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# Statistical analysis of domestic price volatility of sugar in Ethiopia

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**Abstract:** The aim of this study was to model and identify determinants of monthly domestic price volatility of sugar in Ethiopia over the study period from December 2001 to December 2011 GC. The volatility in the domestic price of Sugar has been found to vary over months suggesting the use of GARCH family approach. Thus, family of special characteristics of time series models, namely ARCH, GARCH, TGARCH and EGARCH models with ARIMA mean equations were fitted to the data. The best fitting model among each family of models was selected based on how well the model captures the variation in the data and the optimal lag specification accessed via AIC and SBIC. Comparisons of the symmetric and asymmetric model were carried out based on the significance of asymmetric term in TGARCH and EGARCH models. The analysis showed that: statistically significance asymmetric term and least forecast error from the model established that EGARCH model with Student-t distributional assumptions for residual were superior to the GARCH and TGARCH models. Therefore, ARIMA (0,0,2)-EGARCH(1,3) with Student-t were chosen to be the best fitting models for monthly domestic price volatility of Sugar. Moreover, it was found that from candidate explanatory variables, import price for sugar, fuel oil price, exchange rate (dollar-birr), general inflation, inflation for non food items, inflation for food items, past shock, and volatility on monthly domestic price had statistically significant effect on the current month domestic price volatility on sugar.

**Keywords:** Price Volatility, Time Series Data, ARIMA, ARCH, GARCH, TGARCH, EGARCH Models

## 1. Introduction

Food price volatility has strong and long-lasting effects on emerging economies and low income people; Ensuring food security to a growing human population is a top priority among the challenges facing the world today. Managing food price instability is a long standing policy challenge, which, with mixed experiences of agricultural price policy reforms, has re-emerged as a contemporary policy issue. This is particularly true for Ethiopia, where managing food price instability continues to be a formidable policy challenge. Cereals (teff, wheat, maize, sorghum and barley) and cash crops (coffee, oil seeds and sugar) production and marketing are the means of livelihood for millions of households in Ethiopia. It forms the lion share by being half of food consumption and one-fourth of average expenditure across various household groups. More specifically, for this study I was employ econometric methods to explore the patterns and determinate of domestic price volatility of sugar under consideration in Ethiopia over the study period from December 2001 to December 2011G.C by developing separate GARCH, TGARCH and EGARCH model with Box-Jenkins model for conditional mean specification.

### *1.1. Volatility*

Volatility provides a measure of the possible variation or movement in a particular economic variable. In economic theory, volatility connects two principal concepts: variability and uncertainty; the former describing overall movement and the latter referring to movement that is unpredictable. Lack of predictability and uncertainty associated with increased volatility may influence both producers and consumers. The review share's monthly closing prices of commodities over a period of time; these observed net changes, also called *returns*. These changing or fluctuating commodity prices represent a share's *volatility.*

*Return:* Let $P_t$ be the price of a commodity at time period t (t in days, months, etc). The price return in time period t is defined as

$$R_t = \frac{(P_t - P_{t-1})}{P_{t-1}} \approx \log(P_t) - \log(P_{t-1})$$

$$S = \sqrt{\frac{1}{T}\sum_{i=1}^{T}(r_t - \mu)^2}$$

is the continuously compounded returns.

*Volatility:* Volatility is a measure of price variation from period t − 1 to time period t. If there is a large price variation from period t − 1 to t then $R_t$ is large (in above value) and hence, we speak of large returns or large volatility. Hence, extreme values for returns reflect extreme price variation (volatility) and vice versa. Clearly, if there is no price variation over time (volatility) $P_t - P_{t-1} = 0$ and $R_t = 0$. Note, that a period of sustained price increases (or decreases) may be characterized by low or high volatility. Volatility is often measured as the sample standard deviation

where $r_t$ is the return at time *t* and $\mu$ is the average return over the *T* period. Since variance is the square of standard deviation, it makes no difference which ever measure S or $S^2$ we use to compare the volatilities of two commodities. Two types of volatility are the following:

## 2. Methodology

### 2.1. Data

To assess the average monthly domestic price volatility and its determinants on sugar in Ethiopia, the data for the study were obtained from CSA, NBE, ECX and EPE, as secondary data on monthly basis. They were domestic prices of sugar collected from 119 sample market place in the country, exchange rate, interest rate, fuel oil price index, general inflation rate, food inflation rate, non food inflation rate, and import price for sugar observed from December 2001 to December 2011 GC.

### 2.2. Statistical Models

The Box-Jenkins time series model such as Autoregressive (AR), Moving Average (MA) and ARMA are often very useful in modeling general time series data. However; they all require the assumption of homoskedaticity (or constant variance) for the error term in the model. But, this may not be appropriate when dealing with some special characteristics in the financial and agricultural price time series and this causes the introduction to ARCH Autoregressive Conditional Heteroskedasticity model which was proposed by Engle (1982) and generalized by Bollerslev (1986) and Taylor (1986).

Therefore, to come up with the objectives of the study, After identifying the presence of ARCH effects, the separate GARCH, TGARCH and EGARCH models has been employed in this study to investigate the pattern of domestic price volatility and its determinants on sugar under consideration with joint estimation of a mean and a conditional variance equation as model specification given below. Let $Y_t$ be the returns of average monthly domestic price for sugar under study at time t, $\varepsilon_t$ be error term (residual) from mean equation with mean zero and conditional variance $\sigma_t^2$ and given the historical information on the average domestic price return series as $(Y_1, Y_2, ...., Y_t)$, under the presence of ARCH effect, for GARCH(p,q) family model the conditional mean equation,

The ARMA (m, s) mean model (Box-Jenkins, 1976) is given as:

$$Y_t = \varpi + \sum_{i=1}^{m}\psi_i y_{t-i} - \sum_{j=1}^{s}\theta_j\varepsilon_{t-j} + \varepsilon_t \quad (1)$$

An Autoregressive Conditionally Heteroskedasticity model for the variance of the errors which is known as an ARCH (q) model proposed by Engle (1982), the conditional variance is given by

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q}\alpha_i\varepsilon_{t-i}^2 \quad (2)$$

Generalized by Bollerslev(1986) as GARCH(p, q) which allow the conditional variance to be dependent upon previous own lags as model, then the full model for GARCH(p,q) has two parts the mean model and the conditional variance model given below;

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q}\alpha_i\varepsilon_{t-i}^2 + \sum_{j=1}^{p}\beta_j\sigma_{t-j}^2 \quad (3)$$

$$\alpha_0 > 0, \alpha_i \ge 0, \beta_j \ge 0 \; for i = 1,2...q$$

and $j = 1,2 ... p$

EGARCH (p, q) models with mean equation and the variance of residuals at a time t given as:

$$Y_t = \varpi + \sum_{i=1}^{m}\psi_i y_{t-i} - \sum_{j=1}^{s}\theta_j\varepsilon_{t-j} + \varepsilon_t$$

$$\log(\sigma_t^2) = \alpha_0 + \sum_{i=1}^{q}\alpha_i\left|\frac{\varepsilon_{t-i}}{\sigma_{t-j}}\right| + \sum_{i=1}^{q}\lambda_i\left(\frac{\varepsilon_{t-i}}{\sigma_{t-j}}\right) + \sum_{j=1}^{p}\beta_j\log(\sigma_{t-j}^2) \quad (4)$$

The full model of TGARCH model with mean equation and conditional variance equation is given as:

$$Y_t = \varpi + \sum_{i=1}^{m}\psi_i y_{t-i} - \sum_{j=1}^{s}\theta_j\varepsilon_{t-j} + \varepsilon_t$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q}\alpha_i\varepsilon_{t-i}^2 + \sum_{i=1}^{q}\lambda_i S_{t-i}\varepsilon_{t-i}^2 + \sum_{j=1}^{p}\beta_j\sigma_{t-j}^2 \quad (5)$$

$$S_{t-i} = \begin{cases} 1 if\, \varepsilon_{t-i} < 0 \\ 0 if\, \varepsilon_{t-i} \geq 0 \end{cases}$$

$$\alpha_0 > 0, \alpha_i \geq 0, \beta_j \geq 0 \, for i = 1,2...q$$

and $j = 1,2 \ldots p$

where $S_{t-i} = \begin{cases} 1 if\, \varepsilon_{t-i} < 0 \\ 0 if\, \varepsilon_{t-i} \geq 0 \end{cases}$ That is, depending on whether $\varepsilon_{t-i}$ is above or below the threshold value of zero.

More specifically, the general inflation rate, food inflation rate, non food inflation rate, exchange rate, saving interest rate, fuel oil price, import price, export price and monthly seasonal dummies were introduced into the conditional variance equation as exogenous variables in order to determine the volatility spillover on the average monthly domestic prices returns for sugar under consideration.

### *2.3. Procedures for Model Building*

The basic frameworks that were followed in order to investigate the pattern of domestic price volatility and its determinants on, sugar were follows the following Box and Jenkins approach:

- Test for the presence of unit root (non-stationary) case
- Test for ARCH effects
- Model order selection for GARCH family model
- Model parameter estimation
- Model adequacy checking

## 3. Results and Discussion

### *3.1. Descriptive Statistics*

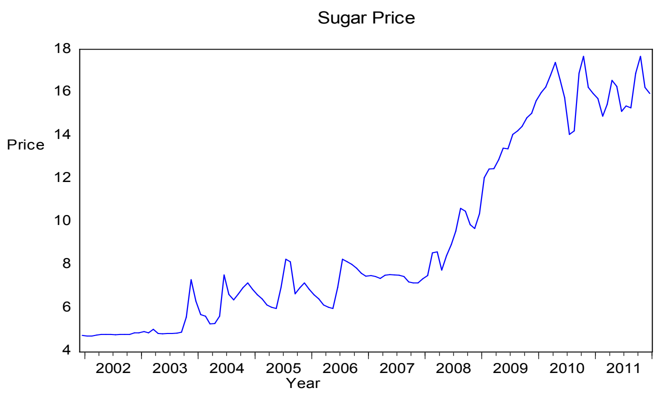


***Figure 3.1.*** *Average Monthly Domestic Price Trend for Sugar from December 2001 to December 2011 GC.*

The data set used in this research were average monthly domestic prices in Birr per kg for sugar observed from December 2001 to December 2011 GC observed at sample of 119 selected markets in the country. The return series were constructed for sugar prices to allow a market wide measure of volatility to be examined. They were calculated as the continuously compounded returns which are the first difference in logarithms of closing prices on successive months. From Figure 3.1, it can be observed that monthly domestic prices in Birr per Kg show an increasing trend over the study period. In particular, high increases of domestic prices are observed in the year 2008-2011.

***Table 3.1.*** *Summary Results for Average Monthly Domestic Prices (in Birr) per kg and Price returns for Sugar.*

| Statistics | Price of Sugar | Return Series of Sugar Price |
|---|---|---|
| Mean | 9.2546 | 0.0101 |
| Median | 7.51760 | 0.0007 |
| Maximum | 17.6959 | 0.2939 |
| Minimum | 4.7220 | -0.1995 |
| Std. Dev. | 4.2297 | 0.0701 |
| Skewness | 0.7180 | 1.0329 |
| Kurtosis | 1.9765 | 6.5836 |
| Jarque- Bera | 15.678 | 85.5500 |
| Probability | 0.0004 | 0.0000 |
| Observations | 121 | 120 |

Table 3.1 displays summary statistics and normality test for the prices under study. Thus, the empirical result shows that the average monthly domestic price (in birr) per kg for sugar was 9.25 with standard deviation of 4.2297. Also displays summary statistics and normality test for the return computed. The returns were positive skewness and longer tails. The coefficient of skewness 1.032898 indicates that the series typically had asymmetric distributions skewed to the right. Also the excess kurtosis coefficients 6.583642 indicated that the distribution of price return series for sugar possess leptokurtic characteristics. Moreover, the implication of non-normality is supported by the Jarque-Bera test statistic which points out that the null hypothesis of normal distribution is rejected at 5% level of significance for return series. Hence, the price returns appropriately contain financial and agricultural time series characteristics such as, long tails and leptokurtosis as documented by Mandelbrot (1963), Cornew et al. (1984) and Hudson et al. (1987).

### *3.2. Test for Stationarity*

As many literatures indicate, most of the time series data possesses non-stationarity property or unit root problem. Thus, in order to check for non-stationarity of prices and their returns ACF, Augmented Dickey-Fuller and Phillips-Perron tests were used.

### *3.3. ADF and PP Unit Root Tests*

ADF and PP unit root tests revealed that all the price series considered were non-stationary as we see in Table 3.2 This is because of their corresponding p-values from both ADF and PP test statistic were greater than 0.05. However, test results presented in Table 3.3 shows that monthly domestic prices appear stationary after first difference of logarithmic transformations of average monthly closing prices in to return series for the sugar under study which were required for further analysis. This is because of their corresponding p-values from both ADF and PP test statistics were less than 0.05. At 5% level of significance, the null hypothesis of non-stationarity was rejected.

***Table 3.2.*** *Mean equation for monthly domestic price return*

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.010509 | 0.003854 | 2.726850 | 0.0074 |
| MA(1) | 0.072224 | 0.083506 | 0.864893 | 0.3889 |
| MA(2) | -0.431255 | 0.083490 | -5.165331 | 0.0000 |

### *3.4. Mean Equation Determinations for Testing ARCH Effect*

Based on equation (1) thirty six combination of (AR 0-5) by (MA 0-5) were computed for each price return series.. Optimal lag length was selected based on SBIC provided that no serial autocorrelation in the residuals from specified mean model. Therefore mean equation for average monthly domestic price return series for sugar were formed to be ARIMA(0,0,2) as shown Table 3.2 above.

Table 3.5 shown below ARIMA(0,0,2) model has the smallest SBIC =-2.531584 and so far selected to be the best fitted model. But all the other fitted AR(0-5) and MA(0-5) combination of models had greater SBIC. To verify the adequacy of selected mean equation, the Ljung-Box Q(k)-test was performed to check for absence of autocorrelation in the residuals for correct specification as the residuals from a model that fits the data well should be uncorrelated

***Table 3.3.*** *ADF Unit Root Test at level*

| Price | ADF Test Statistic | Critical Value (α = 0.05) | p-value |
|---|---|---|---|
| Sugar price | 1.241377 | -1.9426 | 0.2169 |

***Table 3.4.*** *ADF Unit Root Test at 1st Difference*

| Prices | ADF Test Statistic | Critical Value (α = 0.05) | p-value |
|---|---|---|---|
| Sugar price Returns | -9.362531 | -1.9426 | 0.0000* |

### *3.5. Tests for ARCH Effects*

To proceed with volatility modeling ARCH effects (whether or not volatility varies over time) in the residuals from the selected ARIMA model should be tested.

The confirmation of the presence of ARCH effect indicates that the volatility in the average monthly domestic price of sugar is time varying and appropriateness of employing GARCH family models.

### *3.6. Optimal Order Selection and Parameter Estimation of GARCH Family Model*

Once the ARCH effects are determined, then the optimal lag specifications for GARCH family models were determined prior to the construction of the final model to investigate the determinants of domestic price volatility. After testing for different orders of p and q of GARCH family, it was found that EGARCH(1,1) under GED distributional assumptions for residuals, EGARCH(1,3) under Student-t distributional assumptions for residuals and EGARCH(1,4) under Normal distributional assumptions for residuals for domestic price volatility of sugar were selected to be best model to describe the data as they possess minimum SBIC.

***Table 3.5.*** *Optimal Lag selected Based on SBIC under Different Distributional Assumptions of Residuals for Sugar.*

| Model | Error Distribution | SBIC | Asymmetric term (α = 0.05) |
|---|---|---|---|
| ARIMA(0,0,2)-EGARCH(1,1) | GED | -2.993543 | Not significant |
| ARIMA(0,0,2)-EGARCH(1,3) | Student- t | -3.006082 | Significant |
| ARIMA(0,0,2)-EGARCH(1,4) | Normal | -2.850275 | Significant |

The above Table shows optimal lag specification for EGARCH (p,q) models and result reveals that asymmetric terms are statistically significant at 5% level of significance for selected models under specified error distributions except monthly domestic price return series for sugar under GED distributional assumption for residuals. This indicates that asymmetric GARCH class models, specifically EGARCH model are appropriate to assess the determinants of domestic price volatility for sugar.

Moreover, to select appropriate error distribution for selected asymmetric GARCH class models assuming normal, unrestricted Student-t and GED distributions for the error terms from mean equation, the four error statistics: RMSE, MAE, MAPE and Thail Inequality coefficient was applied to evaluate the forecast ability of models using in-sample forecast. Thus, empirical results show that EGARCH(1,3) model with distributional assumptions for residuals under Student-t performs best as compared to others, since in all cases RMSE, MAE, MAPE and Thail Inequality Coefficient of EGARCH(1,3) for monthly domestic price returns of sugar, formulated the model with the smallest measure of forecast errors.

***Table 3.6.*** *Maximum Likelihood Parameter Estimates of the Volatility Models for Selected Orders with the Incorporated Exogenous Variables for Sugar.*

| Parameter | Sugar | |
|---|---|---|
| | Mean | Variance |
| Constant | 0.002666<br>(0.2524) | -0.838392*<br>(0.0141) |
| AR(1) | | |
| MA(1) | 0.167637*<br>(0.0106) | |
| MA(2) | -0.143219*<br>(0.0402) | |
| ARCH(-1) | | 0.784297*<br>(0.0383) |
| ARCH(-2) | | |
| Asymmetric(-1) | | 0.200162*<br>(0.0347) |
| Asymmetric(-2) | | |
| EGARCH(-1) | | 0.532424*<br>(0.0143) |
| EGARCH(-2) | | 0.134494<br>(0.5993) |
| EGARCH(-3) | | 0.080209<br>(0.6873) |
| Food inflation rate | | 0.604428*<br>(0.0218) |
| Non food inflation rate | | 0.023348<br>(0.9328) |
| General inflation rate | | 0.932990*<br>(0.0384) |
| Exchange rate | | 1.066641*<br>(0.0247) |
| Saving interest rate | | 0.143004<br>(0.4441) |
| Fuel oil price | | 0.000324*<br>(0.0225) |
| Import price for sugar | | 0.057997*<br>(0.0399) |
| October | | -1.917165<br>(0.2182) |
| November | | -1.457270<br>(0.1854) |
| December | | 2.276988*<br>(0.0488) |
| January | | 2.289510*<br>(0.0341) |
| February | | -1.900957<br>(0.0660) |
| March | | -1.822906<br>(0.1372) |
| April | | 2.423440*<br>(0.0494) |
| May | | 2.033457*<br>(0.0294) |
| June | | -0.080857<br>(0.9287) |
| July | | -1.203334<br>(0.3957) |
| August | | 4.222389*<br>(0.0008) |

* are statistically significant at 5% level of significance and values inside the bracket denotes p-values of corresponding to test statistic.

At the national level, a positive and significance coefficient is evident for exchange rate (dollar-birr). This is because of its corresponding p-value of 0 0.0247 to test null hypothesis of coefficient for exchange rate is zero in the variance equation of domestic price returns for sugar, respectively were less than 5% level of significance. Thus, there is no evidence to accept null hypothesis at 5% level of significance and the link between exchange rate and increase in domestic price volatility at current month was likely to be through the impact that exchange rate affect the purchasing power of domestic money. Changes in exchange rates reallocate the purchasing power and price incentives across countries without changing the overall agricultural commodities supply demand balance. Dollar devaluation raises prices US producers and consumer's lowers prices of consumers outside the dollar area. This implies that the dollar price of commodities on world market were rises as a result of depreciation, implying a fall in domestic currency say in, Birr and sterling prices (Ridler& Yandle,1972). This result was consistent with finding by Loening et al. (2009), Gilbert (1989), Chambers (1984) and Sarris and Morrison (2009). Therefore, a unit increase in the exchange rate of the U.S. dollar's in to birr serves to increases domestic price volatility for sugar by 1.06641 units.

Coefficients of fuel oil price is positive and statistically significant at 5% level of significance, indicating that the change in fuel oil price was also determinant of current month volatility of domestic price for sugar in the country over the study period. The link between fuel oil prices and sugar domestic price volatility is likely to be through the fact that a fluctuation on the fuel oil prices affects the costs of transportation. This finding was consistent with finding by Swaray (2007) and Baffes (2007) in the domestic price volatility for agricultural crops and sugar. Therefore, a unit increase in the fuel oil price serves to increase current month domestic price volatility for sugar by 0.000324 units.

The coefficient of import price for sugar in the variance equation was positive and statistically significant at 5% level of significance since its corresponding p-value (0.0399) was less than 5% level of significance to test null hypothesis of coefficient for import price is zero was rejected at 5% level of significance. Thus, there is transmission of import price for sugar to the domestic price volatility in the country over the study period. This result also inline findings by Harald Grethe and Stephan Nolte (2005) and Rashid et al (2006) that import price was one of the determinants of domestic price volatility. Therefore, a unit increase in the import price serves to increases domestic price volatility at current month for sugar by 0.05799 units.

The coefficients of food inflation rate on price return series for sugar were positive and statistically significant at 5% level of significance. This is because of its corresponding p-value of 0.0218, to test null hypothesis of coefficient for inflation rate for food items is zero in the variance equation of domestic price for sugar, were less than 5% level of significance. Likewise, the coefficient of general inflation rate in the variance equation for sugar was positive and statistically significant at 5% level of significance.

Among the seasonal dummies added to the EGARCH model price during December, January, April, May and August months had positive coefficients and statistically significant at 5% level of significance, indicating that domestic prices during those months had increasing effects on the current month variability of domestic price for sugar. However, price during September month had negative coefficient as reflected through constant parameter in variance equation for sugar and statistically significant at 5% level of significance. As p-value of 0.0141 was less than 5% level of significance, indicating that null hypothesis of constant parameter is zero was rejected, indicating that domestic prices during September had decreasing effects on the current month variability of domestic price for sugar.

# 4. Conclusions and Recommendations

### *4.1. Conclusions*

This study investigates the average monthly domestic price volatility and its determinants on sugar in Ethiopia, over the study period from December 2001 to December 2011 GC. The results from this study provides evidence to show volatility clustering, leptokurtic distributions and asymmetric effect for average monthly domestic price return series for sugar. Thus, from empirical result it can be conclude that, the volatility in the monthly domestic price of rape sugar has been found to vary from month to month suggesting the use of GARCH family approach, there is strong evidence that there is a persistent volatility in sugar. The forecast performances of the model were evaluated using the MAE, MAPE, RMAPE and Thail inequality coefficient. Asymmetric EGARCH model with GED and Student–t distributional assumption for residual was found to fit better than GARCH and TGARCH models. Therefore, ARIMA(0,0,2)-EGARCH(1,3) model with Student-t for Sugar were found to be the best models for fitting data on monthly domestic price return series. There was evidence to conclude that the variance of domestic price returns at current month influenced by its previous one month's lagged volatility for sugar.

There is also significant evidence that many of the candidate explanatory variables have an impact on monthly domestic price return volatilities of sugar, over the study period. In monthly series, fuel oil price had a positive impact on domestic price volatility for sugar. Likewise, exchange rate (dollar-birr) had positive influence on monthly domestic price volatility of sugar, respectively. Also, it can be conclude that, general inflation rate, non-food inflation rate and food inflation rate had a significant effect on monthly domestic price volatility of sugar, import price for sugar had a positive impact on the domestic price volatility of sugar. Among the seasonal dummies added to the EGARCH model for sugar, price during December, January, April, May and August months had significant increasing effects on the current month variability of domestic price of sugar.

### *4.2. Recommendations*

As many studies indicated price volatility on sugar has a negative impact on the economy of the country by making income instability, for producers, consumers, whole sellers as well as governments in both developing and developed countries and also leads to a major decline in the future output, if they are unpredictable, unreliable and if not identify its determinants. The aim of this study was to model average monthly domestic price volatility and their determinants on sugar. Thus from empirical findings, this study draws the following recommendations:

- Instability in domestic prices for sugar can occur due to fluctuations in international market price of import. In such a case, the government should take measure to balance the interest of consumers to meet the objectives of price stabilization.

- Import price for fuel oil also had statistically significant increasing effect on the domestic price volatility. Thus, the government should take some measures to regulate and reduce demand of import price for fuel oil to meet objective of domestic price stabilization.
- Exchange rate (dollar-birr) had statistically significant increasing effect on the instability of domestic price; therefore, policy makers and concerned bodies should take this in to consideration during exchange rate (dollar-birr) monetary policy setting, to meet the objectives of domestic price stabilization.
- Food inflation rate, non-food inflation rate and general inflation rate had statistically significant increasing impact on the instability of domestic price. Therefore, the government, policy makers and concerned bodies should take some measures to undertake inflation due to food items, non-food items as well as general inflations to alleviate domestic price volatility.
- The volatility in the average monthly domestic price of sugar was varying over time from month to month. September, December, January, April, May and August months had affected the average monthly domestic price volatility of sugar. Thus, the government and concerned bodies should follow and control the price of sugar during those months.

# References

[1] Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroskedasticity, *Journal of Econometrics,* Vol 31, P 307-327.

[2] Engle, R. and Fadng, V. K. (1993). Testing and Measuring the Impact of News on Volatility, *Journal of Finance* Vol 48, P 1749-1778.

[3] Engle, R. F. (1982). Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation, *Journal of Econometrics*, Vol 50, P 987-1007.

[4] Swaray, R. (2007). How did the Demise of International Commodity Agreements Affect Volatility of Primary Commodity Prices? Applied Economics, Vol 17, P 2253-2260.

[5] Ridler, D. and Yandle, C. A. (1972). A Simplified Method for Analyzing the Effect of Exchange Rate on Export of Primary Commodity IMF Staff Paper 19, 559-578.

[6] Loening, J., Durevall, D. and Birru, Y. A. (2009). Inflation Dynamics and Food Prices in an Agricultural Economy: The Case of Ethiopia. World Bank Policy Research Working Paper Series, No. 4969.

[7] Gilbert, C. L. (1989). The Impact of Exchange Rates and Developing Country Debt on Commodity Prices. *Journal of Economics*, Vol 99, P 773–84.

[8] Chambers, R. G. and Just, R. E. (1984). Effects of Exchange Rate Changes on U.S. Agriculture. *Journals of Agricultural Economics,* Vol 73, P 33-43.

[9] Saris, A. and Morisson, J. (2009).“The Evolving Structure of World Agriculture Trade: Implication for Trade Policy and Trade Agreements” Food and Agricultural Organization of United Nations (FAO).

[10] Baffes, J. (2007). Oil Spills on Other Commodities. World Bank Policy Research Working Paper.

[11] Shahidur Rashid (2007). Intercommunity Price Transmission and Food price policies, an analysis of Ethiopian Cereal Markets, International food policy Research Institute.

[12] Harald, G. and Stephan, N. (2005). Agricultural Import Surges in Developing Countries: Exogenous Factors in their Emergence, Humboldt-University of Berlin.