis Ababa, as well as Dire Dawa and Harar. Following the closure of the Ethiopian rail way since almost the last decade, the principal formal route of import of Ethiopia has been the major highway running from Addis Ababa through Oromia and Afar regions to Djibouti. Finally it will be unloaded at the dry port of Mojo or Semera. Thus, we assume the vehicular transportation cost from Addis Ababa to Harar/Dire Dawa and from Addis Ababa to different parts of Oromia regional state is on average equivalent. Given this equivalence in distance between Oromia and Harar/Dire Dawa from Addis Ababa (particularly Mojo dry port) where imported items are unloaded and under the assumption of similar supply of the domestically produced oil (the substitute product), any price difference on imported cooking oil can be attributed to existence of smuggling. Because if this item were not imported directly from Djibouti port to Dire Dawa and Harar by contraband traders and reduce legal import-related costs, there would no reason that, on average, the price of this imported item is different in the study area as compared to its counterpart Oromia. It is, therefore, based on such reasonable

assumption that the average price of imported cooking oil in Oromia region is used as a reference price for the computation of the aforementioned proxy of smuggling in the study area.

The other data considered in the study and used as a proxy for demand and/or market size is GDP. Most of the data owners or sources generating GDP dataset of countries report on annual basis and thus monthly and quarterly data of such macro variables are hardly available. As the rest of our data were constructed in months, to get more observation and reliable model estimates, converting the annual GDP data into its monthly counterparts is necessary. There are some recently introduced techniques of computing monthly GDP. For instance, the Macroeconomic Advisers' index of Monthly GDP (MGDP) introduced by the United States Bureau of Economic Analysis is the well known one (BEA, 2008). Moreover, monthly GDP can also be estimated using the general Kalman filter Framework (Cuche & Hess, 2000). Most researchers also make use of parabolic rule of numeric integration which is used by Goldstein and Khan (1976) and Eviews software package. Nevertheless, the available techniques require monthly data on most of the components of the officially reported GDP and other macroeconomic series, which are hardly available for Ethiopia. On the top of all, these methods are also more appropriate in an economy where output is less sensitive for seasonality. For instance, in developed countries where agriculture (the sector less affected by seasonality) has a negligible share in national output, applying these methods may be appropriate.

However, none of these methods are applicable for Ethiopia. This is because of the fact that, over our study period, near to half of the Ethiopian GDP has been contributed by agriculture. As indicated in Alemayehu *et al* (2011) about 96.9% of the total crop is produced in M*eher* season, September to February, showing that the sector is clearly season dependent. Such a nature of the Ethiopian GDP data conveys a clear message that using any method generating monthly or quarterly series which fails to take seasonality into account leads to misleading results. None of the previous attempts of generating the quarterly or monthly GDP data is successful in capturing seasonality.

In this study, we have developed a new method to estimate monthly GDP data from the annual GDP series which captures the issue of seasonality in agricultural production. The technique we followed is explained as follows. Generally, the Ethiopian GDP is composed of agriculture, industry and service sectors. Unlike in

agriculture, nature of production in the other two sectors is not season sensitive. We reasonably assume same distribution of output of service and industrial sector across months in a given year. Given that most of the agricultural practices are rain-fed, however, it is severely affected by season and thus level of output in this sector is expected to significantly differ from month to month. Crop production currently accounts about 72% and 30% of agricultural GDP and the total GDP, respectively (MoFED, 2012). It is for this component of agricultural output that we made adjustment for seasonal variation. Whereas, like that of industry and service sectors, similar distribution was assumed for animal rearing and fishery since production in these activities are not that much season sensitive.

Therefore, crop production is season sensitive component of GDP and reasonable allocation of its monetary value across months alleviate the problem of seasonality. To this end, we have computed the crop sub-sector's share of total annual GDP for each year from MoFED data. All types of cereals, pulses and oil seeds were considered in constituting the total value of crop sub-sector[3]. The GDP share of all crops was further disaggregated into individual crop type so that the GDP share of each crop type for each year was easily known. Ignoring the production in *Belg* season, the crop component of GDP, in each year, should be attributed to months of the *Meher* season (September to February). However, there is no data showing level or value of agricultural production for each month separately; nor assumption of equal level of production in each of these months and dividing the total value for six is appropriate. In this study, we utilize the concept of crop calendar to allocate production across months[4]. The crop calendar of Ethiopia for all types of cereals, pulses and oil seeds was taken from USDA (2003). This calendar tells the month, on average, during which each crop is harvested. After knowing the GDP share of each crop and the month during which they are harvested, the total value of crops (crop component of GDP) has been distributed over the six months accordingly. For instance, if harvesting season for maize is in the month of December, the entire value of GDP attributed by maize is allocated for December. On the other hand, total value of GDP attributed by sectors that are less sensitive for seasonality are equally distributed for the 12 months in a given year. This procedure enable us generate a more reliable monthly GDP data from the

[3] Here, the value of tubers is ignored because of their negligible share of GDP.
[4] Crop calendar specifies the period (in months) during which different activities (sowing, harvesting etc) of producing a given crop is performed

annual ones and the harvesting seasons like December and January were found to have more monthly value than the slack periods, as expected.

The proxy for expected inflation used in this study is derived from the actual inflation using Autoregressive Integrated Moving Average (ARIMA) method following Junttila (2001) and Meylar, et al., (1998). In this approach, expected inflation is estimated as the fitted value in the regression of actual inflation on lags of its own and the error term. In this study, ARIMA(3,1,3) was used to generate the data on inflation expectations.

All of the variables, except smuggling (SMUG) and expected inflation (EXP), are used in natural logarithmic forms to capture non-linearity in relationships and reduce the problem of heteroskedasticity. Smuggling and expected inflation are used in level forms because they have some negative observations which results in missing values, and thus loss of information, if they are used in logarithmic forms.

In addition, primary data were collected to acquire additional micro level information on qualitative aspects of price dynamics and market performance such as market structure, behavior of major market actors, the pattern and level of competition, the mechanisms of price setting, communication and interdependence among the different actors, smuggling, transportation and storage availability and costs, availability of market information and degree of marketing risk, administrative and legal efficacy and costs, among others. These primary data were collected from key informants including consumer cooperatives, suppliers, retailers, and government officials of trade and industry bureau.

4.2 Methods of Data Analysis

Both qualitative and quantitative data analysis techniques were used. Specifically, time-series (trend and seasonality) and econometric techniques were utilized to address the stated objectives.

The time series analysis helps to understand the temporal variation of food price. Time series data has four components, namely, trend (T), Seasonality (S), cyclical (C) and irregular (I) components (Washington et.al. 2010). The first two components can be modeled to understand their nature while the later two cannot be modeled as they do not exhibited specific pattern. In this study, both seasonality and trend analyses were

made to understand the annual and quarterly fluctuations, respectively, of the price of the aforementioned food commodity bundles. Ratio to moving average method was used for seasonality analysis. The trend analysis of prices was made based on deseasonalized data.

Econometric Model

This model is employed to identify the derivers of food price inflation in the study area. Both macro and meso level factors are incorporated in the econometric model. Coupling macro level variables with meso ones are not unusual in modeling meso level prices (see Andrade and Marios, 2011, and Galati *et al*, 2011 for macro-meso framework in modeling inflation). These demand and supply side variables are hypothesized as important derivers of price and they can be put in equation form to determine aggregate food price inflation (DFPCI) as:

$$DFCPI_t = \beta_0 + \beta_1 M2_t + \beta_2 DNFCPI_t + \beta_3 EXR_t + \beta_4 GDP_t + \beta_5 EXP + \beta_6 WOP_t + \beta_7 WFCPI_t + SMUG_t + \varepsilon_t. \quad (1)$$

Where ε is the stochastic term, $\beta_i's$ are the model parameters and the subscript t stands for time.

Following Johansen (1988) and Johansen and Juselius (1990), assuming the variables mentioned above are endogenous and using matrix notation denoted by vector Z, the vector autoregressive model (VAR) of order p can be written as

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-1} + \cdots + A_p Z_{t-p} + U_t. \quad (2)$$

It can be reformulated in a vector error correction model (VECM) as follows

$$\Delta Z_t = r_1 \Delta Z_{t-1} + r_2 \Delta Z_{t-1} + \cdots + r_{p-1} \Delta Z_{t-p} + \Pi Z_{t-1} + U_t \quad (2')$$

Where $r_i = (I - A_1 - A_2 - ..... - A_p)$ (I = 1, 2, .., P-1) and $\Pi = -(I - A_1 - A_2 - ..... - A_k)$ from which the speed of adjustment to equilibrium coefficients and the long run coefficient matrix or the co-integrating vector will be identified. In the empirical estimation, Equation (2') can be augmented to include the deterministic term (time

trend and/or intercept) and the appropriate lag length will be selected using Akaike Information Criterion (AIC), Schwarz Criterion (SC) and others.

When we become specific and taking our variable of interest in mind, all the variables in the above VAR model, except smuggling (SMUG) and expected inflation (EXP) which are integrated of order zero or I(0), are found to be I(1). Hence, the appropriate modeling approach to identify the long run and short run determinants of domestic food price inflation is vector error correction model (VECM). The specification of our VEC model that considers the existence of mixed order of integration of variables can be specified as follows[5]:

$$\Delta DFCPI_t = \alpha_0 \sum_{i=1}^{k} \alpha_{1i} \Delta DFCPI_{t-i} + \sum_{i=0}^{k} \alpha_{2i} \Delta M2_{t-i} + \sum_{i=0}^{k} \alpha_{3i} \Delta DNFCPI_{t-i} + \sum_{i=0}^{k} \alpha_{4i} \Delta EXR_{t-i} + \sum_{i=0}^{k} \alpha_{5i} \Delta GDP_{t-i} + \sum_{i=0}^{k} \alpha_{6i} EXP_{t-i} + \sum_{i=0}^{k} \alpha_{7i} \Delta WOP_{t-i} + \sum_{i=0}^{k} \alpha_{8i} \Delta WFCPI_{t-i} + \sum_{i=0}^{k} \alpha_{9i} SMUG_{t-i} + \alpha_{10} D_t + \gamma(\beta_{1i} DFCPI_{t-1} - (\beta_{2i} M2_{t-1} + \beta_{3i} DNFCPI_{t-1} + \beta_{4i} EXR_{t-1} + \beta_{5i} GDP_{t-1} + \beta_{7i} WOP_{t-1} + \beta_{8i} WFCPI_{t-1})) + \varepsilon_t. \quad (3)$$

Where γ is the error correction parameter which measures the speed of adjustment towards long-run equilibrium in each period, β_i are coefficients of the long run relationship in the system and D_t is a vector of deterministic variables such as constant and trend. This quantitative analysis coupled with the qualitative assessments or justification is believed to foster to a good understanding of the causes of inflation in the study areas.

5 Results and Discussion

5.1 Marketing System and Price Determination in Harar and Dire-Dawa

There are, currently, about 120 and 252 retailers of food items in Harar and Dire-Dawa markets, respectively. The retail market in the region is highly competitive that retailers are price takers and entry is easy due to low initial capital requirement and absence of market barriers. Retailing price is determined by 'cost-plus' basis, adding mark-up on the total purchasing cost (purchase price, transportation and other transactional costs, etc) commonly employed by all retailers. Few retailers with relatively higher capital and marketing essence purchase crops from the source areas of central

[5] Justification for this is provided in section 4.3.1 along with the unit root test.

and northern Ethiopia (particularly, Shoa, Arsi and Gojam), and keep buffer stock for future sale. However, most of the traders of food items both in Dire Dawa and Harar towns receive supplies mainly from wholesalers that are based in the aforementioned surplus producing areas of the country. Prices charged by retailers move simultaneously due to the quick flow of information in the retail market.

Based on observations and surveys conducted in the markets, the number of suppliers/wholesalers is so small that they have significant monopoly power in determining price. Information from key informants upholds the increased responsiveness of farmers to market changes contributed for the upward pressure in food under a situation of high food demand-supply gap. Administrative inefficiencies of public offices (such as regional trade and licensing bureaus) escalate cost of making business and contributed for price hike. What is more, price change is happened due to seasonal variation of production in and around the study area.

5.2 Seasonality and Trend Analysis of Prices

5.2.1 Seasonality Analysis of Crop Prices

In this section, we discuss the seasonal variation of the prices of four categories of food items, namely cereals, pulses, bread and other prepared food items and vegetables and fruits, based on computed moving weighted average prices. Thus, in order to diagnose the seasonal variation in price, ratio to moving average method of seasonality analysis was employed and actual and deseasonalized prices are also discussed as follows.

Cereals take the lion's share of the consumption bundle of households. Sorghum and maize are the dominant cereals produced in Hararghe area while the rest are mainly supplied from other surplus producing areas. The weighted average price of cereals in the study area over the study period was found to be volatile with a general increasing trend, which is similar to the national trend.

The seasonality index of cereals in winter season shows an increment by 26% than the typical quarter price level of 100, but decline in autumn and summer seasons in Harari. This may be associated with less cereal production practices and different consumption preferences of the community. During autumn and spring, there is rainfall but erratic and farmers produce vegetables supported by the common practice of irrigation. This

enables them to reduce their dependence only on cereals, which in turn, relatively reduces the price of cereals due to decrease in demand (see Appendix B, Figure 2). Similar trend was also found in the seasonality analysis of bread and other prepared foods category (see Appendix B, Figure 5). It should be noted, however, that the overall consumption pattern of Harar is difficult to understand and an independent study on consumer behavior and consumption pattern might be essential.

In Dire-Dawa, cereals become expensive particularly during summer and the beginning of autumn (see Appendix B, Figure 1). During these seasons, based on the information obtained from key informants, Djibouti is very hot and people temporarily migrate from Djibouti to Dire-Dawa to escape the hot period. This scenario raises demand for food and other items putting upward pressure on price.

In winter and spring, price of bread and other prepared foods gets higher (see Appendix B, Figure 6). One possible reason, based on survey findings, for this is that the population in Dire-Dawa tends to consume prepared food items like bread, pasta and macaroni in winter and spring since other durable food types are spoiled by the hot weather of the season.

Pulses, the other food items considered in this study, are not widely produced in the study area. Hence, like cereals, pulses traded in these markets areas are supplied from the surplus producing parts of the country. The graphical representations of pulses are depicted in Figure 3 and 4 of Appendix B. Similar to the price variation of cereals, price of pulses vary but at lower rate. In Dire-Dawa, the prices for pulses varied by 4% and 3% in summer and autumn, respectively, above the typical average quarter price level and approximately with the same rate below the price level during winter and spring.

Finally, Appendix B Figure 7 and 8 reveal the price patterns of vegetables and fruits in the study area. Vegetables and fruits are produced in the eastern part of Ethiopia and supplied to the local markets and to the neighboring countries including Djibouti and Somali land. In this area, the supply of vegetables is relatively high even during spring and autumn due to a strong tradition of rain water harvesting and underground water utilization, thus irrigation, by farmers. Though there is perpetual supply, there was moderate seasonal variation in the price of vegetables and fruits, revealed higher in winter and lower in autumn.

Generally, the variation of prices from season to season was found to be low where as price levels, for almost all food categories, remained high over the study period. Since the end of 2007 and more particularly in 2008, price of food items alarmingly spoke.

5.2.2 Trend Analysis

Trend analysis, a tool to determine the movements of prices overtime, is used to see the trend of sample food prices in the area over the study period. As the trends of the selected categories can be understood from the graphs presented for seasonality analysis, showing separate graphs for all food categories is not necessary. As a result, only two figures (Figure 9 and 10 in Appendix B) are presented to Harar cereal and pulses data to exemplify increasing trends of prices.

The actual and deseasonalized price of cereals fluctuated over the study period due to cyclical factors. The functional trend line of the price change with time is $Y=4.85+0.32t$ and this enables to project price changes in future t period in the area. Similar to the price of cereals, the price of pulses showed an increasing trend with the actual and deseasonalized price fluctuating around the increasing trend line and sometimes, especially in 2012, going up from the trend line. The function of the pulses price trend line was found to be $Y_t = 5.23+ 0.82t$ again showing the increasing trend over time.

5.3 The Econometric Result

Stationary Test /Unit Root Test

We have carried out unit root test for each variable using Augmented Dickey-Fuller (ADF) test for unit-root null versus a stationary alternative. The test result revealed that (Appendix A, Table A.1) for both Dire Dawa and Harar, all variables except smuggling and expected inflation were not stationary at level. After differencing the non-stationary series, however, the null of unit root were well rejected at conventional level of significance. Thus, smuggling and expected inflation are integrated of order zero, I(0), while all other variables used in the model are integrated of order one, I(1). The result suggests that the food price inflation, our variable of interest, exhibit a stochastic trend or non-stationary drift, rather than mean-reversion to a fixed long-run level, over the sample period. The cointegration analysis attempts to explain these long-run trend developments by identifying long-run determinants, or I(1) explanatory variables, which

share a common variable trend, i.e., cointegrate, with food price inflation. Based on the corresponding cointegration estimates, fluctuations in food price can then be decomposed into trend (permanent) and cyclical (transitory) components, depending on the time series behavior and its fundamental determinants.

In the unit root test the fact that variables other than smuggling and inflation expectation appear to be I(1) indicating that they are possible candidates helping to explain the (stochastic) trend in a given endogeneous variable. This mean that the long run cointegration equations will only consist of variables which are I(1). Smuggling and inflation expectation (I(0) variables), however, appear to be stationary so that (transitory) changes in these variables are likely to have only a short-run impact on the explained variable. Thus, these variables should only be introduced in the short run equation of domestic food price inflation. And differences in the long-run level of such variables should be reflected in the constant terms of the cointegrating equations, representing level rather than trend implications. The construction of our VECM specified in Equation (3) is based on this argument.

5.3.3 Lag Length Determination

Ackakie Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and Schwarz Bayesian Information Criterion (SBIC) were used to determine the appropriate lag length (Table 1). Lag two and one are selected to be the optimum lag lengths for Dire Dawa and Harar, respectively, as these are selected by of the majority of the criteria.

Table 1: Test of Lag Length Determination

Lag	Dire Dawa			Harar		
	SBIC	AIC	HQIC	SBIC	AIC	HQIC
0	-6.12911	-8.27831	-8.21768	-7.6927	-7.8434	-7.8218
1	-26.6666*	-27.8602	-27.3751	-27.5444*	-28.7496	-28.2598*
2	-26.1306	-28.3686*	-27.4591*	-26.5493	-28.8900	-27.8907
3	-24.8720	-28.1544	-26.8205	-25.4375	-28.7517	-27.4049
4	-23.7126	-28.0393	-26.2810	-24.4455	-28.8138*	-27.0385

'*' indicates the optimal lag

5.3.4 Johansson Test of Cointegration

The result of the Johansen cointegration test depicted in Table 2 shows that the number of cointegratin equations for both Dire Dawa and Harar is 2.

Table 2: Johansson Cointegration test result

	Dire Dawa		Harar	
Maximum rank	Trace statistic	5%critical value	Trace statistic	5%critical value
0	193.2709	124.24	149.8063	124.24
1	113.5209	94.15	97.7012	94.15
2	65.7360*	68.52	43.2288*	68.52
3	39.7895	47.21	23.4283	47.21
4	22.8401	29.68	10.1341	29.68

* Indicates the rank of the cointegrating matrix

5.3.5 Estimation of the Vector Error Correction Model (VECM)

Macroeconomic theory is mainly based on long-run equilibrium relations and economic theory rarely tells us anything about short-run dynamics. If variables are non-stationary but cointegrated, it is possible that the parameters of long-run relations are estimated (super) consistently without considering the short-run dynamics. In order to estimate long-run equilibrium relations consistently, we no longer need the complete and fully specified model. It is sufficient to know which (non-stationary) variables are elements of these relations (Kirchgässner and Wolters, 2007).

In our pre-estimation diagnostic effort, we have shown that variables are cointegrated. From Granger (1983) and Engle and Granger (1987), if a set of variables are cointegrated, then there exists a valid error-correction representation of the data. This VECM in our case is specified in Equation (3) from which we can estimate the long run and short run determinants of food price.

Given that the cointegrating matrix is of rank two for each case, the two potentially cointegrating equations of the model for each study regions are estimated.

Table 3: VEC Weak Exogeneity Wald Test

No	Variable	Dire Dawa			Harar		
		Chi-square	P-value	Decision	Chi-square	P-value	Decision
1	ln(DFCPI)	34.22	0.000	Endogenous	11.01	0.0007	Endogenous
2	ln(DNFCPI)	6.44	0.0123	Endogenous	5.521	0.011	Endogenous
3	ln(WFCPI)	8.53	0.0007	Endogenous	0.074	0.7995	Weakly exogenous
4	ln(WOP)	3.12	0.0793	Weakly exogenous	26.05	0.0000	Endogenous
5	ln(M2)	0.33	0.6520	Weakly exogenous	1.61	0.4014	Weakly exogenous
6	ln(GDP)	1.21	0.3855	Weakly exogenous	2.31	0.0814	Weakly exogenous
7	ln(EXR)	0.05	0.8532	Weakly exogenous	1.801	0.4109	Weakly exogenous

In order to support the theory by statistical test in the effort of identifying the exogenous and endogenous variables and make the necessary restriction and normalization, weak exogeniety test was carried out. The test examines the null that the variable is weakly exogenous against the alternative of not weakly exogeneous and the test result is presented in Table 3. The test result suggested that ln(DFCPI), ln(DNFCPI) and ln(WFCPI) (for Dire Dawa) and ln(WOP)(for Harar) are endogenous while others were found to be weakly exogenous. Even if the statistical test reveals that world oil and world food prices are endogeneous, it is unlikely to be true practically and thus the exogeniety restriction was imposed. Therefore, the two cointegrating equations suggested by the rank test are associated to domestic food prices and domestic non-food prices. In estimating the two long run equations for each case, restrictions were imposed and the cointegrating matrix could be identified. In the cointegrated equation where it was normalized for our variable of interest, ln(DFCPI), the long-run drivers of domestic food price inflation were identified. Though there is also another long run equation for the other endogenous variable(non food inflation) estimated simultaneously and it is possible to derive its respective short run dynamics, we did not report and discuss this since we are rather interested only on explaining long run and short run drivers of domestic food price inflation. So, the long run equation of our variable of interest, food price inflation, for Dire Dawa and Harar are:

$$ECM_d = \ln(DFCPI) - 0.37\ln(GDP)^{**} - 0.818489\ln(WFCPI)^{**} - 0.48675\ln(M2)^{**} \quad (4)$$

$$ECM_h = \ln(DFCPI) - 0.475909\ln(GDP)^{*} + 0.9955991\ln(EXR)^{**} - 1.204714\ln(WOP)^{*} - 0.369265ln(M2)^{**}. \quad (5)$$

Where, * and ** show 1% and 5% level of significance and the subscripts d and h stands for Dire Dawa and Harar, respectively.

In the two long run models presented in Equation (4) and (5), only statistically significant regressors are reported. The presence of a cointegrating relationship implies that there exists an error-correction model that describes the short-run dynamics consistently with the long-run relationship (Johansen, 1988). Given evidence about the long-run equilibrium relationship between integrated variables, the short-run dynamics is captured by the lags of the differenced variables and an equilibrium correcting term. As a result, the rest part of the model specified in Equation (3) was fit and the short run coefficients and the speed of adjustment to the long-run equilibrium have been estimated and the parsimonious vector error correction model have been reported in Table 4 along with their significance level.

As it can be seen from these equations, money supply, exchange rate, world food price, world oil price and national income were identified to be the long run determinants of food price, at least in one of the two cases. Whereas inflation expectation, world oil price dynamics, exchange rate and smuggling were found to significantly affect domestic food price inflation in the study area in the short run (Table 4). Exchange rate and world oil price affect domestic food price dynamics both in the short run and the long run. Most of the coefficients in the VECM result have appeared with their expected signs.

The long run estimates presented in Equation (4) and (5) show that a 1% increase in world food price leads to a 0.82% rise in domestic food price inflation (for Dire Dawa Data), *citrus paribus*. This evidence suggests that food price hike at international market pushes the domestic food price up since it makes imported foods more expensive. This is expected as the country is net food importer. The rise in world food price also creates a good motivation to export domestically produced food items,

notably, cereals and pulses[6]. Both of these effects compromise the domestic food supply and cause domestic food price to go up. Similar role was found to be played by international oil price from the Harar data. It is known that Ethiopia is highly dependent on imported crude oil and gas for its energy consumption. Hence, the world oil price shock directly affects the domestic food price through its impact on transportation costs and high cost of production. This is particularly true in our study area where most of domestically produced food items are obtained from other surplus producing distant areas.

Table 4: Parsimonious vector error correction model (dependent variable D_ln(DFCPI))

Variables	Dire Dawa		Harar	
	Coef.	P-value	Coef.	P-value
EXP	0.0045427	0.000	0.0021634	0.004
DlWOP	0.0540863	0.027		
DlWOP _1	0.0396307	0.035	0.0722238	0.017
SMUG			-0.0047604	0.006
DlEXR _1	0.1810403	0.000		
ECM_1	-0.0196355	0.020	-0.0071828	0.004

Money supply is the other important driver of long run domestic food inflation in the study area. Its coefficient both Dire Dawa and Harari data is significant and positive. Other things being equal, a 1% rise in monetary aggregates causes 0.49% and 0.37% rise in aggregate domestic food price in the long-run as per the results from VEC regression of the Dire Dawa and Harari data sets, respectively. This is because of the fact that the growth in monetary aggregates causes aggregate demand to rise. For a given level of aggregate supply, this might end up with stepping up prices. This finding confirms with Alemayehu and Kibrom (2011) and Jema and Fekadu (2012) though the scope of interest, geographically, is different. The betterment of income represented by real GDP was also significant in aggravating food price inflation in the long run both in Dire Dawa and Harar through increasing purchasing power and aggregate demand.

One of the surprising finding of this study is about the effect of exchange rate on domestic food price. As it can be seen in Equation (5) and Table 4, exchange rate was

[6] It is because of this fact that, now days, the Ethiopian government has banned exports of some selected cereals and pulses.

found to have a negative and significant impact on food prices in the long run while it turns to be positive in the short run for Harara data. The result implies that higher exchange rate (devaluation or depreciation of domestic currency) reduces inflationary pressure in the long run. This might be because of the fact that devaluation or depreciation may discourage import since importing becomes expensive and encourages domestic production following the principle of import substitution. This blocks imported inflation which is proved, even by this study, to be one source of the domestic inflation. In addition, devaluation may encourage foreign investors as it makes investment cost lower and domestic inputs cheaper. Such foreign investment, on one hand, may contribute for positive supply shock and thus lower food price, *citrus paribus*. Added to these, more foreign investment flow following devaluation can be used as a good source of government revenue (from tax and lease). This may contributes for less fiscal deficit and thus less pressure to print excess money as a means of deficit financing. This less fiscal deficit channel can further be strengthened through the contribution of devaluation for improved balance of payment and hence less fiscal deficit, provided that Marshal-Lerner condition is satisfied and external deficit and fiscal deficit are intrinsically related. All these channels may contribute to lower long run inflation following devaluation of Birr. Similar to the widely available literature, we have confirmed devaluation of domestic currency heighten the inflationary pressure, evidence from Dire Dawa data (Table 4). This might be because of its impact in making import expensive and increase cost of production.

Since our study area has a unique feature of widespread smuggled products, especially in consumption items, we were also interested in exploring whether having such feature has any relation with domestic food price movements. To this effect, we have constructed a proxy variable for smuggling as it is described in the methodology section. The short run part of the estimated model for Harar data suggests that smuggling practices plays an important role in cooling down the heat of food price inflation.

There are some plausible explanations of the inverse relationship between price level and smuggling. One possible explanation is that price in Ethiopia is relatively larger than its international parity price precipitating pressure for import. Dire Dawa Administration and Harari regional state are among the major places in Ethiopia where smuggling is practiced owing to their location near to the Gulf of Aden-the major gateway of commodities to Ethiopia. The import augments domestic supply, improves competitiveness and, thus, puts downward pressure on domestic price. Another

possible explanation is the high cost of making business in Ethiopia. According to World Bank (2012), Ethiopia is ranked 111th out of 183 countries in ease of doing business in 2012. Hence, the financial as well as non financial cost of doing business in Ethiopia is quiet high and might significantly hamper the motive to engage in formal business. This motivates actors to involve in practices of smuggling whenever the option is available. The same source in the same year ranked Ethiopia 157th in easiness of trading across borders. Therefore, trading across the borders of Ethiopia is very difficult justifying high cost of engaging in formal international trade and high level of smuggling activity in parts of the country which are close to coastlines like Dire Dawa and Harar. Five different types of taxes namely: customs duty, excise tax, VAT, sur tax and withholding tax are levied on most of imports into Ethiopia which are calculated sequentially (Negarit Gazeta, 2009).

Therefore, in the area where no smuggling is undertaken, traders and/or producers have to pass through all the formal procedures to supply consumption items. This involves higher transaction costs as compared to those areas where suppliers do business without bearing the cost of being formal and legal. The effect of such high transaction costs will finally be reflected on selling prices of items. This may be one reason why existence of smuggling plays a stabilizing role in the study area. The smuggling-inflation nexus coveys a message that making the market more competitive (through easing the formal way of doing business) and reducing cost of supply (reducing import tax and tariff for imported items, for instance) may be among the remedies for current galloping inflation. The coefficient of smuggling from the Dire Dawa data, though negative as expected, is statistically insignificant. This might be due to the significant fall in smuggling practice of the town following the termination of the Ethio-Djibouti rail transport. On the other hand, smuggling in Harar town has continued to be practiced due to its proximity to Somaliland.

The other evidence supported by this study is the positive and significant relationship between current prices and future expectation. As it can be seen in Table 4, higher expectation about future prices creates upward pressure on current actual prices in the short run, which is in line with the theory. Finally, the error correction term in the short run model (Table 4) was found to be negative and significant, as expected. The coefficient of the error correction term is interpreted as the speed of adjustment towards the long term equilibrium. The negative sign of this coefficient implies that the

food price adjusts/converges to its long run equilibrium with a relatively higher speed in Dire Dawa and slower in Harar.

The robustness of all these findings have been checked by different post estimation diagnostic tests in addition to the pre-estimation tests discussed before. The lagrangean multiplier (LM) test of autocorrelation was conducted against the null of no serial correlation. The test result reported in Appendix A, Table A.2, shows that the error terms are not serially correlated since P-value at any lag order is greater than 0.05. Again, inference based on VECM requires that the cointegrating equations be stationary and that the number of cointegrating equations be correctly specified. If a VECM has K endogenous variables and r cointegrating vectors, there will be K-r unit moduli in the companion matrix. If any of the remaining moduli are too close to one, either the cointegrating equations are not stationary or there is another common trend and the rank specified in the model is too high. This test is called the VEC stability test. Even if there is no general distribution theory that allows to determine whether an estimated root is too close to one, our test result depicted in appendix A, Table A.3 and A.4 shows that the non- moduli are not too close to one and thus the model is stable.

6 Conclusion and Policy Implication

The purpose of this study is to investigate the determinants of food price inflation at meso or regional level. To this effect, the study was carried out on Dire Dawa Administration and Harari regional state by intermingling meso and macro level variables.

Dire Dawa City Administration and Harari Regional State have experienced high level of price volatility in the last decade. The volatility of food price in this area exhibits both trend and seasonal patterns. The result from the VECM model reveals that the rise in money supply, aggregate demand (GDP), and international food and oil prices exacerbate the domestic food price in the long-run. Similarly, future price expectation and world oil price increment aggravate domestic food price in the short-run. On the contrary, depreciation or devaluation of domestic currency reduces inflation in the long run. Likewise, existence of smuggling practices stabilizes domestic food prices in the short run through its role in supplying consumption items at a lower cost and increasing domestic supply and competitiveness in the market.

In light of the above concluding remarks, some policy implications can be drawn. The fact that money supply appears to be a seminal factor of food price inflation in the long run and short run entails the need to pursue tight monetary policy. Moreover, the significant effect of smuggling on food price determination is an alarm for the government to smoothen the cross boarder trading system and formal way of doing business by avoiding unnecessary and superfluous barriers. In this regard, it is essential to increase domestic supply and induce competitiveness in the market. Moreover, the government may also consider a careful further devaluation of Ethiopian Birr to attract foreign investment and promote domestic production.

Finally, future researchers may consider other regions of the country and utilize their special futures through micro-macro modeling to explain price movements. Researchers may also reconsider the issue we raised by looking at better measures of variables like smuggling.

References

Ahmed, H. (2007). "Structural Analysis of Price Drivers in Ethiopia". Addis Ababa: Ethiopian Development Research Institute. Processed

Alemayehu S. Taffesse, P. Dorosh and Sinafikeh A. (2011). "*Crop Production in Ethiopia: Regional Patterns and Trends"*, Development Strategy and Governance Division, International Food Policy Research Institute, working paper 16, Ethiopia Strategy Support Program II, Ethiopia

Alemayehu, G. (2008). 'The Political Economy of Growth in Ethiopia', in Benno Ndulu, Stephen O'Connell, Robert Bates, Paul Collier and Charles Soludo. *The Political Economy of Economic Growth in Africa, 1960-2000.* Cambridge: Cambridge University Press.

Alemeayehu, G and Kibrom, T. (2011). "The Galloping Inflation in Ethiopia: A Cautionary Tale for Aspiring 'Developmental States' in Africa", Institute of African Economic Studies, Working Paper Serious No. A01/2011

Andrade, P. and Marios, Z. (2011). "Global Versus Local Shocks in Micro Price Dynamics," Department of Economics, University of Cyprus, Discussion Paper 10.

Ball, R. J. and Doyle, P. (1969). Inflation: Selected Readings. Harmondsworth, England, Penguin. Penguin Modern Economics Readings.

Barro, R. J. (1996). "Democracy and Growth". *Journal of Economic Growth*, 1:1-27, Kluwer Academic Publishers, Boston

BEA (Bureau of Economic Analysis). (2008). "Macroeconomic Advisers' Measure of Monthly GDP", *Macro focus, 3(3).*

Branson, W. H. and Myhrman, J. (1976). "Inflation in Open Economies: Supply-Determined versus Demand-Determined Models", European Economic Review, vol. 7, no. 1, pp. 15-34.

CSA (Central Statistical Authority). (2007). "The Federal Democratic Republic of Ethiopia population and housing census report", Addis Ababa, Ethiopia.

_____. (2012). "Crop production statistics 2011/12 at national and regional levels report", Addis Ababa, Ethiopia.

_____. (2012). "Monthly food prices survey data for Harari regional state and Dire-Dawa administration (2007-2012) report," Addis Ababa, Ethiopia.

_____. (2012). "Country and Regional Level Consumer Price Indices, for the month of October 2012," Addis Ababa, Ethiopia.

Cuche, N. & Hess, M. (2000). **"**Estimating Monthly GDP in a General Kalman Filter Framework: Evidence from Switzerland. Economic & Financial Modeling," Information No. 61 *Discussion Paper 83-13*, University of California, San Diego.

EDRI (Ethiopian Development Research Institute). (2007). "Determinants of Inflation in Ethiopia", the Federal Democratic Republic of Ethiopia.

Engle, R. F. and Granger, C. W. J. (1987). "Cointegration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, 251–276.

Federal Negarit Gazeta. (2009 February). "Proclamation No 622/.2009, customs reclamation, 15(27).

FAO (Food and Agricultural Organization). (2008). "Integrating the Crop and Food Supply and the Emergency Food Security Assessments", *FAO/WFP Crop and Food Security Assessment Mission to Ethiopia*, http://www.fao.org/decrep/010/ah883e/ah883e00.htm

Frisch, H. (1977). "Inflation Theory 1963-1975: A Second Generation Survey", *Journal of Economic Literature*, Vol. 15, No. 4, pp. 1289-1317.

Galati, G., Teppa, F. and Alessie, R. (2011). "Macro and Micro Derivers of House Price Dynamics: An Application to Dutch Data," De Nederlandsche Bank (DNB) Working Paper No. 288.

Goldstein, M. and Khan, M. (1976). "Large Versus Small Price Change and the Demand for Import, IMF Staff paper, 200-225.

Granger, C. W. J. (1983). "Co-Integrated Variables and Error-Correcting Models," Unpublished

Hill, R. Carter, William E. Griffiths and Guay C. Lim. (2011). *Principles of econometrics*. 4th Edition, Johy Wiley and Sons, Inc.

IMF (International Monetary Fund). (2008). "Federal Democratic Republic of Ethiopia: 2008 Article IV Consultation Staff Report." IMF Country Report 08/264. Washington DC:

Ivanic, M. and Martin, W. (2008). "Implications of Higher Global Food Prices for Poverty in Low-Income Countries," Policy Research Working Paper WPS4594. Washington DC: The World Bank.

Jema H. and G. Fekadu. (2012). "Determinants of the Recent Soaring Food Inflation in Ethiopia", *Universal Journal of Education and General Studies*, Vol. 1(8), pp. 225-233.

Johansen, S. (1988). "Statistical Analysis of Cointegrating Vectors," *Journal of Economic Dynamics and Control*, 12, 231-54.

Johansen, S. and Juselius, K. (1990). "Maximum Likelihood Estimation and Inferences on Cointegration with applications to the demand for money," Oxford Bulletin of Economics and Statistics, 52, 169 – 210.

John, M., Sindu, W. and Paulos, Z. (2009). "Impact of Soaring Food Price in Ethiopia: Does Location Matter?" IFPRI Discussion Paper 00846

Junttila, J. (2001). "Testing an augmented Fisher hypothesis for a small open economy: The case of Finland", *Journal of Macroeconomics*. 23, 4:577-599.

Kirchgässner, Gebhard and Jürgen Wolters. (2007). *Introduction to Modern Time Series Analysis,* Springer-Verlag Berlin Heidelberg.

Laryea, A. and Sumaila, U. (2001). "Determinants of inflation in Tanzania", CMI Working Papers, No. 12.

Loening, L., Durevall, D. and Birru, A. (2009). "Inflation Dynamics and Food Prices in an Agricultural Economy: The Case of Ethiopia," Working Paper 347. University of Gothenburg, Gothenburg, Sweden.

MoFED (Ministry of Finance and Economic Development). (2012). Brief *Note on the 2004 (EFY) National Accounts Estimates series: The major results of the 2004 estimates*.

Marco, L., Yavni, B., Karla, B. and Yaneer, B. (2011). "The Food Crises: A quantitative model of food prices including speculators and ethanol conversion", New England Complex Systems Institute, USA

Meylar, Aidan, Geoff Kenny and Terry Quinn, 1998, "Forecasting Irish Inflation Using ARIMA Models," Munich Personal RePEs Archive (MPRA) Paper No 11359.

NBE (National Bank of Ethiopia). (2008/09). "Annual Report, Economic Research and Monetary Policy Directorate", National Bank of Ethiopia, Addis Ababa

Maruye A. (1992). "The Refurbishing and Expansion of Trade Networks in the Horn of Africa." In Beyond Conflict in the Horn: Prospects for Peace, Recovery and Development in Ethiopia, Somalia and the Sudan, edited by Martin Doornbos et al., 115-16. London: Institute of Social studies.

Tegegne T. and Alemayehu A. (2002)."Cross-Border Livestock Trade and Food Security in the Ethiopia-Djibouti and Ethiopia-Somalia Borderlands", OSSREA Development Research Report Series, no. 4. Addis Ababa.

USDA (United States Department of Agriculture). (2003). "Crop Calendar of Ethiopia", Production Estimates and Crop Assessment Division, Foreign Agricultural Services.

Washington, S., Karlaftis, M., and Mannering, F. (2010). *Statistical and Econometric Methods for Transportation Data Analysis*, 2nd edition. CRC Press / Routledge, United States of America,

WB (World Bank). (2007). "Ethiopia: Explaining Food Price Inflation Policy Note", Washington DC.

_____. (2012). "Doing Business in Ethiopia" Accessed at: www.doingbusiness.org.

Yonas, A., and Mans, S. (2012). "Household-Level Consumption in Urban Ethiopia: The effect of a large food price shock," World Development, 40 (1): 146-162

APPENDIX

A. Diagnostic Tests Results for Econometric Model

Table A.1: Augmented Dickey-Fuller test for unit root

S. No	Variable	At level	At first difference	Order of integration
A	**Dire Dawa Data**			
1	ln(DFCPI)	0.9990	0.0000	I(1)
2	ln(DNFCPI)	0.9991	0.0000	I(1)
3	SMUG	0.0056	0.0000	I(0)
4	EXP	0.0000	0.0000	I(0)
B	**Harar Data**			
1	ln(DFCPI)	0.9887	0.0000	I(1)
2	ln(DNFCPI)	0.9990	0.0000	I(1)
3	SMUG	0.0001	0.0000	I(0)
4	EXP	0.0000	0.0000	I(0)
C	**National and International**			
5	ln(GDP)	1.0000	0.0002	I(1)
6	ln(M2)	1.0000	0.0000	I(1)
7	ln(EXR)	0.9982	0.0000	I(1)
8	ln(WFCPI)	0.8882	0.0000	I(1)
9	ln(WOP)	0.7501	0.0000	I(1)

Table A.2. Lagrangian Multiplier test for autocorrelation

La lag	P-Value	
	Dire Dawa	Harar
1	0.3561	0.15092
2	0.01749	0.205074

Table A.3: Eigen value stability condition for Harar error correction model

Eigenvalue		Modulus
1		1
1		1
1		1
1		1
1		1
.6014721	+.5196358i	.794852
.6014721	-.5196358i	.794852
.7479841		.747984
.6493061	+.3186011i	.72326
.6493061	-.3186011i	.72326
-.5434745	+.3687132i	.656745
-.5434745	-.3687132i	.656745
-.06855332	+.6224381i	.626202
-.06855332	-.6224381i	.626202
.4491154	+.4259595i	.618988

The VECM specification imposes 5 unit moduli

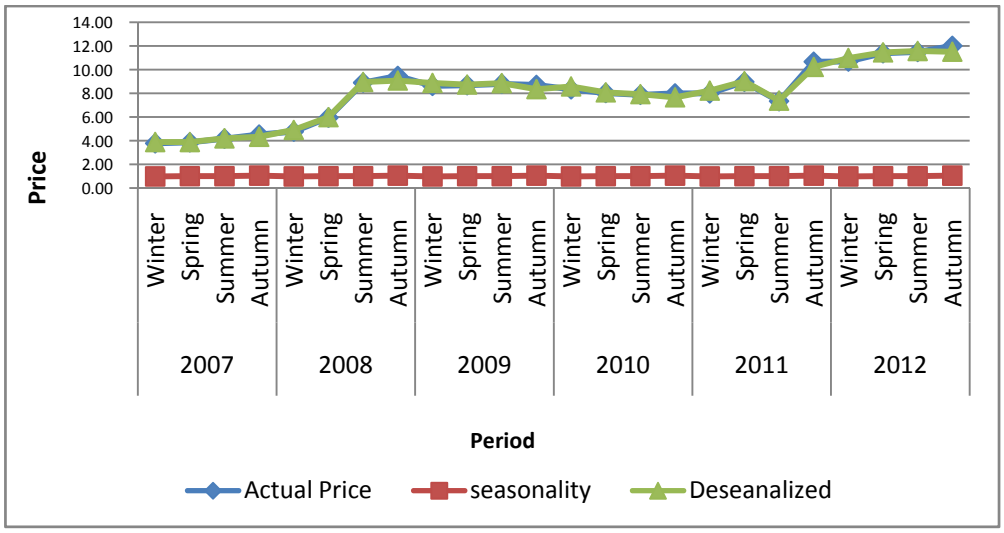
Table A.4: Eigen value stability condition for Dire Dawa error correction model

Eigenvalue		Modulus
1		1
1		1
1		1
1		1
1		1
. 8189528	+ .2546032i	.857617
.8189528	- .2546032i	.857617
-.8447993	+ .02845745i	.845278
-.8447993	- .02845745i	.845278
.5079251	+ .6529895i	.827275
.5079251	- .6529895i	.827275
.02454462	+ .8264356i	.8268
.02454462	- .8264356i	.8268
.3044485	+ .752338i	811604
.3044485	- .752338i	.811604

The VECM specification imposes 5 unit moduli.

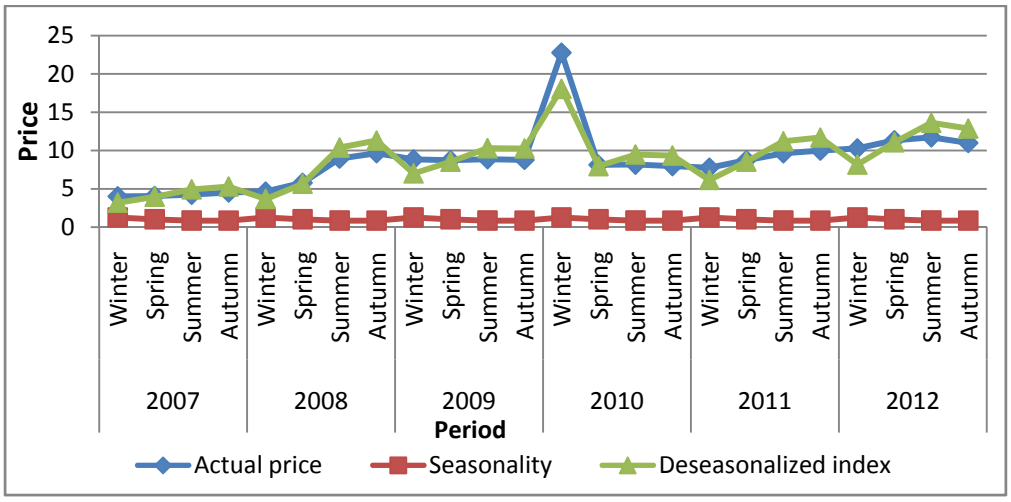
Appendix B: Figure for Trend and Seasonality Analysis

Figure 1: Cereals Price Variation in Dire-Dawa



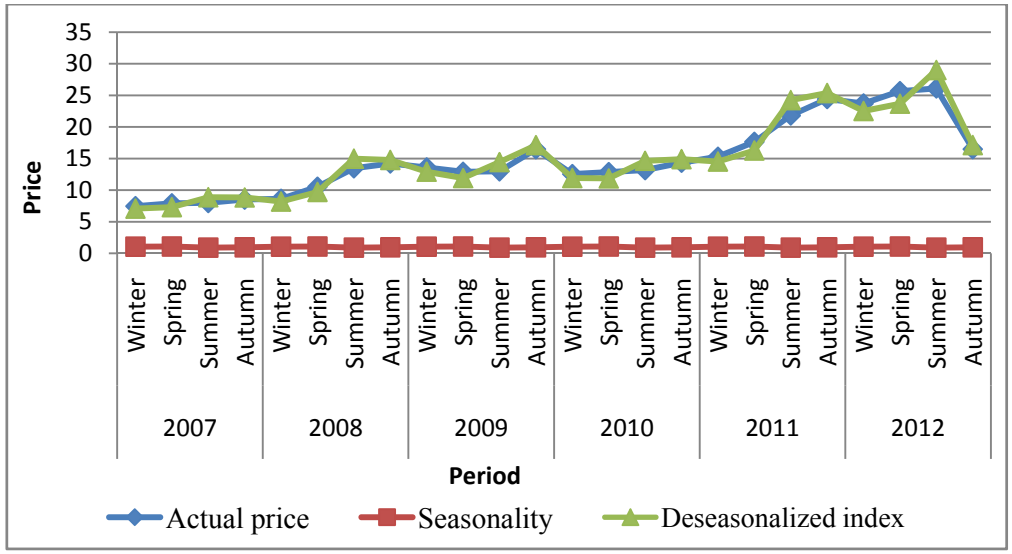
Source: Own computation from CSA Data (2007-2012)

Figure 2: Cereals price variation in Harar



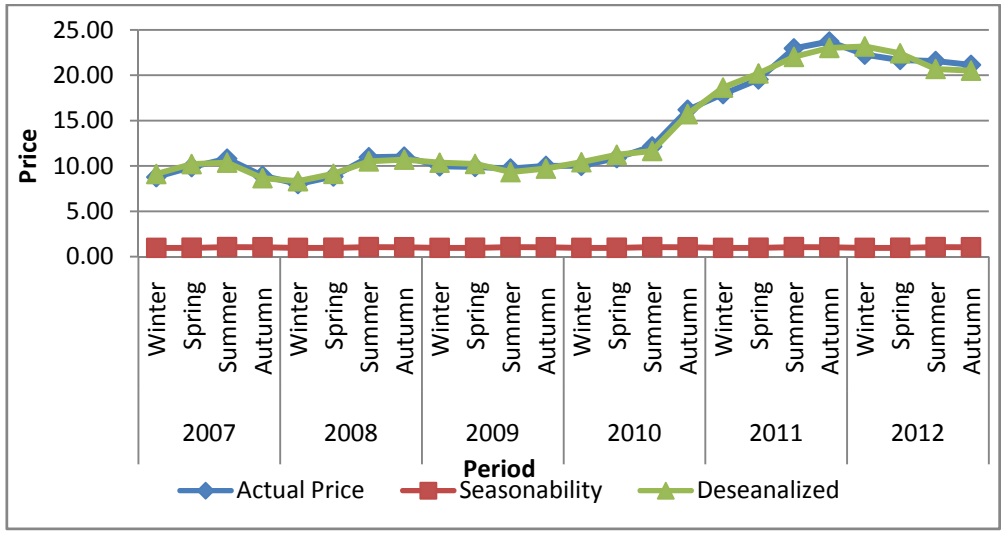
Source: Own computation from CSA Data (2007-2012)

Figure 3: Pulse Price Variation in Harar



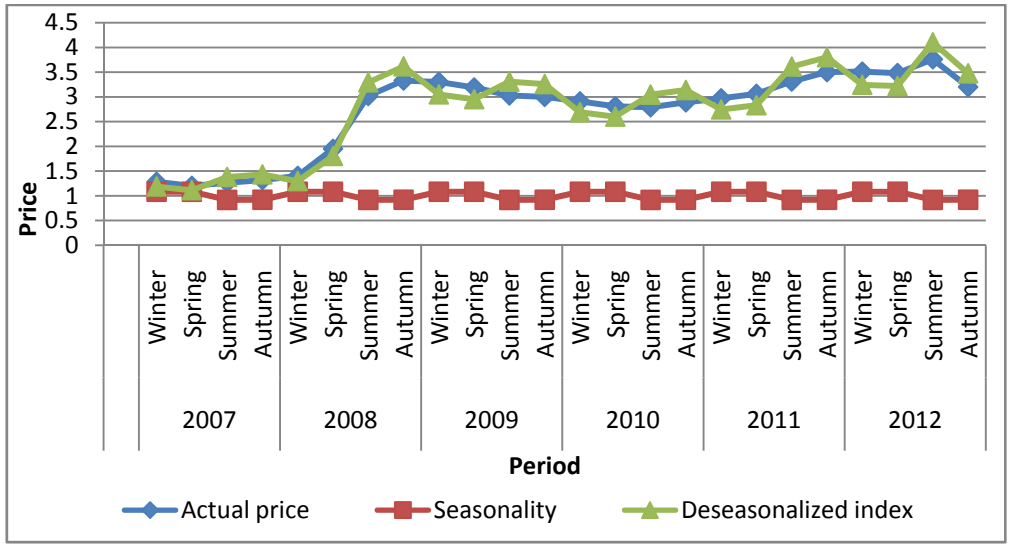
Source: Own computation from CSA Data (2007-2012)

Figure-4: Pulses Price Variation in Dire-Dawa



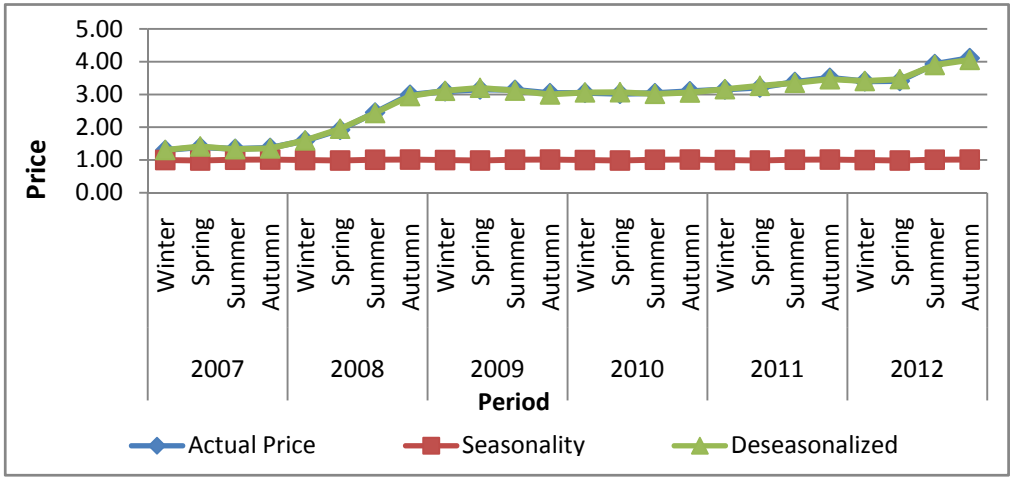
Source: Own computation from CSA Data (2007-2012)

Figure 5: Bread and other prepared foods Price Variation in Harar



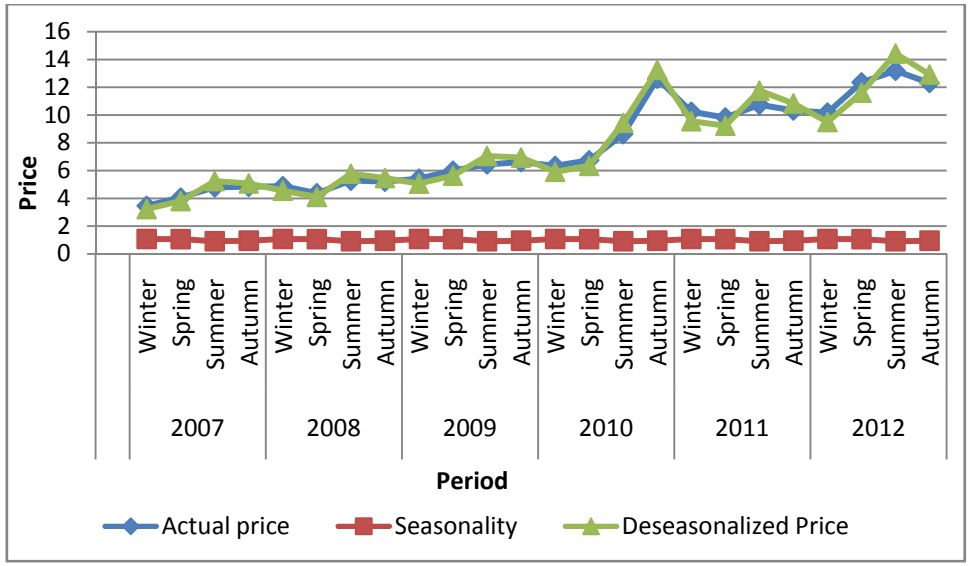
Source: Own computation from CSA Data (2007-2012)

Figure 6: Bread and other prepared foods Price Variation in Dire-Dawa



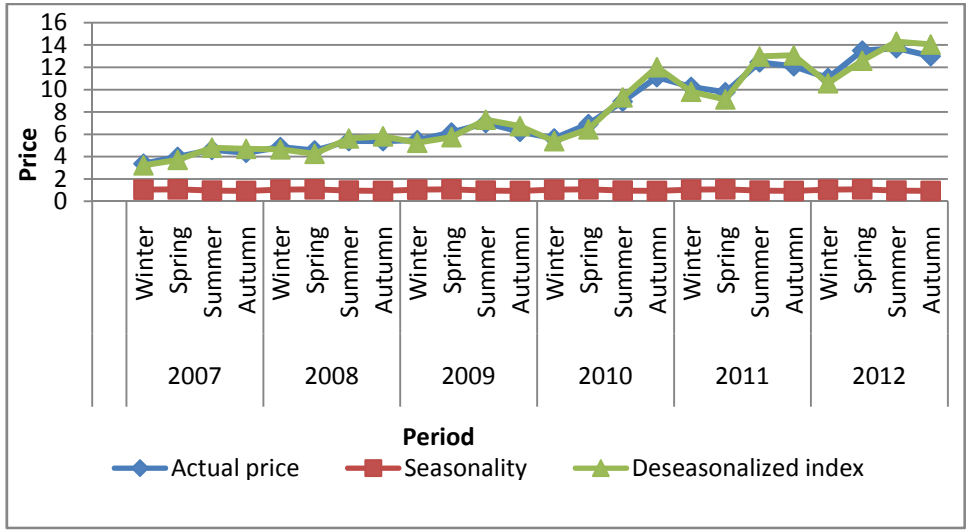
Source: Own computation from CSA Data (2007-2012)

Figure 7: Vegetables Price Variation in Harar



Source: Own computation from CSA Data (2007-2012)

Figure 8: Vegetables Price Variation in Dire-Dawa



Source: Own computation from CSA Data (2007-2012)

Figure 9: Trend of cereal price in Harar

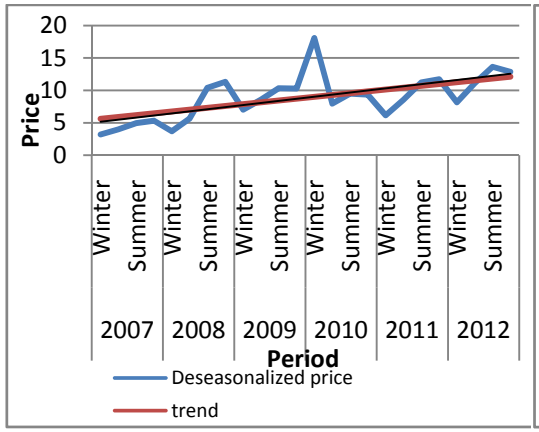


Figure 10: Trend of Pulses price in Harar