Rice Importation in Northern Region of Ghana; Its Impact on Domestic Rice Production and Some Policy Measures

Mohammed Tanko

1Department of Agricultural and Resource Economics, Faculty of Agribusiness and Communication Sciences, University for Development Studies, Tamale, Ghana.

Author’s contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/AJAEES/2016/22970

(1) Kwong Fai Andrew Lo, Agronomy and Soil Science, Chinese Culture University, Taipei, Taiwan.

Reviewers:

(1) Ajala Adeladun Stephen, Ladoke Akintola University of Technology, Nigeria.
(2) Diana Bilkova, University of Economics, Prague, Czech Republic.

Complete Peer review History: http://sciencedomain.org/review-history/12863

ABSTRACT

The paper assessed the volume of imported rice in Northern region of Ghana, its effects on domestic rice production and the essential policy measures needed to improve the production of rice in the region. The Johansen method of cointegration was used to test the long run co-movement of prices of imported rice at the central market (Tamale) and that of domestic rice is selected districts markets. Granger causality and Vector Error Correction Models (VECM) were used to detect the price leadership direction and the extend of prices response to the re-establishment of long run equilibrium when there is distortion in the market respectively. Statistical figures served as evident that Ghana and for that matter Northern experienced a flooding of imported rice leading to its share of the market stood at 76% against 24% share of domestic rice. The results reflect a strong long run relationship between prices of imported rice in the Tamale market (central market) and prices of domestic rice in the districts markets. Also, the causality results indicate no price leadership except in the case of Saboba where there is bilateral causality. Analysis from the VECM shows that, domestic rice prices in the various districts markets respond to price shock when there is disequilibrium in the long run. Based on the findings, there is the need
to implement appropriate government policies to improve domestic rice production in the region – imposing higher tariff to reduce rice importation, improvement in domestic rice standard to enable it compete effectively and effective and efficient dissemination of information (advertisement) to the target group to create their awareness about the quantity and quality of domestic rice in the local market.

Keywords: Northern region; Ghana; imported rice; domestic rice; consumption; Production.

1. INTRODUCTION
The agricultural sector plays a major role in Ghana’s economy, contributing 21.5% to the Gross Domestic Product [GDP], employing about 69% of the labour force and serving as a source of income and food security to the poor. In 2012, Ghana produced about 29,192 ('000 Mt) of foodstuffs. Out of the total food produced, rice contributes about 770 ('000 Mt) representing 2.6% of the total production in the country [1].

With the rise in per capita consumption of rice per head from 39.2 kg in 1985, 42.5 kg in 2010 to 45.0 kg in 2010 without the corresponding increase in domestic rice production lead to shortage in supply of rice in Ghana resulting a massive importation of its kind from foreign countries.

Ghana is currently, has only about 30% self-sufficient in rice production, producing only about 150,000MT compared to a prevailing consumption requirement of about 700,000MT [2]. To meet the excess demand, about 70% of rice are imported from Asia Viz. China, Thailand and Vietnam, and the USA. The high demand for imported rice is attributed to the joint determinants of increasing rural-urban migration leading to urbanization, improvement in consumers’ income and the likeness of Ghanaians for imported rice due to tast, short time in cooking among other are driving rice imports to unprecedented high levels. Ghana’s 70% deficits in rice output have several apparent causes. These include low productivity (MT/ha of paddy), high inputs prices such as cost of fertilizer, seed and accessibility of credit due to high interest rate as well as inefficient processing facilities leads to overwhelming production cost, the inefficient processing method given rise to multi-colour and stony rice has a consequent of low demand for locally produced rice [3]. For the past three decades, an increase in the quantity of rice imported to Ghana is more than 30% mainly due to the shift in domestic consumption patterns from domestic rice to imported rice and the improvement in purchasing power of the consumers, making it a critical cereal staple for many households in Ghana.

In Ghana, according to [4] Northern region is one of the three regions (Northern, Upper and Volta) that account for about 80% of the total national output and 73% of the total production in 2010. These three regions also fall in three of the country’s six agro-ecological zones – Coastal savannah, Guinea savannah and Sahel savannah. Based on Ministry of Food and Agriculture (2015) Statistics, Research and Information Directorate (SRID) report [5], Northern region has five months of food insecurity in rice crop, though, it has abundant agricultural and natural resources. Yields of rice crops produced in Northern region by estimates from the Ministry of Food and Agriculture [3]: Facts and Figures (2012) are far below their climatic potential. Of a climatic potential of 7.2 Mt/ha for rice, the region observed 2.61 Mt/ha in 2009, 3.0Mt/ha in 2010, 2.33 Mt/ha in 2011 and 2.36 Mt/ha in 2012. This indicates that, Northern region by the 2010 estimate met only 42% of achievable yield and the year 2012 witnessing observed yields of approximately 33% of the climatic potential. Like Ghana, rice production in the region is far less than the consumption requirement. Though, the region is considered to have high rural population who earned a low income and expected to consume local or domestic rice that has relative low price and low quality, imported rice demand currently has risen to unprecedented level in the region.

Many stakeholders including lobbyists, farmers, politicians and NGOs blame the importation of rice as a reason for the low production of domestic production of the same kind because of the substitutability of the two brand of rice. This is some time called the rice war in Northern region and Ghana as a whole. The debate attracts government attention leading to the implementation of measures to reduce the importation of rice with the intended aim of improving the production of domestic rice. For instance, an increase of the tariff on rice imports by 5% was considered in 2003 in response to an import surge, an alternative that could not be considered for the unavoidable reasons of government willingness to comply with conditions
of the World Bank and IMF [6]. Again, in the peak of the global food price crises in 2008, the government of Ghana removed the import tariff of 20% on rice imports in response to the rising food prices, but indicated in its 2011 budget statement to review the import duty exemption for rice [7]. The target here was to satisfy the concerns and grievances of domestic rice producers, distributors (sellers) and other stakeholders in the domestic rice chain. In 2014, the government put some temporary ban on rice importation, to boost domestic rice production. This was intending to reduce the prices of domestic rice and encourage the consumption of made in Ghana goods. The public criticisms and discontent arising from and inflaming the so called rice war often lacked the guidance of any empirical evidence. Though, the percentage of imported rice in total rice consumed in Northern region of Ghana indicates a rise at an increasing rate from 2005, over the same period, the percentage of domestically produced rice also shows a sharp decline. In 2014 the market share of local rice was 89%, but this has sharply declined to 32% in 2014 whilst imported rice experienced 18% risen in the share of the rice market by 2014. This enables imported rice to cover up 76% of the total rice consumption market in the study area. The questions that remain unanswered are:

- Is there any long run relationship between prices of imported rice at the central market and prices of domestic production of the same commodity in selected districts markets? and
- Does imported rice offer any price incentive for the expansion of domestic rice production or it serves as a price disincentive to farmers in the production of domestic rice?

Finding empirical evidence to these questions will enable policy makers to find solution to the debate or the so called rice war and improve the production of rice which is the concern of many stakeholders in the region.

2. LITERATURE REVIEW

Even though, rice crop is the concern of many politicians and technocrats for self-sufficiency in Ghana, government pays less attention to the (inflow) importation of rice in the country. Inversely, current policies of Ghana’s government pragmatically favour the importation of rice into the country [7]. Ghana’s rice marketing system has two major supply channels - the domestic rice supply channel and the imported rice supply channel. Opened trade played a significant role in creating the current structure of the rice market. From the control system of government intervention in the marketing and distributing in the pre-liberalisation period, now, the country skewed to the existence of a host of private traders distributing and determining the price of rice through price mechanism from the farm gate to urban and or rural consumers in the domestic rice supply chain; and/or from the country’s ports at Tema to consumers in the hinterland on the imported rice supply channel. The domestic rice supply channel involves a host of indigenous rice millers/processors, and profit oriented middle men (wholesalers and retailers) operating between the largely smallholder farmers and the final consumer. To satisfy their basic needs, most producers of rice in a smallholder scale (about 94%) begin selling their produce immediate after harvesting to small scale village processors and sellers, who are usually processors co-operative society and individual women [8]. Domestically rice milled locally is distributed through four paths – wholesalers and retailers, (institutional or household) consumers in the producing areas, itinerary wholesalers from distant, urban, restaurants and often rice deficit markets. From the itinerant and sedentary traders, rice is usually distributed directly to final consumers, or may be divided in to smaller units further by different group of retailers and some times restaurants before the final consumer.

Imported rice on the other hand is purchase either from the Tema port by wholesers during the time of shortage or at the warehouses of importing companies by wholesale traders in Ghana’s port cities – Tema and Takoradi. The wholesale traders then sell their rice from market stores to sedentary retailers, consumers and restaurants in the same markets; or alternatively to wholesalers from distant markets in the hinterland. In some cases, imported rice may be distributed directly by the importing companies to wholesalers in major cities. Some traders in feeder and urban markets in Ghana often participate in the two supply channels simultaneously by selling both domestic and imported rice.

Both domestic and imported rice are sold on urban markets, however due to the irregularity in supply of domestic rice, imported rice dominates
The market women, who often offer access to capital and credit for input purchase as well as transportation for farmers, operate an oligopolistic system, which constrains the market and limits innovation (ODI, 2003). Market price for rice is subject to fluctuations in the market. Market women also present another challenge to farmers; this pertains to measurement of rice. Paddy rice is sold in sacks of 82 kg weights in Ghana. Due to a lack of standard measurements, market women's sometimes bring larger sacks than the standard 82 kg to collect the paddy from farmers at harvest time [10].

Imported rice on the other hand is sold either to wholesalers, retailers, or directly to consumers for instance at the local ports in Tema and Takoradi where consumers can directly purchase goods from importers, although middle men are often used to link wholesalers to consumers. In comparison to locally produced rice, imported rice is packaged in smaller packs of 50 kg, 25 kg, 10 kg and 5 kg bags. Marketing of imported rice (in particular rice from the US) is done through advertisement on audio and visual media (television and radio) and print media (graphics and magazines) all over the country [10]. Grade 1 rice accounts for about 6% of total imports while grade 2 constitute more than 50% of total imports. The grade 1 rice produced in Ghana is insignificant and the country can only boast of 4% of grade 2 rice of total production. A bout 83% of the rice produced domestically is of grade 5 [7].

According to [11] and [12], the leading rice exporting countries to Ghana are the U.S., Thailand, Viet Nam, China, Pakistan, India and Korea. Equation (1) represents explanation of how to arrive at imported rice price ($P_F$). Technically computed by purchase price plus freight and insurance to transport it to a Ghanaian port ($P_C$), excise, custom and other government-mandated fees ($T_E$), internal transportation and distribution ($F$) and other transaction costs ($T_I$) and importers' margin ($\pi$), that is:

$$P_F = P_C + T_E + F + T_I + \pi$$  

(1)

Imported rice price differences are, thus, defined by differences in $P_C$ (which will reflect quality differences) and the expected margin if all other costs are assumed to equal. Importers may distribute their products through wholesalers who sell to urban and rural retailers or distribute directly to retailers themselves, depending on the size of the retailer. Unlike importers who handle only imported rice, wholesalers may handle only imported rice or both local and imported rice. The wholesalers who handle only imported rice tend to be large and generally serve large urban retailers, who not only serve urban consumers but may also supply smaller urban and rural retailers with their imported rice needs.

Local rice producers tend to be small scale, although some medium and large scale producers are emerging in the Ghana rice industry. These producers will generally use a processing plant or mill to process their rice while the small producers typically use traditional threshing and winnowing techniques and sun drying on mats and concrete floors to process their rice. These small local rice producers distribute their marketed products directly to rural consumers, rural retailers or small wholesalers/retailers (essentially “middlemen” who would often travel to rice producing areas to assemble production from numerous small producers) [13,14].

3. METHODOLOGY

3.1 Study Area and Data Set

Northern Region covers land area of about 71,083 square kilometres, is the largest region in Ghana in terms of land area. It shares boundaries with the Upper East and Upper West Regions, Brong Ahafo and Volta Regions, two neighbouring countries, the Republic of Togo, and La Cote d’ Ivoire to the north, south, east and west respectively. The soils types are savannah Ochrosols, which develops under rainfall average between 800 mm and 1500 mm. There are predominantly sandy-loams for the cultivation of maize and rice and other cereal in the valley and upland regions respectively. This supports the cultivation of many food crops such as soybean, yam, cassava, maize, rice, cowpea etc.
The study used monthly wholesale prices of imported rice at the regional market (central market) and domestic rice prices of selected districts markets in the Northern Region of Ghana for the analysis. The data spanned the period from January, 2005 to September, 2015. This period is selected because, data for the period is available and accessible continuously for the entire set of the price variables considered. The period also covers duration of global economic recession and hence, it is critical for this research. Data is collected from the Statistics, Research and Information Directorate (SRID) of the regional office of Ministry of Food and Agriculture (MoFA) in Tamale. The study covers selected districts in Northern region of Ghana because of the level of production and consumption of rice and the region being ranked as the third poorest region in Ghana. The target districts comprised of eight in number, namely; Nanumba North, Sawla-Tuna-Kalba, West Mamprusi, Bole, East Gonja, Zabzugu, Saboba and Tamale (central market). These districts are selected based on availability of continuous time series data and their distance to the regional capital (central market).

To ensure price equivalent units, prices of domestic rice were transformed from Ghana cedis per 100 Kg bag to the equivalent imported rice prices of Ghana cedis per 50 Kg bag. Table 1 shows summary statistics of the prices.

| Variable       | Obs | Mean | Std. dev. | Min | Max |
|----------------|-----|------|-----------|-----|-----|
| Tamale         | 129 | 70   | 21        | 35  | 220 |
| Nanumba North  | 129 | 61   | 19        | 25  | 113 |
| Sawla-Tuna-Kalba | 129 | 54   | 27        | 28  | 103 |
| West Mamprusi  | 129 | 62   | 26        | 26  | 130 |
| Bole           | 129 | 63   | 30        | 21  | 114 |
| East Gonja     | 129 | 69   | 22        | 20  | 117 |
| Zabzugu        | 129 | 68   | 21        | 24  | 110 |
| Saboba         | 129 | 61   | 28        | 24  | 125 |

Source: Author’s computation

From the table, prices of imported rice for the period under study indicate an average of GH¢70 at the regional or central market with a minimum and maximum of GH¢35 and GH¢220 respectively. For domestic rice, the minimum average price for the entire period among the seven selected districts is GH¢54 at Sawla-Tuna-Kalba and the minimum and maximum prices are GH¢20 in East Gonja and GH¢130 in West Mamprusi respectively. The relative lower prices of domestic rice at the districts markets to the higher imported rice prices at the Tamale (central market) can be attributed to the high...
consumption of imported rice at the expense of domestic rice.

3.2 Empirical Model

Spatial integration of the rice market in Northern region of Ghana is the focus of this paper. Four main econometrics methods have was recognised in the review of literature that concerns the measurement of spatial price integration [15,16]: the Law of One Price (LOP), the Ravallion model, Cointegration, and Granger-causality. This study used the Johansen method of cointegration, Granger causality and Vector Error Correction models to determine the long term connectivity between the prices of imported and domestic rice respectively. The study used the bivariate approach of Johansen cointegration analysis. This is because of the two variables (price of imported rice at the central market and that of domestic rice) analysis that we are concerned with in this study.

Trace and Maximum Eigenvalue test is used to determine the presence of cointegration relationship between the market series. Using the estimates of the characteristic roots [13], the test for the number of behavioural roots that are different insignificantly from unity was conducted using the following statistic:

\[ \hat{\lambda}_i - 1 \leq \lambda_i \leq \hat{\lambda}_i \]

(2)

Where \( \hat{\lambda} \) = the estimated values of the characteristic roots (Eigen values) obtained from the estimated \( \Pi \) matrix; and \( T \) = the number of usable observations. The second statistical test is the maximum Eigenvalue test \( \lambda_{\text{max}} \) that is calculated using the formula

\[ \lambda_{\text{max}}(r, r + 1) = -T \ln \left(1 - \frac{1}{\hat{\lambda}_{r+1}}\right) \]

(3)

The test of cointegration is based on the null hypothesis of no cointegration \( (H_0: \ r=0) \) against the research hypothesis of at least one cointegration \( (H_1: \ r=1) \). The series are tested for long run relationship after satisfying that, there is stationarity using Augmented Dicky-fuller model which states as

\[ \Delta P_i = \beta_1 P_{i-1} + \beta_2 \sum_{i=1}^{m} \Delta P_{i-i} + \epsilon_i \]

(4)

Where \( \epsilon_i \) is a pure white noise error term, \( m \) is the maximum length of the lagged dependent variable and \( \Delta P_{i-i} \) is change in price of time \( t \) less \( i \) term. The number of lagged difference terms to include is often determined empirically, the brain behind this is to factor enough terms so that the white noise error term in equation (4) is serially uncorrelated. In ADF we still test whether \( \beta_1 = 0 \). The ADF is used Jointly with Philip Peron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests.

The results suggest that, the variables have unit root or are non-stationary at level but are stationary at the first difference. The ADF and the PP tests reject the null hypothesis of unit root/non-stationary at first difference which is confirmed by the KPSS test. In that, the KPSS test could not reject the null hypothesis of stationarity at first difference.

| Variables         | Level          | First difference |
|-------------------|----------------|------------------|
|                   | ADF            | PP              | KPSS            | ADF        | PP      | KPSS  |
| Tamale            | -3.935**       | -2.229          | 3.4670***       | -7.463***  | -9.825*** | 0.0949 |
| Nanumba North     | -2.119         | -2.398          | 4.3974***       | -8.573***  | -11.597***| 0.1093 |
| Sawla-Tuna-Kalba  | -1.875         | -1.664          | 2.3267***       | -9.545***  | -10.578***| 0.1678 |
| West Mamprusi     | -2.056         | -2.110          | 1.8766***       | -10.234*** | -12.907***| 0.2567 |
| Bole              | -2.121         | -1.994          | 3.2467***       | -7.946***  | -9.988***  | 0.1685 |
| East Gonja        | -1.236         | -1.124          | 1.7629***       | -11.845*** | -11.897***| 0.0764 |
| Zabzugu           | -1.785         | -2.004          | 1.8965***       | -8.857***  | -14.975***| 0.1765 |
| Saboba            | -2.657         | -2.744          | 2.1468***       | -7.903***  | -13.457***| 0.1556 |

Source: Author’s computations

Note: ***1% and **5% critical values for both the ADF and PP test are -5.264 and -4.381 while the KPSS test has ***1%, **5% and *10% critical values of 0.674, 0.514 and 0.417 respectively.
Following the logic that the existence of cointegration between two markets implies at least unidirectional Granger causality, we extend the cointegration tests to test for Granger causality using the equations:

\[
P^d_t = \alpha_1 P^m_{t-1} + \sum_{i=2}^{n} \alpha_i P^d_{t-i} + \varepsilon_t \quad (5)
\]

\[
P^m_t = \sum_{i=1}^{n} \delta_i P^m_{t-i} + \sum_{i=1}^{n} \beta_i P^d_{t-i} + \varepsilon_t \quad (6)
\]

Where the disturbances \( \varepsilon_t \) and \( \varepsilon_t \) are assumed to be uncorrelated.

A unidirectional Granger causality of \( P^m \rightarrow P^d \) or \( P^d \rightarrow P^m \) is proved by an F-test on the null hypothesis that the coefficients of \( P^m \) in equation (5) and \( P^d \) in equation (6) equal zero. i.e. \( \alpha_i = \sigma_j = 0 \), while the alternative hypothesis states that; at least one of the coefficients is not equal to zero. When computed F-value is greater than the F-tabulated value, we reject null hypothesis, explaining causality relationship.

The VECM tests for the effect of changes in each price variable on each other. In the context of this study, the two-variable VECM tests the effect of changes in imported rice prices in the central market (Tamale) on domestic rice prices in the district markets and vice versa after insuring the existence of cointegration [14]. The VECM is therefore presented as follow:

\[
\begin{pmatrix}
\Delta P^d_t \\
\Delta P^m_t 
\end{pmatrix} = \alpha + \left( \begin{array}{c}
\alpha^d \\
\alpha^m
\end{array} \right) (P^d_{t-1} - \beta P^m_{t-1}) + \delta \Delta P^m_t + \rho \Delta P^d_t + \varepsilon_t \quad (7)
\]

where

\( P^d_t \) is the log of domestic rice price;

\( P^m_t \) is the log of imported rice price;

\( \Delta \) is the difference operator, so \( \Delta P_t = P_t - P_{t-1} \);

\( \alpha, \theta^d, \theta^m, \beta, \delta \) and \( \rho \) are estimated parameters; and

\( \varepsilon_t \) is the error term.

4. RESULTS AND DISCUSSION

Table 3 shows the results of the bivariate cointegration using [17] cointegration test, since there is enough evidence to show that the two pairs of rice prices (domestic and imported) are stationary for KPSS at level and first difference for ADF and PP test in all the eight (8) selected markets, The cointegration is run on prices of imported rice in the regional market against prices of domestic rice in the selected districts markets using both the trace and Eigen value statistics.

The results show that prices of imported rice in Tamale market has long run relations with domestic rice prices in Nanumba North, West Mamprusi, Bole, East Gonja, Zabzugu and Saboba markets. The imported rice prices in the central market seems not to cointegrated with domestic rice prices of Sawla-Tuna-Kalba market even at 5% significant level. The null hypothesis of no cointegration \( H_0: r = 0 \) is therefore rejected in the six different markets. The rejection of the null hypothesis indicates an evidence for a long-run equilibrium relationship. However, the alternative hypothesis of at least one cointegration vector between the two pairs of price could not be rejected at the given levels (1% and 5%). The study then proceed with the analysis considering only the six market pairs for which a significant long-run equilibrium is found.

If the alternative hypothesis of the existence of co-integration is not rejected between two times series variables, then, one of the price variables must Granger cause the other, although price need not be simultaneously determined according to Granger representation theorem [18,19]. So, after establishing by the use of Johansen procedure, that the two price series, \( P^d_t \) and \( P^m_t \) of rice in each market are cointegrated; we conducted Granger (1969) causality test to find out the order and direction of long-term equilibrium relationships. Whether prices of domestic rice \( (P^d_t) \) in the distance districts markets Granger cause prices of imported rice \( (P^m_t) \) in the regional market (central market) or vice-versa. The long run causality test verifies price leadership between the central market imported rice prices in Tamale as a regional market vis-a-vis domestically produced rice prices in the other districts markets which are far away from Tamale. The
econometrics analysis with the support of JMulTi for causality or price leadership produced the results which shows that, the null hypothesis of absent of Granger causality of imported rice prices in Tamale as a regional market to domestic rice prices at the various district markets is not rejected in all the cases, except Tamale – Bole and its reverse as the probability values are less than 5% (i.e. 0.034 and 0.022) in Table 4. So, the study reject the hypothesis that imported rice prices in Tamale market do not Granger-cause domestic rice prices in Bole market and also reject the null hypothesis on the reverse indicating a bilateral causality – given evidence that domestic rice prices in the district market (Bole) leads imported rice prices in the regional market in price determination and vice versa. This implies, arbitrageurs of domestic rice in the named district market above is both price takers and price makers – they use information of imported rice prices in their price determination and arbitrageurs of imported rice at the regional market (Tamale) sometimes also used information on domestic rice prices in their price decision making. As [20] prefers the term predictive causality, we will conclude by saying that imported rice prices in Tamale market has a predictive causality on only domestic rice prices in Bole. This is in conformity with [21] in Ghana grain product market that prices in Accra as a national capital market Granger causes Techiman and Wa prices. However, the reverse is not generally true in the region as out of six market pairs only one indicates this results.

Applying the vector error correction model (VECM) to the data in its logarithm form gives the speed of price transmission between imported rice \((\hat{\theta}^m)\) and that of domestic rice \((\hat{\theta}^d)\). Also, the long run elasticity coefficients were obtained as the prices were in their natural logarithms \((\hat{\beta})'\) form. The elasticity illustrates the long term effects of local to imported rice and vice versa in the various markets, while the adjustment parameters indicates how equilibrium will be restored when there is distortions in the studied markets. The table below shows the results for adjustment parameters and cointegration elasticity coefficient.

From the Table 4, it is observed that, the cointegration elasticity coefficient indicates that an increase in the price of imported rice in Tamale market by 1% will result in a decrease in domestic rice price in the East Gonja market by 34.8%. Conversely, the figure for Nanumba North depicts that a 1% increase in the price of imported rice at the regional market will induce domestic rice price to also increase by 57.4%. The changes for all the beta parameters are statistically significant either at the 1% or 5% significant level. The Nanumba North and Saboba markets depicts 1.028% and 1.781% respectively long term price transmission between imported rice price in the central market and domestic rice prices in their various market. The negative and positive signs are anticipated based on the factors affecting demand and supply. This can link to the low patronage or consumption of imported rice relative to the other selected districts and the high production of cereal crop like maize.

### Table 3. Results of Johansen test of cointegration for price pairs (trace and eigenvalue test statistic)

| Market pairs           | Trace statistic | No of lags | Maximum statistic |
|------------------------|-----------------|------------|-------------------|
|                        | \(H_0: r=0\)    | \(H_A: r=1\) | \(H_0: r=0\)      | \(H_A: r=1\) |
| Tamale – Nanumba North | 22.51**         | 3.86       | 18.45**           | 3.57          |
| Tamale – Sawla-Tuna-Kalba | 18.74         | 2.47       | 14.98             | 2.98          |
| Tamale – West Mamprusi  | 25.11***        | 1.54       | 21.12***          | 1.76          |
| Tamale – Bole           | 23.33***        | 4.34       | 20.24***          | 3.98          |
| Tamale – East Gonja     | 21.34**         | 2.05       | 17.41**           | 2.11          |
| Tamale – Zabzugu        | 22.03**         | 2.89       | 17.98**           | 2.64          |
| Tamale – Saboba         | 28.27***        | 3.99       | 23.47***          | 3.78          |
| 0.01 critical value     | 23.15           | 8.32       | 19.24             | 8.32          |
| 0.05 critical value     | 21.08           | 5.43       | 16.34             | 5.43          |

**Source:** Author’s computations

**Note:** The asterisks ** and * denote non acceptance of the null hypothesis of no cointegration at the 1% and 5% levels. Lag selection is based on the suggestion of a maximum lag criterion, but much attention is given to the Hannan-Quinn criterion as it ensures there is no asymptotically overestimating the lag order [18]
Table 4. Estimated speed of price transmission and long run effects

| Market difference                  | $\hat{\theta}^d$ | $\hat{\theta}^m$ | $\hat{\beta}$ | Causality pro. |
|-----------------------------------|------------------|------------------|---------------|----------------|
| Tamale – Nanumba North            | 0.251***         | -0.013           | 0.574***      | 0.231          |
|                                   | [0.092]          | [-0.054]         | [1.791]       |                |
| Tamale – West Mamprusi            | -0.163***        | 0.018            | 0.436***      | 0.078          |
|                                   | [-0.536]         | [0.354]          | [2.451]       |                |
| Tamale – Bole                     | 0.188***         | -0.056           | 0.486***      | 0.034**        |
|                                   | [2.436]          | [-0.642]         | [1.211]       |                |
| Tamale – East Gonja               | -0.201***        | -0.089           | -0.539**      | 0.523          |
|                                   | [-0.857]         | [-0.753]         | [-1.437]      |                |
| Tamale – Zabzugu                   | 0.148***         | -0.043           | 0.645***      | 0.115          |
|                                   | [1.764]          | [-0.242]         | [2.743]       |                |
| Tamale – Saboba                    | -0.231***        | 0.114            | -0.734***     | 0.098          |
|                                   | [-4.425]         | [0.846]          | [-4.756]      |                |
| Nanumba North – Tamale            | 0.157***         | -0.033           | -1.028***     | 0.348          |
|                                   | [1.946]          | [-0.465]         | [-5.431]      |                |
| West Mamprusi – Tamale            | 0.151***         | -0.125           | 0.499**       | 0.286          |
|                                   | [3.211]          | [-0.864]         | [4.322]       |                |
| Bole – Tamale                      | -0.214***        | 0.184            | 0.966***      | 0.022**        |
|                                   | [-2.997]         | [0.745]          | [8.113]       |                |
| East Gonja – Tamale                | 0.159***         | -0.104**         | -0.348***     | 0.647          |
|                                   | [1.686]          | [-0.432]         | [-4.576]      |                |
| Zabzugu – Tamale                   | 0.137***         | -0.045           | 0.499**       | 0.154          |
|                                   | [3.492]          | [-0.054]         | [1.923]       |                |
| Saboba – Tamale                    | -0.151***        | 0.092            | 1.781***      | 0.846          |
|                                   | [-3.492]         | [0.186]          | [0.881]       |                |

Source: Author’s computations

Also, the a priori expectation sign for the adjustment parameters are met and both negative and positive sign are expected to restore the equilibrium. This is critical because, for price adjustment to attain equilibrium the positive price adjustment of one brand must be accompany by a negative price adjustment of the other brand.

The adjustment parameters ($\hat{\theta}^d$ and $\hat{\theta}^m$) denotes estimated margins of price adjustment of one price to ensure the formation of equilibrium. The coefficient shows deviations from the long run equilibrium relationship. The coefficients called adjustment coefficients are the elasticity of price transmission or the speeds of price adjustment by the districts domestic and regional imported rice prices respectively. The closer a value approaches one in absolute terms; the faster deviations from equilibrium become corrected. For instance, the results in Bole domestic rice price adjustment speed between domestic and imported rice prices of -0.214 corrects deviation from equilibrium faster compared to the imported rice price adjuster in Saboba market which valued 0.092. The fact is that, in absolute value, the domestic rice price adjustment parameter in Bole is closer to one (1) than the imported rice adjustment parameter in Saboba.

The speed of transmission involving imported rice price $\hat{\theta}^m$ in Zabaugu market corrects error significantly by -0.045% towards the attainment of equilibrium. This implies 4.5% changes of domestic rice prices are transmitted to imported rice prices as a result of shocks. But in general, 13.7% or more changes in domestic rice prices are to transmitted to imported rice prices for equilibrium to be restored. On the other hand, a speed of transmission from imported rice prices to domestic rice prices in all the six market for an error to correct towards the attainment of equilibrium is 10.4%. This means, 10% of the changes in imported rice prices are transmitted to domestic rice prices based on demand and supply shocks. The values at the bottoms of the estimated parameters are the test statistics. From analysis, domestic rice prices at the various districts markets response to price shocks - domestic prices adjust to deviations from the long run price co-movement, however, foreign commodity prices of the same brand does the
5. CONCLUSION AND POLICY RECOMMENDATION

The study illustrates the situation of import surge based on the actual quantity of rice imported to Ghana. It is observed that as rice imports increased for the period under consideration that of domestic rice yield and production remained the same or halved in the study area. Analysis of an econometrics model shows that, there is a long run connectivity between prices of imported in the central market at Tamale and domestic rice prices at the far away distance market under the selected districts in Northern region of Ghana. The connection is as a result of improvement in infrastructure like road network from Tamale as the regional capital to the various districts and it can improve through upgradation of standard in the rice industry. Also, domestic rice producer are not price takers in the price determination process as imported rice sellers based on the results are not leading in price decision making. This suggest that domestic rice sellers are critical in price determination process; hence, local producers and sellers should be placed on an equal ground with imported rice sellers to compete. This gave domestic producer opportunity to grab positive price shocks from the imported rice market by increasing their output and quality of their produce to competitive level. This is especially necessary since global food prices have since 2007 has been rising.

Based on the findings of the study and the conclusion drawn, some critical measures need to put in place for the improvement of the domestic rice industry. The fact that is undeletable is that, the market in Norther and Ghana as a whole has been flooded with many different grades of imported rice which is a substitute commodity to domestic rice exposed a threat to the demand of domestic rice, hence, there is the need for appropriate Government action such as the application of higher tariff to reduce rice importation and improvement in domestic rice standard to enable it compete effectively. As the region is classified as the third poorest region, there is the need for government to assist either in cash or kind to the private sector to acquire a unique “brand name and symbol”, destoning machines and set up an efficient regional distribution system for domestic rice. With this, consumers can get quality and identifiable domestic rice easy to access at the region and producers and seller will have a price incentive as they will be ready market for their produced.

Though, many consumers make conclusion that, imported is quality, tasty and easy to cook, a few domestic rice has at least one of the quality preference but still encounter a low demand. This is due to ineffective and inefficient dissemination of information to the target group about the kind of rice in the market. Therefore, private sector should be assisted to make effective advertisement using the local media for the understanding of the people to enable domestic rice compete with the imported rice. The implementation of these measures will motivate domestic rice producers.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Mr. Seidu Alhassan (Shala), Mr. Baba Abdullai in JICA office Tamale and Mr. Peter Claver Anyeembey (M & E officer) from the Northern regional office of Ministry of Food and Agriculture (MOFA) for providing me the necessary secondary data from their office for this research.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. MoFA. Agriculture in Ghana: Facts and Figures (2010). Statistical, Research and Information Directorate (SRID). Accra, Ghana: Ministry of Food and Agriculture; 2013.
2. MoFA. (2015, October Monday 19). Northern Region Agricultural Development Unit. Available:mofafoodsecurity:mofafoodsecuri
   ty.wordpress.com/food-security-situation-
   in-ghana/ (Retrieved Oct Monday 19,
   2015)
3. MoFA. Agriculture in Ghana: Facts and Figures (2010). Statistical, Research and Information Directorate (SRID). Accra, Ghana: Ministry of Food and Agriculture; 2011.
4. USAID. Rice price trend in Ghana- 2006 to 2011 METSS-Ghana Research and Issue Paper Series No. 02-2012. USAID; 2012.
5. MoFA. (2015, October Monday 19). Northern Region Agricultural Development Unit., Available:mofafoodsecurity:mofafoodsecurity.wordpress.com/food-security-situation-in-ghana/ (Retrieved Oct Monday 19, 2015)

6. BMOS AGRO-CONSULTS LTD. Tariffs and rice development in Ghana. FSRPOP/MoFA, Accra; 2004.

7. USAID. Global Food security response: Ghana case study, Report No. 156. USAID; 2009.

8. Amikuzuno J. (2010, September 19-23). Spatial Price Transmission Analysis in Agricultural Markets: Does the Data Frequency Improve our Estimation? Contributed Paper presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, p. 35.

9. FAO. The extent and impact of import surges: The case of developing countries. Rome: MAFAF, FAO; 2013.

10. ODI. Multi-Agency partnership for technical change in West African Agriculture: Rice production and livelihood in Ghana. ODI. 2003;75.

11. USAID. Rice price trend in Ghana- 2006 to 2011 METSS-Ghana Research and Issue Paper Series No. 02-2012. USAID; 2012.

12. USAID. The Global Food Security Response West Africa Rice Value Chain Analysis: Ghana Rice Study, Micro-report, August 2009 USDA, 2011 Grain and Feed Annual Report. USAID; 2011.

13. Johansen S, Kal J. Maximum likelihood estimation and inference on cointegration: With an application to demand for money. Oxford Bulletin of Economics and Statistics. 1990;52:169-210.

14. Rapsomanikis G, Sarris A. The impact of domestic and international commodity price volatility on agricultural income instability in Ghana, Vietnam and Peru. A Paper prepared for the WIDER Project on Hunger and Food Security: New Challenges and New Opportunities; 2005.

15. Baulch B. Testing for food market integration revisited. The Journal of Development Studies. 1997;33(4):512-534.

16. Asuming-Brempong S, Osei-Asare YB. Has imported rice crowded-out domestic rice production in Ghana? What has been the role of policy? AAAE Conference Proceedings. 2007:91-97.

17. Johansen S, Kal J. Maximum likelihood estimation and inference on cointegration: With an application to demand for money. Oxford Bulletin of Economics and Statistics. 1990;52:169-210.

18. Lutz C, Tilburg AV. Framework to Assess the Performance of Food . N.Y: Macmillan; 1997.

19. Granger CWJ. Some recent developments in the concept of causality. Journal of Econos. 1988;39:199-211.

20. Francis AB. Market organisation and consumers’ perception of locally produced rice in the Ashanti region of Ghana. Master’s Thesis submitted to The School of Graduate Studies – Kwame Nkrumah University of Science & Technology (KNUST), Kumasi, Ghana, June, 2009. Kumasi: KNUST; 2009.

21. Cudjoe G, Clemens B, Diao X. Local Impacts of a Global Crisis Food Price Transmission and Poverty Impacts in Ghana. IFPRI Discussion Paper 00842, 9; 2008.