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# The fuel-food price nexus and its potential effects on food pricing in Ghana

Albertina K. Jarawura, Joseph Amikuzuno and Isaac Gershon-Ansah, Faculty of Agribusiness and Communication Sciences, University for Development Studies, Tamale

**Contact of Corresponding Author:** amikj26@yahoo.com; 0244818174.

## Abstract

Stable and affordable food commodity prices are important in ensuring food security. In 2007/8, the world experienced an unexpected rise in both food commodity prices and fuel (petroleum products) prices, which drew the attention of world leaders and researchers. The effect of this continues increases in gasoline prices on the price of food have implications for Ghanaians and food/ agricultural policies. The paper seeks to determine the dynamic relationship between domestic fuel prices and maize prices across different markets in Ghana. Data on monthly maize and gasoline prices, January 2000 to December 2015. Models used are the TAR and impulse response function analysis. Generally maize prices in all four markets under study moved in the same direction as gasoline prices over the years, all markets over the years studied experienced an immediate sharp rise in maize prices when gasoline prices are raised. This effect, is permanent and never leads to a nominal fall in maize prices. The study recommended that policies on fuel pricing should be sensitive to its effect on maize pricing and seasonality. Also MRT and all actors in the infrastructural/agricultural sector should provide standard transportation infrastructure and alternative energy sources to lessen the effect of gasoline prices on maize pricing.

Key words: maize prices, gasoline prices, cointegration, TAR and IRF

## 1.0 Introduction

The food price shock during 2007-2008 drew the attention of researchers and policy makers to its underlying causes and implications for the food security of the world's populace (Matthias et. Al, 2016). Food price shocks occur when a country or region experiences sharp and sudden increases in its food prices ( Badolo et al., 2012). To draft and apply

policies for agricultural development, factors influencing agricultural commodity prices are usually questioned.

Research has evidenced the food price crises, in 2007/2008 episode, to be caused by multiple factor interactions, including higher oil prices (Fowowe, 2016) and government trade policies (Abbot et al., 2008). The 2007/2008 crises invoked a rise in staple food prices such as rice, maize, cassava, cowpea and groundnut. The impacts of this shock drew the attention of world leaders to the issues of volatile food prices. Following this event, many nations have been considering and instituting measures to prevent their economies from such future shocks.

Maize as one of the most traded food commodities in the country is vastly influenced by shocks in the domestic prices of gasoline. This is because traders transport maize from producing areas to consuming areas and each of these areas (markets) are in different locations. It is therefore not surprising to hear news reports on the rise of transportation fares leading to a general increase in maize prices immediately domestic gasoline prices increase (Sharrif and Iddrisu, 2016).

Agriculture is an energy intensive sector with both a direct and indirect link to the oil sector (Nazlioglu and Soytas (2010)). Increases in oil prices usually lead to an increase in input costs which are used in agricultural processes and causes the prices of agricultural products to rise. The appreciation or depreciation of local currency, influences local maize prices directly by increasing transportation fares and indirectly through the cost of spare parts for transportation vehicles.

In Ghana fuel prices determine the direction and extent of food commodity prices either directly or indirectly. Food commodities are usually transported from farms in rural areas by traders. When the price of gasoline or diesel increases, transporters increase the fares to cover cost and make profits. The rise in transport fares is however transferred by the traders to end users through various pricing mechanisms, which is a direct effect. Oil price volatility, which is often reflected in domestic fuel prices, leads to sharp increases in food commodity prices in Ghana (Charles, 2014). As a net oil importer, Ghana's struggles with oil price volatility will not end soon since fuel price hikes are influenced by international

factors (Mahamah, 2012). It is therefore important to study the price movement between maize and domestic gasoline prices.

## Food policies in Ghana

Ghana, since independence, has created some policies with the aim of improving agricultural output, pricing and food security for both farmers and consumers. The development of the agricultural sector has been a priority of the Ghanaian government with great emphasis on increased output and prices for farmers as well as reasonable prices for consumers. "vision 2020" was launched in 1995 and envisions Ghana as the first developed country in Africa by 2039 (UN country specific report, 2015). To achieve the goal of good pricing for both producers and consumers, the national buffer stock company was established in 2010 to buy products during gluts at a minimum price to ensure price stability. However the UN 2015 country specific report specifies that, NAFCO since its establishment has not achieved its goal of price stability in the maize, rice and soya bean market.

Also, Ghana is one of the founding members of the ECOWAS which aims at integrating the economic policies of the region. However, the country implements some policies which does not augur well for policy integration in the region. For instance in 2015, the UN reported that, Ghana banned the importation of rice through any other border except the Tema, Accra and Tarkoradi ports. Also the Ghana export promotion was established to promote trade with the rest of the world.

## Literature review

In relation to food prices and gasoline prices, not enough studies have been conducted in the Ghanaian context. However studies have been conducted on agricultural food pricing and energy pricing especially after the food crises in 2008. Nazlioglu and Soytas (2010) investigate the direct and indirect effects of world oil prices on Turkish agricultural commodity prices (wheat, maize, cotton, soybeans, and sunflower). They utilized Toda and Yamamoto (1995) procedure which showed that oil prices affect individual agricultural prices in Turkey neither directly nor through the exchange rates.

Nazliogo and Soytas (2010) examined the dynamic relationship between world oil prices and twenty four world agricultural commodity prices accounting for changes in the relative

strength of US dollar in a panel setting. Cointegration and granger causality were used in their analysis. Their results showed evidence that, world oil prices do have a great impact on agricultural commodity prices.

## Pricing of Petroleum (Gasoline) in Ghana

The national petroleum authority (NPA) regulates the importation of petroleum products in to the country by bulk distribution companies (BDC). The aim is to ensure full cost recovery, government revenue generation and uniformity of prices via the Unified Petroleum Price Fund (UPPF). The IPP benchmark refers to the cost of refined fuel at the port gate of Ghana; this includes the international price for refined fuel freight charges, exchange rate, customs and port duties, insurance and losses. The reason for the IPP benchmark is to ensure a strong relationship with the actual costs of fuel imports into Ghana considering global developments (Acheampong and Ackah, 2015).

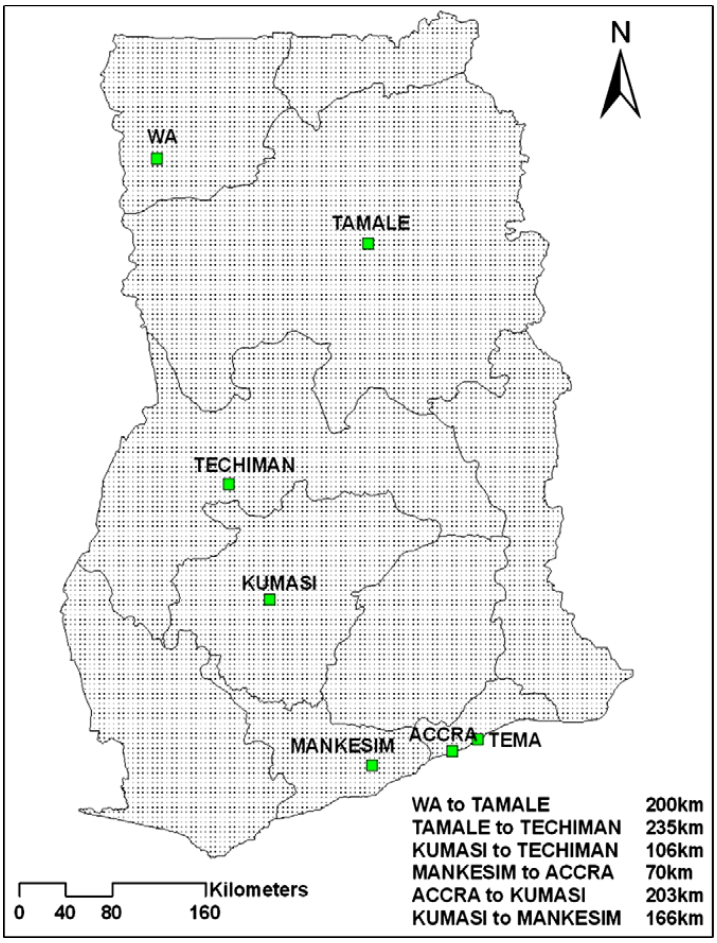
To arrive at the ex-pump price, NPA has a two week period, where the average of FBO prices of petroleum products is calculated. The average of the dollar figures within the two weeks window is calculated in to the pricing framework. Other charges like port duties are also added to arrive at the ex-refinery price in Ghana pesewas. To arrive at the ex-pump price, other charges such as taxes or subsidies approved by parliament and OMC distribution cost are finally added (Franklin, 2016). The Ex-pump price is the price at which the public buys fuel at the fuel stations. According to Acheampong and Ackah (2015), fuel taxes and margins typically make up about 35-40% of ex-pump fuel prices in Ghana.

## The study Area

The study is conducted using prices of four major maize markets, Tamale, Techiman, Kumasi and Accra. The Tamale and Techiman and gasoline prices in Ghana. These markets

are among the leading producers of maize in Ghana based on a 3-year average production from 2012 to 2014 (MOFA-FAF, 2014).

Ghana's land area of 23.9 million hectares (AGRICINGHANA, 2013) is made of the five ecological zones (FAF, 2014) which are based on their different climatic conditions and soil compositions. The natural vegetation varies in each zone due to different climatic conditions and soil types. Each zone under study is characterized by different influencing factors (climate, culture, taste and preference) and hence pricing of food might be different in each zone. The Northern Savana zone experiences only one wet season while the Transitional (TZ), Deciduous Forest (DF), Rain Forest (RF) and Coastal Savanah (CS) zones do experience two wet seasons in a year. Among the zones, TZ serves as the hub for the production and distribution of maize in Ghana. This is due to its ecological conditions especially suitable for the production of maize all year round. The TS and NS respectively serve as the production arears of maize.




**Source: Adopted from Cudjoe et al**

Fig. 3.1. Map of Ghana's major markets.

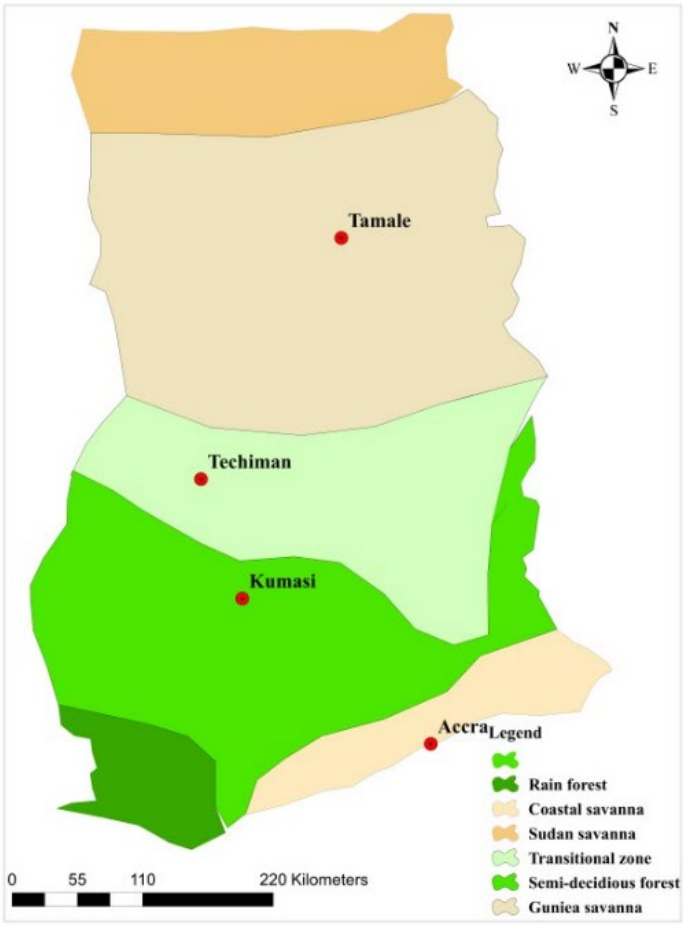



Fig 3: Map of the study area

## 3.0 Methodology

The variables under study are maize prices of markets and domestic fuel prices. Secondary data on whole sale prices of white maize from January 2000 to December 2015 are used for the analysis. Monthly data on maize prices was sourced from the Ministry of Food and Agriculture, Statistical Research and Information Division (MoFA-SRID). The price series from MOFA-SRID are in GHS per 100kg of white maize. Data on domestic fuel prices was also obtained from the African Centre for Energy Policy (ACEP) for the same period of time. Domestic fuel price series are in GHS per 100 litters. The period under study yielded 192 observations.

The empirical analysis of the data was based on the logarithmic transformation of the data. However, since the series of maize prices under consideration are of the same level, there was need to deflate it, nominal values are used. Prices of gasoline were not deflated either. All prices are expressed in Ghana Cedi and analysis done with logarithmic transformation of the prices. The data for this research was analyzed with STATA.

Bivariate time series methods will be used for the data analysis. First, trend analysis and graphs were employed to examine the trend of food commodity prices across the markets under study and gasoline prices. The maize prices, and domestic gasoline prices were the main variables under study. Trend analysis, unit root test, cointegration, and impulse response functions are used for the study.

### Trend Analysis

The trend of a series reflects the long term growth or decline of the time series over time. This study employs a graphical method where the movement of the prices is analyzed and explained using policy and natural events that occurred.

## Threshold Autoregresssive Model

Analyzing market integration based on price data alone while neglecting the role of transaction costs in influencing the direction of trade is often critiqued, this study therefore endeavored to overcome this critique. By applying the Threshold Autoregressive model, the study accounted for the effects of transaction costs in price transmission without relying on transaction cost data directly. The Threshold Autoregressive model was used to fit the economic requirements for the analysis of price adjustment. It also presented the ability of capturing potential symmetric price adjustment processes between markets based on the assumption of a constant transaction costs.

The TAR model is used to determine if there is price transmission between selected maize markets in Ghana from the year 2000 to 2015. The price difference between a net consumer market $P^c$, and a net producer market, $P^s$, is given by $m_t = P_t^c - P_t^s$.

The TAR model, allows the price adjustment process to vary depending on the price difference at time, i.e., if it the price is below or above a threshold, $\tau^{cs}$ which is a proportional measure of the transaction costs between markets (Amikuzuno,et al, 2011). The relationship is given as follows:

$$\Delta m_t = \begin{cases} \rho^{out} m_{t-1} + \varepsilon_t, & if \ m_{t-1} > \tau \\ \rho^{in} m_{t-1} + \varepsilon_t, & if \ \tau \le m_{t-1} \le \tau \\ \rho^{out} m_{t-1} + \varepsilon_t, & if \ m_{t-1} < \tau \end{cases} \qquad 3.12$$

where $\rho^{in}$ is the speed of price adjustment when the price difference is below $\tau$ and $\rho^{out}$ is the speed of price adjustment when the absolute value of the price difference exceeds $\tau$. Theory assumes that there is no adjustment when the price difference is below $\tau$ i.e. $\rho^{in} = 0$. With this assumption, the TAR model actually estimated is:

$$\Delta m_t = \begin{cases} \rho^{out} m_{t-1} + \varepsilon_t, & if \ m_{t-1} > \tau \\ \varepsilon_t & if \ \tau \le m_{t-1} \le \tau \\ \rho^{out} m_{t-1} + \varepsilon_t, & if \ m_{t-1} < \tau \end{cases} \qquad 3.13$$

The estimation process involves identifying the $\tau^{cs}$ through a grid search for the threshold that maximizes the sum of squared residuals.

## Impulse Response Function (IRF) Analysis

Impulse response functions (IRF's) give a graphical representation of a variables response to shocks from an influencing variable. Which gives more information than the granger and instantaneous causality test. IRF's are based on the Wolds's moving average form of

a Vector Autoregressive (VAR) process. If there is a reaction of one time series variable to an impulse in another variable, then the latter is causal for the former. However, the effect of a unit shock in any of the variables dies away quite rapidly due to stability of the system. If there is a reaction of one time series variable to an impulse in another variable, then the latter is causal for the former. However, the effect of a unit shock in any of the variables dies away quite rapidly due to stability of the system. The Wold representation is based on the orthogonal errors $\eta_t$ given by;

$$P_t = \mu + \theta_0 \eta_{t-1} + \theta_2 \eta_{t-2} + \ldots$$

where $\Theta_0$ is a lower triangular matrix. The impulse responses to the orthogonal shocks $\eta_{jt}$ are;

$$\frac{\partial R_{i,t+s}}{\partial \eta_{j,t}} = \frac{\partial R_{i,t}}{\partial \eta_{j,t-s}} = \Theta_{ij}^{s} \quad i,j = 1,2,\ldots,k, s > 0 \tag{3.68}$$

where $\Theta_{ij}^{s}$ is the $(i,j)th$ element of $\Theta_0$. For $k$ variables there are $k^2$ possible IRF.

Results analysis

## Unit Root Test on Levels of the Series

Augmented Dickey Fuller (ADF) and Phillip Peron unit root test (PP) were conducted and represented in Table 4.2. The test statistic failed to reject the null hypothesis of a unit root in level data for all markets.

**Table 4. 1: Augmented Dickey Fuller and Philip Peron Test, Lag 4**

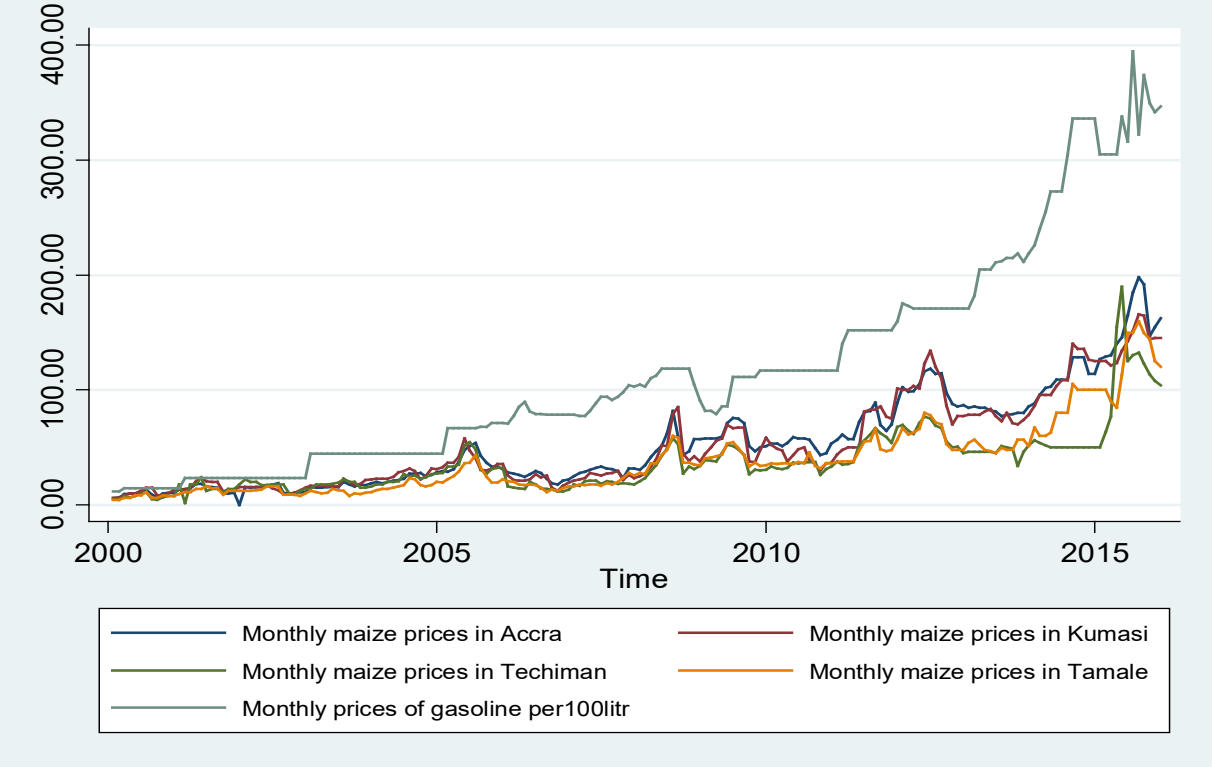
| | **ADF-Test** | | **PP-Test** | |
|---|---|---|---|---|
| | 1%: -3.480 5%: -2.884 | | | |
| | Levels | Fist Differenced | Levels | Fist Differenced |
| Accra | 0.053 | -9.212*** | -0.167 | -10.992*** |
| Kumasi | -0.508 | -8.22*** | -0.667 | -12.188*** |
| Techiman | -1.425 | -8.325*** | -1.964 | -12.532*** |
| Tamale | -0.692 | -8.134*** | -0.608 | -11.995*** |
| Gasoline | 1.206 | -6.776*** | 1.177 | -21.227*** |

Source: computed from monthly data obtained from MOFA-SRID on maize prices from 2000 to 2015

The null hypothesis however, was rejected at 1 percent significance level after the first difference for both the ADF and PP tests. The price series are therefore a first-difference stationary process which implies the presence of unit root or an integration of order one, I (1). In a similar study by Ansah (2012) wheat price series in markets of Ethiopia were also integrated of order one. This implies that, all price series under study have a similar stochastic process and can exhibit the tendency toward long-run equilibrium. This instigated a test for cointegration.

## Annual Trend of Maize and gasoline prices

As seen in fig.1, nominal prices in each market varied over the years under study and portrayed trends and seasonal patterns. Fig.1 shows that prices in each market generally moved together in same direction while increasing over time. Prices reached the highest level in 2015 however, there were some exceptional hikes in 2005, 2008/9 and 2012. Gasoline prices however experienced a steep rise during the years. It is worth noting that whenever there is a rise in gasoline prices, maize prices tend to reach a peak in all markets as seen in 2005, 2008/9, 2012 and 2015.




Source: computed from monthly data obtained from MOFA-SRID on maize prices and gasoline prices from ACEP from 2000 to 2015

**Figure 1: Annual trend of maize market prices and gasoline price in Ghana**

The price hike in 2008/9 was attributed to the influence of the world food and financial crises in that period and increases in fuel prices. During this period, the government of Ghana temporally waived tariffs on some food imports to help stabilize food prices during

the crises and this trend is indicative of its effect. However, prices started to rise again by the mid of 2011 until 2013 with the Accra market experiencing the highest prices. Thereafter, prices fell in all markets and stayed relatively stable until 2014 where prices began to rise relatively high again. Generally, the highest price series was recorded in the Accra market with Tamale and Techiman recording the lowest. The high price in Accra is expected because Accra is mainly a consumer market while Techiman and Tamale are producer markets.

The rise in prices is attributed to supply and demand factors. Supply factors were adverse weather conditions (poor rainfall, floods and adverse temperature), increasing fuel prices (gasoline) and high cost of fertilizer which led to the reintroduction of the fertilizer subsidy program in 2008 by the Government of Ghana. A study by Cudjoe et.al.( 2014) realized a similar trend in the development of wheat and rice prices in Ghana from the year 2004 to 2008. Also studies by Ankamah –Yeboah (2012) and Ayedevor (2014) reported similar trends in maize prices over the years.

Some of the demand factors that could have contributed to the trend observed include, a continuous growth in population, income growth and the world food crises experienced in 2008. Unstable food prices have the potential to render a country or region food insecure hence the right policies should be developed to help prevent such a catastrophe.

## 4.2 Threshold Authoregressive Model

The TAR model is used to determine whether there is threshold cointegration between the market pairs. In Table 4.4 the estimated threshold ($\phi$) above which the price differences between the market pairs must exceed before necessitating a price adjustment is measured in Ghana cedi's. The price difference between Tamale-gasoline must exceed a threshold of approximately 90% to cause an adjustment. The lowest threshold of 50% is between Kumasi and gasoline prices. On average, a threshold of 98% must be exceeded among all market pairs to create an adjustment.

**Table 4.2 Threshold Autoregressive Model Results**

| Threshold Autoregressive Model Results | | | |
|---|---|---|---|
| | lamda | threshold | Halvelives |
| **Tamale Gasoline** | 0.022 | 0.947 | 2.839 |
| **Techiman Gasoline** | 0.075 | 1.486 | 0.494 |
| **Kumasi Gasoline** | 0.027 | 0.509 | 2.163 |
| **Accra Gasoline** | 0.300 | 0.992 | 1.946 |

There is fast adjustment speed between market pairs under study except Techiman which are significantly different from zero at 1% significance level. Tamale and Kumasi recorded the faster's speed of adjustment of 2%, whereas and Accra experienced a lowest speed of adjustment of about 30%. On average, there is a 10% speed of adjustment between the market pairs.

The time needed for half of the price deviations from equilibrium to be adjusted was fairly different for all market pairs. The Techiman market adjust half of the deviations from equilibrium within three months (0.494) which is the fastest among all markets under study. The next fastest pair is the Accra with a half-life of about two months (1.946). Tamale-Kumasi obviously have the longest period of two months and three months (2.838). on average, one month and three weeks (1.853) respectively to adjust half of the deviations to equilibrium. On average, all market pairs under study will have two months (1.86) within which half of the deviations from equilibrium will be corrected.

The TAR results show that there is cointegration among maize prices and gasoline prices under study and that these prices are highly integrated. Price transmission does exist among them indicating the existence of market integration in the local maize market. In spatial price transmission, it is hypothesized that due to transaction costs traders will only respond to a deviation from the long-run equilibrium between two markets if the deviation exceeds

a certain threshold value. The estimated threshold value therefore serves as a proxy for transaction costs. Similar results were achieved by Abdulai 2000 Ayeduvor (2014), Ankamah-Yeboah (2012) about the maize market in Ghana. Amikuzuno et al (2011) also found similar results about the tomato market in Ghana.

## 4.3 Impulse Response Analysis

The dynamic relationship between domestic gasoline prices and maize prices in different markets is examined by the use of impulse response functions. Impulse response functions give additional information about the long-run dynamic interrelationships that exist among market pairs such as the time path needed to take the system back to equilibrium.

The response to a price shock is dependent of the history of the time series and the sign and magnitude of the postulated shock. Positive shocks here, refer to shocks that affect the profit margins of those involved in the maize market positively (i.e. a decrease in gasoline price) while negative shocks are shocks that affect the profit margin of traders negatively, thus reducing the profit margins (i.e. an increase in gasoline price). To understand the time period it takes for a unit shock in gasoline price to be eliminated, impulse response was estimated from a VAR model. The nonstationarity of price data and VAR properties may allow shocks to elicit responses that are temporary (such that there is a return to the initial time path of the variables) or permanent (such that there is persistent shift in the time path).

The impulse is a one standard deviation positive shock from gasoline price and the response relates to each market price affected by the shock. The IRFs show that, a positive shock to gasoline prices leads only to permanent and negative effects on the various markets.

All markets respond immediately to a one-standard-deviation positive shock in gasoline prices within two weeks of implementation. These markets respond negatively to the positive shocks though, their individual responses and magnitudes differ. In the Accra market, maize prices respond by, increasing immediately during the first six weeks and then, escalating thereafter and never goes back to equilibrium.

The Techiman market however experiences an immediate sharp rise in maize prices after the shock is applied. The Tamale market also responds after about two weeks of the shock but after which it continues to rise slowly without stabilizing. In the Techiman and Accra markets the response is however highest and immediate as compared to the rest of the markets.

Though all markets experience the shock which remains positive thereafter, Tamale and Kumasi however responded slowly but continuously.

The IRFs also show that all markets respond to shocks in gasoline prices. Thus, in the unexpected shocks in gasoline prices will have a permanent and devastating effects on Maize prices in the markets under study. This means when fuel prices are increased in Ghana; in the long run it causes an ever increasing rise in maize prices. Similar results were reached by Mawejje (2016) that energy prices are a main driver of food prices in Uganda.

The practice of 'petroleum-price-response' by Ghana's informal transport sector where transport fares would increase at the slightest increase in prices of petroleum products with no decrease even when prices go down, comes across as practices that is in to stay (Sharrif and Mustapha, Joynews, 2015). Transportation services in Ghana are practically provided and ruled by the private sector which is mainly profit motivated. Increases in gasoline prices are immediately transferred to the directly through transportation of maize to the markets or through the rise in input prices. This makes the effect severe since it is uncontrollable by the farmer, middle person or the final consumer. This effect is further exacerbated by the poor state of roads leading the rural producers to the urban consumers.

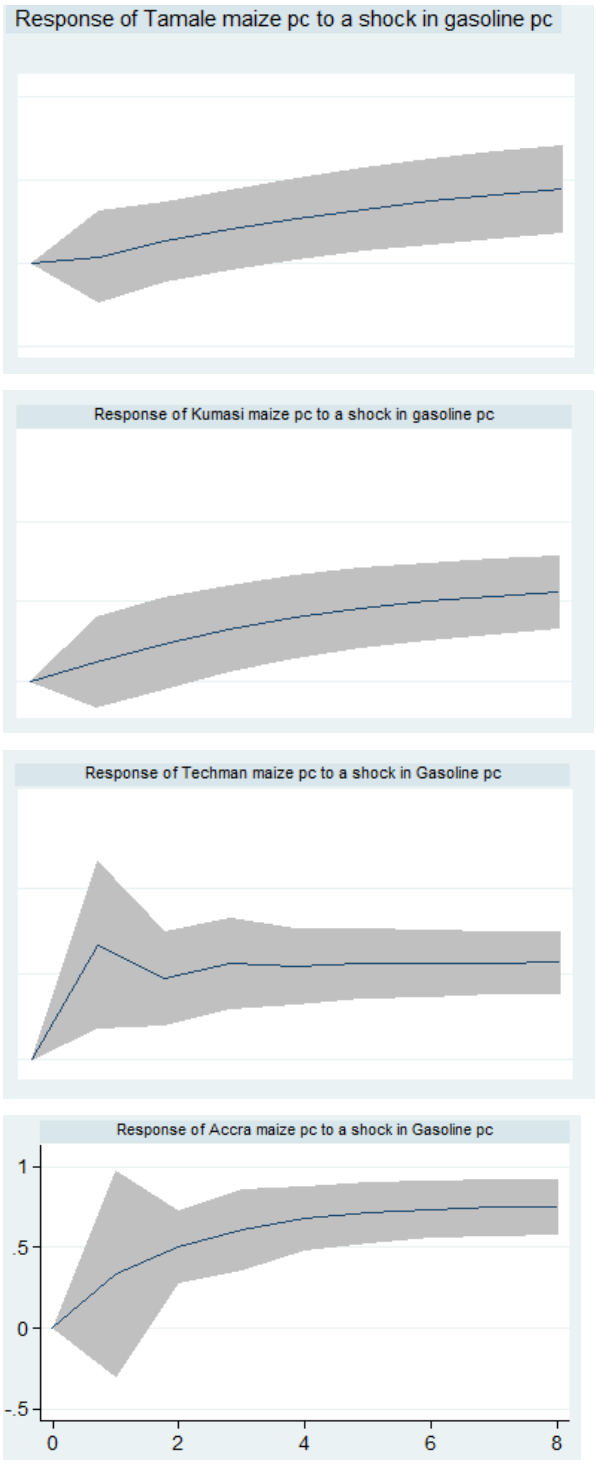



**Figure 1: Impulse response graphs showing response of markets to an impulse in gasoline price**

Source: computed from monthly data
obtained from MOFA-SRID on maize prices
from 2000 to 2015

Gasoline prices have had a spiraling effect on maize markets in Ghana as its prices increases. This shows that both Agricultural and energy policies have not considered the effect of fuel pricing on maize pricing thus its effect on both production and consumption. Policies such as FASDEP I AND II (METASIP) and GADS I and II have not had a complimenting policy or strategy on fuel pricing. Thus leaving an important influencer not tackled. Over the years, the government of Ghana has tried subsidizing the cost of gasoline but is gradually fading it out. This means the new sources of energy especially renewable will have to be developed and adapted by Ghana.

## 5.0 Summary

Impulse response functions were also used to analyze the dynamic relationship between gasoline prices and maize prices in different markets. All markets responded positively to a shock from gasoline prices. Maize prices in all markets especially that of Accra and Kumasi within two weeks of the shock, sharply rose, and then gradually kept rising. This shows that increases in Gasoline prices permanently increased Maize prices there by reducing the profit margins of the farmers (producers and retailers) and further exacerbating the plight of the poor. Furthermore, shocks from gasoline prices renders efforts towards sustained food security in the country null.

Maize is a staple food for most Ghanaians; hence policies on gasoline pricing should be consciously designed and implemented to avoid worsening the welfare of both citizens and residents. The current pricing system led by NPA is promising since the OMCs autonomy to follow the world market prices however; these companies should be well monitored to ensure that reductions in prices are reflected in the domestic prices of fuel. Majority of people use a large portion of their income on food and hence the effect being described here has a bigger impact especially on the poor. Increases in gasoline prices should be avoided during the lean season as it can greatly cause an increase in maize prices.

The development and adaption of renewable energy by the ministry of Energy and MOFA will help reduce over reliance on fossil fuel and mitigate its vast negative effect on the agricultural sector. Solar and wind energy is being adopted by most developed countries around the world as these are more sustainable than fossil fuel. As the ministries adopt new forms of energy sources other supporting ministries such as Transport should priorities the development of transport facilities especially those linking rural and urban places. This can be achieved effectively through

the effective implementation of the countries long term development plans without political disruptions.

## 5.1 Policy Recommendations

Agricultural policies and their implementation plans have over the years inadequately considered the effect of gasoline (fuel) pricing policies on the prices of maize. FASDEP I and II, METASIP, GSGDA II and GADS have all failed to make reference to the possible dumping effect of gasoline prices on the prices of the produce of the famers (beneficiaries of these policies) and the overall welfare of the peasant farmer. Policy makers especially in the agricultural sector should incorporate the negative effect of fuel pricing policy on these policies, planned or being implemented. The most recent is the Planting for Food and Jobs (PFJ) flagship initiative which hopes to boost food production in the country yet very little consideration is given to the pricing of gasoline. The national petroleum authority (NPA) should advice the design of the policies in order to create an all-inclusive policy for the benefit of citizens.

Energy policies in Ghana have immense impacts on the maize prices. This implies that policies that intend to stabilize agricultural commodity prices need to concurrently address pricing of fuel. When making polices on agriculture, the effects of demand, supply, weather and other influencing factors should be complemented by fuel pricing since its effect is extreme and bidirectional. The study therefore recommends that the effect of gasoline on maize pricing be included in agricultural policies and ways of reducing its effect considered.

## References

Abbott, P., C. Hurt, and W. Tyner. ‘‘What’s Driving Food Prices?’’ Farm Foundation Issue Report July 2008

Ankamah-Yeboah I. (2012), Spatial Price Transmition in the Regional Maize Markets in Ghana, MPRA Paper.

Babajide Fowowe (2016). Do oil prices drive agricultural commodity prices? Evidence from South Africa. Energy Economics 104 (2016) 149e157

Charles Benoni Okine (2014), High petroleum prices; Risk to economic growth, Business News of Tuesday, 30 December 2014, https://www.ghanaweb.com/GhanaHomePage/economy/Comment-High-petroleum-prices-Risk-to-economic-growth-340852

Felix Badolo and Somlanare Romuald Kinda (2012), Climatic shocks and food security in developing countries. MPRA Paper No. 43006, posted 5. December 2012 10:10 UTC, https://mpra.ub.uni-muenchen.de/43006/

Godsway Cudjoe, Clemens Breisinger and Xinshen Diao (2010), Local Impacts of a Global Crises: Food Price Transmition, Consumer Welfare and Poverty in Ghana. Food Policy 2010, vol. 35 issue 4, pages 294-302.

Iddrisu, S. M. (2015, 08 13). *Ghana | Myjoyonline.com*. Retrieved 10 04, 2017, from http://www.myjoyonline.com/opinion/2015/August-13th/deregulation-sanitising-ghanas-downstream-petroleum-sector-or-business-as-usual.php

Mahama Hudu (2014). The effects of oil price hikes in Ghana's economy. https://www.ghanaweb.com/GhanaHomePage/NewsArchive/The-effects-of-oil-price-hikes-in-Ghana-s-economy-317314

Matthias Kalkuhl and Joachim von Braun and Maximo Torero (2016), Food Price Volatility and Its Implications for Food Security and Policy. MPRA Paper No. 72164, posted 23 June 2016 08:03 UTC. https://mpra.ub.uni-muenchen.de/72164/

Mawejje, J. (2016). Food Prices,Energy and Climate Shocks in Uganda:Agricultural and Food Econonmics,. *A Springer Open Journal*.

Nazlioglu Saban and Soytas Urgur (2010), World Oil Prices and Agricultural Commodity Prices; Evidence from an Emerging Market, Energy Economics.

Sharif Mahmud Khalid and Iddrisu, Mustapha. (2015, 08 13). *Ghana | Myjoyonline.com*. Retrieved 10 04, 2017, from http://www.myjoyonline.com/opinion/2015/August-13th/deregulation-sanitising-ghanas-downstream-petroleum-sector-or-business-as-usual.php