Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.4, No.20, 2013


# Price Transmission between Imported and Local Rice Markets in a Liberalised Economy: Are Ghana's Rice Wars Just Much I Do about Nothing?

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**Abstract**
The effect of the reduction in import tariffs and liberalisation of marketing channels on price transmission between agricultural commodity markets in developing countries, like Ghana has been a source of a notional trade conflict since the mid 1990s. The conflict is based on the view that import trade liberalisation destroyed the domestic markets of import substitutes. One of Ghana's import substitutes whose marketability, price and production are believed to be adversely affected by import liberalisation is rice. To understand what role liberalisation plays in this regard, we examine the transmission of price signals between imported and local wholesale rice prices from 2006 to 2011 in Ghana. The results reveal the existence of long-run equilibrium relationships and partial transmission of price shocks from local to imported rice prices, but the latter do not dominate prices of the local rice. Thus banning rice imports or slapping imports with high tariffs in line with public opinion in Ghana might not be an option to consider. Rather, encouraging quality improvement of local rice through modern processing techniques and enhancing competition between the two grades of rice at the domestic scene has to be a key concern of government.
**Key Words:** Markets, Rice, Price Transmission, Ghana, Liberalization

## 1. Introduction

Rice is not a traditional Ghanaian staple food, but it is becoming an important part of the daily Ghanaian menu, both in terms of its caloric value and share of the household budget. Ghanaians, especially urban and suburban dwellers eat rice not only as a source of calories but also as a convenient food. It is therefore not surprising that rice is one of five staple crops recommended by Ghana's Food and Agricultural Development Sector Policy II (FASDEP II) for productivity improvements in order to accelerate Ghana's pace towards attaining the MDG 1 – i.e. to end poverty and hunger.

Even though rice (alongside maize) is the most widely traded agricultural commodity in Ghana and self-sufficiency in rice production is an issue of national pride, rice is Ghana's largest cereal import commodity, costing the country about $500M in foreign exchange to import annually (deGrassi, 2007; Atengdem, 2009). Ghana is presently only about 27% self-sufficient in rice production, producing only about 160,000MT compared to a prevailing consumption requirement of about 600,000MT (MoFA, 2011). To meet the supply deficit, Ghana imports about 70% of its rice consumption requirement from Asia viz. China, Thailand and Vietnam, and the USA. A combination of increasing urbanization, consumers' income and preference of Ghanaians for imported ("perfumed/polished") rice are driving rice imports to unprecedented high levels.

The about 70% deficit in Ghana's rice output has several apparent causes. These include low productivity (MT/Ha of paddy), high production cost including cost of credit, farm inputs, improved seed as well as efficient processing facilities, and as a consequent of the last cause, low demand for locally produced rice.

The notable underlying causes of low productivity and demand for Ghana's locally produced rice notwithstanding, public opinion in the last two decades of Ghana's agricultural market liberalisation, i.e. the reduction in government involvement in marketing, price regulation, and control of international trade, has always blamed the challenges in the domestic rice sector on the high competiveness, quality and marketability of rice imported from Asian and American markets (hereafter called imported rice).

Opponents of Ghana's agricultural market liberalisation argue that huge imports of rice has destroyed the domestic market for locally produced rice (here after called local rice), leading to additionally unprecedented levels of rice imports into Ghana. The opponents believe that through its high competitiveness, quality and taste, and relatively low prices, imported rice compared to local rice is more marketable, and this reduces the parity

price for local rice, and distorts inter-market transmission of price signals in the domestic scene. In Ghana, negative media propaganda, hectic parliamentary debates, strong NGO advocacy campaigns and numerous formal and informal campaigns from rice farmers against rice imports is a common, daily phenomenon. These conflicts have been termed "Ghana's rice wars" in the media.

Due to public criticisms and discontent[1] arising from and inflaming the so called rice war, Ghana's government has often thought of getting directly involved in the regulation of rice imports and prices. For instance, an increase of the tariff on rice imports from 20% to 25% was considered in 2003 in response to an import surge, an option that was eventually dropped for various reasons including government willingness to comply with conditions of the World Bank and IMF (BMOS AGRO-CONSULT, 2003 in Lançon 2007). Again, in the peak of the global food price crises in 2008, the Ghana government removed the import tariff of 20 percent 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 (Republic of Ghana, 2010; USAID, 2009). The objective here too was to satisfy the concerns of local rice farmers and other stakeholders in the domestic rice industry.

The above interventions among others, have always been proposed to merely satisfy lobbyists including farmers, politicians and NGOs, but have often lacked the guidance of any empirical evidence. While the ability of the domestic markets of a country to function efficiently – i.e. to transmit price signals and information between themselves and across the country's borders - is the panacea for producers and consumers to benefit from liberalised marketing systems (Alam et al, 2010; McCulloch, Winters and McKay, 2004), whether import liberalisation can be solely blamed for low demand, marketability and volatile prices of local rice ,and the resultant decreasing profitability of local rice producers in Ghana is highly contestable.

To the best of our knowledge, there is simply little empirical evidence on the effect of imported rice price changes on the prices of locally produced rice. Except Alderman 1992, no other study in Ghana has undertaken inter-commodity transmission of price signals. Price transmission studies in Ghana such as Asante et al 1989; Alderman and Shively, 1996; Abdulai, 2000; Ihle et al 2010; and Amikuzuno, 2011, analysed either only spatial or vertical price relationships in Ghana for different commodities. These studies have not examined the direct impact of Ghana's import liberalisation on the price dynamics of import substitutes in the domestic market.

In this paper, we fundamentally examine the transmission of price signals between wholesale prices of two distinct rice grades - imported and local rice[2] to establish whether there is a long-run, equilibrium relationship between the two i.e. whether price changes of imported rice affects prices of local rice within the period of liberalisation in Ghana. Secondly, we determine whether imported rice prices dominate local rice prices or vice versa. The question is, do Ghana's local rice prices adjust to changes in the international price of rice, and are these changes quickly or sluggishly transmitted to the local rice prices? The markets under analysis include Ghana's biggest seaport market, Tema and the five most important inland rice markets namely, Accra, Kumasi, Techiman, Tamale and Bolgatanga.

We hypothesize that changes in imported rice price signals affect prices of local rice in Ghana, and that imported rice price changes lead local rice prices in the price determination process. Our analysis for imported rice/local rice prices within selected markets is akin to vertical price transmission with the two grades of rice representing different stages of the product; while the analysis assessing the linkage between imported rice prices in the seaport market – Tema and local rice prices in the inland markets is similar in concept to spatial price transmission. This study thus employs a spatio-temporary approach of price transmission analysis.

The policy relevance of this study lies in the need for empirical evidence on the possible long run relationship between imported and local rice prices. Given the ongoing volatility in food prices and its implication for food security especially for the urban poor in Ghana, establishing the extent of price transmission between the two grades of rice should be the only basis of any government policy intervention in the rice sector. Also, evidence on the price dominance or market leadership will help determine how increasing or decreasing imported rice prices or its high quality may influence the demand and prices of local rice in the long run.

The next section describes the structure of Ghana's rice market and examines the theoretical link between liberalisation and price transmission. The data used for the analysis and methodology applied to the data are presented in section 3 and 4 respectively. Section 5 presents the results while section 6 concludes the paper.

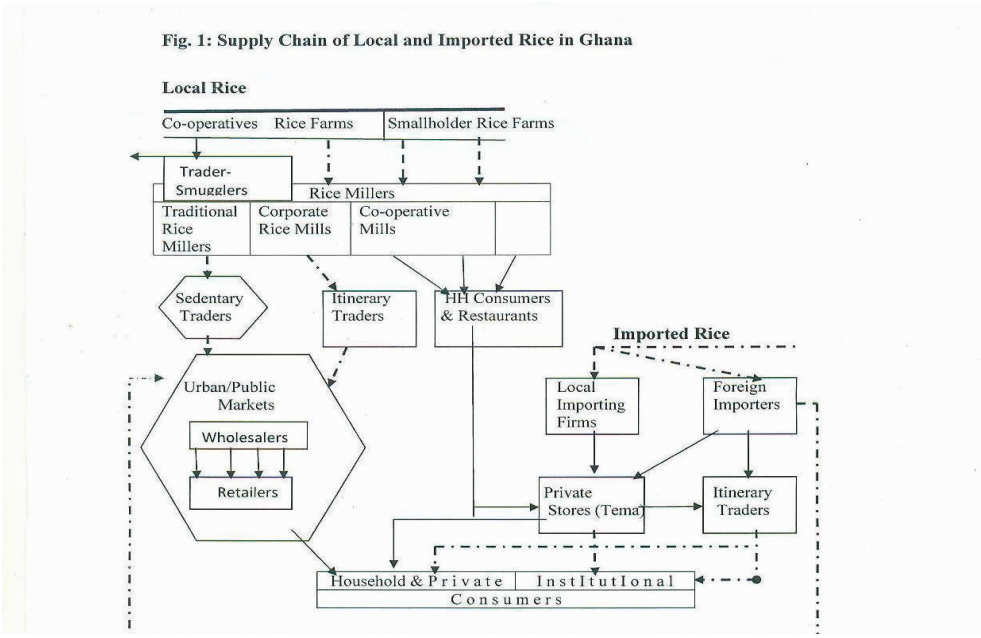
## 2. Ghana's Rice Market and the Trade Liberalisation–Price Transmission Link.

***2.1 The Rice Marketing System in Ghana*:** Even though rice is a politically-sensitive and a priority crop for self-sufficiency in Ghana, government does not regulate the import flow of rice. On the contrary, current policies of

[1] The so-called Ghana's rice wars
[2] This is basically intra-commodity price transmission.

Ghana's government pragmatically favour the importation of rice into the country (USAID, 2009).
Ghana's rice marketing system has two major supply chains - the local rice supply chain and the imported rice supply chain. Trade liberalisation played a significant role in creating the current structure of the rice market. From government regulation and distribution in the pre-liberalisation period, there now exists a host of private traders distributing and determining the price of rice through supply and demand shocks from the farm gate to urban consumers in the local rice supply chain; and/or from the country's ports to consumers in the hinterland along the imported rice supply chain. The two supply chains of rice in Ghana are shown in Figure 1.
The local rice supply chain involves a host of indigenous rice millers/processors, and sedentary and itinerary wholesalers and retailers operating between the largely smallholder farmers and the final consumer. To meet their cash needs, most smallholder rice farmers (about 94%) begin selling their produce after harvesting to small scale indigenous, processors/millers, who are usually individual women or women associations.
**Figure 1**




Locally milled rice is distributed via four links – sedentary traders (wholesalers and retailers), restaurants, (institutional or household) consumers in the producing areas, and itinerary wholesalers from distant, urban and often rice deficit markets. From the itinerant and sedentary traders, the commodity may either be distributed directly to final consumers, or may be further distributed through different levels of retailing and restaurants before the final consumer.

Imported rice on the other hand is bought from the ware houses 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 chains simultaneously by selling both local and imported rice.

***2.2 The Link between Trade Liberalisation and Price Transmission*:** Across borders, integration in commodity markets is achieved through price transmission. By eliminating barriers to trade, liberalisation of domestic markets and the globalisation of world markets are expected to bring about increased price transmission and integration between domestic and world markets (Raman, 2006; Jaramilo and Nupia, 1997). That is trade liberalisation should increase the transmission of world price signals of tradable commodities from consumers to the producers of such commodities in the domestic markets in the liberalised countries. This means, evidence of price transmission is an assessment of the potential impact of trade liberalisation on the price and trade movements of homogenous commodities between local and international markets (Tomek and Robinson, 1995,

in Padilla-Bernal and Thilmany, 2003).

Now the question is how do changes in world prices affect domestic prices? The import price of a commodity in the domestic market $P^m$ may be stated as:

$$P^m = P^w R(1+tm) + C^{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where $P^w$ is the world market price of the commodity, $R$ is the exchange rate, $tm$ is a proportional import tariff or tax, and $C^{ij}$ is the transfer costs of importing the commodity from the foreign market i to the domestic market j. The $P^m$ and $P^w$ are assumed to be expressed in a common currency.

Alternatively, the local price of an exportable commodity $P^l$ can be expressed as:

$$P^l = P^w R(1 - t_x) - C^{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where $t_x$ *is the* proportional export tariff or tax, and the other variable notations are as already defined above.

In a liberalised economy for a given commodity, a price shock on $P^w$ first triggers, through the commodity's border price, changes in the import price ( $P^m$ ) of the commodity in markets close to the country's ports, borders and hub of market information such as urban markets with highly organised network of traders and reliable telecommunication facilities. These markets then lead the commodity's prices in interior markets in the price discovery or market clearing process. The rate of price discovery however depends on whether price transmission mechanisms within the country for the commodity are strong or weak (Badiane and Shively, 1997).

For a price shock on $P^l$ , the effect is first transmitted through border prices of the commodity to its international price. The rate of transmission of price shocks in this case also depends on the degree of integration between domestic and border markets for the commodity. The interdependency between the world and domestic prices of the given commodity is particularly more pronounced if the supply chains for the commodity (grades) in the domestic scene are not, as illustrated in Fig. 1, mutually exclusive.

Our analysis examines price linkages at the domestic level but within a liberalised trade context. We state, following the Law of One Price (LOP) and the Enke-Samuelson-Takayama-Judge (ESTJ) model, the contemporaneous relationship between two prices, $P_t^m$ and $P_t^l$ respectively for imported and local grades of rice as:

$$P_l^m = P_t^l + D_t^{ml} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where $D_t^{ml}$ is the price differential between imported and local rice and is equivalent to $C^{ji}$ . The price differential represents the difference in the attributes of the two grades of rice as a result of consumers adjusting for quality. According to the LOP, perfect price transmission across the two grades of rice holds only if (3) is met.

**3. Research Methodology**

In this study we use the Vector Error Correction Model (VECM)[3], a very useful technique that provides a stylized picture of the relationship between the prices of the two grades of the commodity. The VECM also provides a methodological framework within which gradual, rather than instantaneous price transmission can be tested; meaning it takes into consideration discontinuity of trade and other factors that may impede price transmission over time (Rapsomanikis et al, 2003). In addition the model includes unit root test that determines the special time series properties of the data, while cointegration analysis is a prerequisite for applying the VECM (Engel and Granger, 1987).

If the prices for the imported and local grades of rice, denoted $P_t^m$ and $P_t^l$, are time series variables that contain stochastic trends and are integrated of the same order e.g. I(d), then they can be said to be cointegrated if a long run, equilibrium relationship between the two prices can be stated as:

$$P_t^m - \beta P_t^l - \varepsilon_t \sim I(0)$$

We used Johansen vector autoregressive (VAR) approach to test for the existence of a cointegration relationship

[3] Since we use the standard version of the VECM, we only briefly present its theoretical framework here. Interested readers may see Lütkepohl and Krätzig (2004) for details.

between $P_t^m$ and $P_t^l$.

If the imported and local rice prices, $P_t^m$ and $P_t^l$, are cointegrated, the VECM representation of price transmission between the two commodities is specified by stating the changes in each of the contemporaneous prices $\Delta P_t^m$ and $\Delta P_t^l$, as a function of the lagged short term reactions of both prices, $\mathbf{\Delta P_{t-k}^m}$ and $\mathbf{\Delta P_{t-k}^l}$, and their deviations from equilibrium at period $t-1$ as follows:

$$\begin{pmatrix}\Delta P^m\\ \Delta P_l\end{pmatrix} = \begin{pmatrix}a^m\\ a_l\end{pmatrix} + \begin{pmatrix}\alpha^m\\ \alpha_l\end{pmatrix}\left(P_{t-1}^m - \beta P_{t-1}^l\right) + A_1\begin{pmatrix}\Delta P_{t-1}^m\\ \Delta P_{t-1}^l\end{pmatrix} + \cdots + A_k\begin{pmatrix}\Delta P_{t-1}^m\\ \Delta P_{t-1}^l\end{pmatrix} + \begin{pmatrix}u_t^m\\ u_t^l\end{pmatrix} \quad (4)$$

Where $\Delta P_t^m$ *and* $\Delta P_t^l$ are a vector of first differences[4] of the imported and local rice prices respectively; $a^m$ and $a^l$ are a vector of constant terms that denote long-run, inter-market price margins; the cointegrating equation $(P_{t-1}^m - \beta P_{t-1}^l)$, is the error correction term; so named because it depicts deviations from the long run relationship or 'errors' that are 'corrected' by the price transmission process, $\beta$ is the cointegrating vector[5]; $\alpha^m$ and $\alpha^l$ are called the loading or error correction coefficients since they measure the extent to which $P_t^m$ and $P_t^l$ "error correct" i.e. adjust towards restoring the long run equilibrium relationship between them[6]. The $\alpha^m$ and $\alpha^l$ are also known as the elasticity of price transmission or the speeds of price adjustment by the imported rice and local rice prices respectively, to deviations from long-run equilibrium. The coefficients $A_k$ *(2 x 2)* are matrix of coefficients quantifying the intensity of the response of the contemporaneous price differences to their lagged values i.e., they express the short-run reactions of the matrix of prices $\mathbf{P_t}$ to random shocks. Finally, the $\mathbf{\mu_t^m}$ and $\mathbf{\mu_t^l}$ are white noise error terms and *k* is the number of lags included in the model.

Equation (4) can be reformulated as follows:

$$\begin{pmatrix}\Delta P_t^m\\ \Delta P_t^l\end{pmatrix} = \begin{pmatrix}a^m\\ a_l\end{pmatrix} + \begin{pmatrix}\alpha^m\\ \alpha_l\end{pmatrix}\hat{e}_{t-1} + \sum_{t=1}^{k}\Gamma\begin{pmatrix}\Delta P_{t-k}^m\\ \Delta P_{t-k}^l\end{pmatrix} + \begin{pmatrix}u_t^m\\ u_t^l\end{pmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Where $\hat{e}_{t-1}\,(=(P_{t-1}^m - \beta P_{t-1}^l))$ is the error correction term and $\Gamma(=A_1 + A_2 + \ldots + A_k)$ is a 2x2 matrix of short run coefficients relating current price changes to past price changes. Commonly $0 < |\alpha_i| < 1$, such that the closer the $\alpha_i$ is to one in absolute terms, the faster the deviations from price equilibrium become corrected, and vice versa.

The existence of cointegration between $P_t^m$ and $P_t^l$ implies Granger causality (Granger, 1987). Furthermore, since cointegration between variables does not automatically imply causality between them, the evidence of causality between the variables must be provided by Granger causality analysis. The Granger causality models applied in this study are specified in equations (6) and (7).

$$P_t^m = \sum_{k=1}^{n} a_k P_{t-1}^l + \sum_{k=1}^{n} b_k P_{t-1}^m + \varepsilon_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

$$P_t^l = \sum_{k=1}^{n} a_k P_{t-1}^l + \sum_{k=1}^{n} b_k P_{t-1}^m + \varepsilon_{2t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7)$$

The equation (6) postulates that, $P_t^m$ is dependent on $P_{t-1}^l$ and $P_{t-1}^m$; conversely, equation (7) postulates the same (theoretically) for $P_t^l$. The $\varepsilon_{1t}$ and $\varepsilon_{2t}$ are uncorrelated error terms. A proof of causality between the imported and local rice prices implies that the variability of either price overtime can be explained by varying episodes of the other over the same period of time. The variant of the Granger causality tests run in this paper is based on the vector error correction model (VECM).

## 4. The Dataset

We use monthly average wholesale prices of local and imported rice for six major markets in Ghana for the analysis. The markets include Tema (located at Ghana's biggest seaport), and Accra, Kumasi, Techiman, Tamale

[4] *The I(1) price series need to be differenced in order to achieve stationarity.*
[5] *Because this analysis is bivariate, this is actually a scalar.*
[6] *Where the prices are expressed in their natural log values, the* $\alpha^m$ *and* $\alpha^l$ *are the elasticity of the imported rice price with respect to the local rice price and the elasticity of the local price with the respect to the imported price respectively.*

and Bolgatanga (see Appendix A). The prices are in Ghana Cedi per 50Kg bags of imported and local rice and are obtained from the Statistics, Research and Information Division (SRID) of Ghana's Ministry of Food and Agriculture (MoFA). Table 1 presents the descriptive statistics of the prices.

**Table 2: Descriptive Statistics of the Prices (GHC)**

| Statistic | Accra | Kumasi | Techiman | Tamale | Bolga | Tema |
|---|---|---|---|---|---|---|
| No. of Observations | 58 | 58 | 58 | 58 | 58 | 58 |
| Min | 34 | 36 | 36 | 33 | 29 | 35 |
| Mean | 62 | 56 | 61 | 60 | 55 | 60 |
| Max | 106 | 81 | 109 | 121 | 86 | 93 |
| Stan Dev | 16 | 13 | 16 | 17 | 15 | 15 |

Source: Authors' calculations.

The data covers the period from 1.2006 to 8.2011. Though this period was selected on the basis of availability of a continuous time series data for the entire set of the price variables considered, the period spans the global food price crises and thus useful for this exercise. The reference price is that of the imported rice in Tema and in the other markets. All prices were transformed to their log values for the cointegration and VECM analysis.

The periodic volatility (see Figs. 2a and 2b) in both the local and imported rice price series are quite stark. Both series exhibit expected near-cyclical patterns with price peaks alternating quite regularly with periods of low prices around an overall mean value of about GHC59.00 for the imported rice and GHC43.00 for the local rice. The figures illustrate that both the local and imported rice prices follow world trends in the long run; as slightly increasing price trends may be seen for both price series over the years coinciding with the global food price crises. One cannot however conclude at this stage that domestic rice prices are driven by the world price of the commodity.

**Figure 2 (a and b): Monthly Prices of Imported and Local Rice in Selected Markets in Ghana**

**Figure 2a**

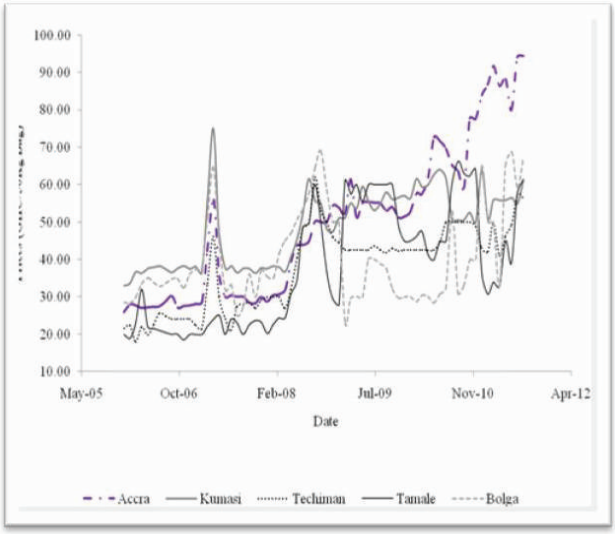
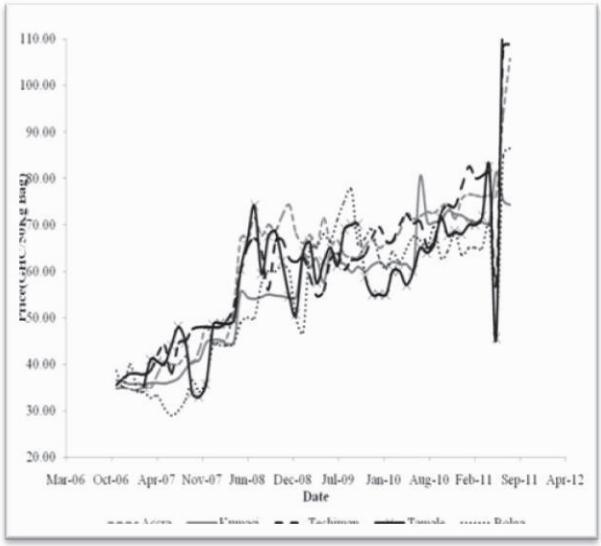



**Figure 2b**




To check the stationary properties of the price series, the ADF and KPSS tests were used to check for unit roots in the individual series (Table 2). The ADF test (Dickey and Fuller, 1979) fails to reject the null hypothesis of a unit root in all price series in levels, and rejects the null hypothesis for the first differences of all price series. The KPSS test (Kwiatkowski et al., 1992) corroborates these results by rejecting the null hypothesis of stationarity for all price series in levels, and failing to reject this null for the corresponding first differences. Hence, we conclude that all rice price series under this analysis are I(1).

**Table 2: ADF and KPSS Unit Root Tests on the Monthly Price Series**

| *Series* | *ADF Test* | | *KPSS Test* | |
|---|---|---|---|---|
| | Levels | First Diff. | Levels | First Diff. |
| Accra | -2.095 | -3.401** | 0.728** | 0.441* |
| Bolga | -1.521 | -3.654*** | 1.200*** | 0.450* |
| Kumasi | -1.591 | -3.798*** | 1.220*** | 0.431* |
| Tamale | -1.936 | -4.293*** | 0.894*** | 0.332 |
| Techiman | -1.737 | -2.629* | 1.006*** | 0.413* |
| Tema | -1.539 | -0.831 | 1.057*** | 0.488** |

Source: Own calculations

*The asterisks ***, ** and * denote rejection of the null hypothesis at the 1%, 5% and 10% significance levels. The respective critical values at the 1%, 5% and 10% significance levels are -3.43, -2.86 and -2.57 for the ADF test, and 0.739, 0.463 and 0.347 for the KPSS test at both the price levels and first differences of the prices.*

The results of the ADF test, considering the suggested lag lengths, show that at the 1%, 5% and 10% significance levels with critical values of -3.43, -2.86 and -2.57, the null hypothesis of unit root, Ho: $\rho = 0$ i.e. the series is non-stationary, cannot be rejected for all price series in their levels. As expected, the null hypothesis is rejected in all cases except for Tema after taking a first difference of all series and testing for stationarity. The KPSS results largely confirm those of the ADF test. By this test we strongly reject the null hypothesis of no unit roots (i.e. the series is stationary) in the level of the price series in all cases, but cannot reject the null hypothesis at the first difference of the price series especially at the 1% and 5%. Therefore, the series under the study are (first) difference stationary processes i.e. they have unit root or are I (1).

**4. Results**

The analysis is done at two levels. First, we tested for cointegration between the prices of imported and local grades of rice within each of the five major hinterland markets under study. Then, we estimated the speeds of price transmission ($\alpha^i$) between the imported rice and local rice prices within each of the major markets, and between imported rice prices in the port city of Tema and local rice prices in the hinterland markets.

The Johansen trace test for cointegration (Johansen, 1991) rejects the null hypothesis that there is no cointegrating vector in favour of the alternative hypothesis that there is one cointegrating vector in each of the local rice/imported rice price pairs in the five (5) markets (Table 3).

The test are conducted at the 90%, 95% and 99% confidence levels in a specification of the Johansen's VAR approach containing a constant and a trend term as revealed in the graphical plots of both types of price series.

The findings suggest that, there exists at least one equilibrium cointegration relationship ($r = 1$) between imported and local rice prices in the selected rice markets over the period of the analysis. The strong evidence that local rice and imported rice prices within these major Ghanaian markets are integrated indicates that shocks on the international prices of rice may be passed on to local rice prices in the long run and that there may be causality at least in one direction, most probably from the imported rice price to the local rice price.

International price shocks may influence local price dynamics because of the low market share of Ghana's local rice vs. the high levels of rice imports, and the small size of Ghana's rice market compared to the international market for rice. The results also suggest that participants in Ghana's domestic marketing system make full use of available market information (Alderman, 1992).

**Table 3: Test for Cointegration between Imported and Local Rice Prices**

| Market (Local - Imported) | Test Statistics $r = 0$ | $r = 1$ | No. of Lags (AIC) | Cointegration Coefficient ( $\beta$ ) |
|---|---|---|---|---|
| Accra-Tema | 43.00*** | 6.76 | 10 | 0.675*** [5.745] |
| Kumasi-Tema | 23.18* | 6.25 | 2 | -0.044 [0.089] |
| Techiman-Tema | 25.34* | 10.60 | 2 | 0.372 [0.766] |
| Tamale-Tema | 25.77** | 8.11 | 1 | 0.759*** [-2.967] |
| Bolgatanga-Tema | 23.72* | 4.31 | 1 | -1.115*** [-2.888] |

Source: Own estimation with MoFA- Ghana A data

*Notes: *, ** and *** indicate significance of the test statistics (r = 0 and r = 1) and the cointegration coefficient ( $\beta$ ) at the 10%, 5% and 1% respectively. The values in parenthesis are t-statistics of $\beta$.*

The estimated cointegration elasticity[7] coefficients ( $\beta$ ) represent the long run responsiveness of local rice prices to imported rice prices. These are strongly significant in all cases except two - local rice/imported rice prices in Kumasi and Techiman. These are markets in the forest, middle belt of Ghana with many other staple food products like maize, plantain and cassava. There is especially a high but negative sensitivity of local rice prices to imported prices in Bolgatanga ( $\beta = -1.115$ ), which is in an area of surplus rice production and a major producer of other cereals like millet and sorghum, but has a relatively low income population. The estimated elasticity of -1.115 implies that a 1% any price shock that raises the price of imported rice will cause a 1.12% downward shock in price of local rice in the long run.

Positive and negative signs of the elasticity coefficients are expected since the nature of actual price responsiveness following shocks will be dependent on underlying supply-demand factors in the selected markets such as income of consumers, as well as on the availability of close substitutes for rice in each market. Having determined the cointegration relationships and elasticity coefficients, we estimate the Vector Error Correction Model (VECM) of price transmission to examine the extent of price transmission between local and imported rice prices within the major Ghanaian rice markets (non-spatial, inter-grade transmission) and price transmission between rice prices in the port city of Tema and the other selected inland rice markets (spatial, inter-grade transmission).

The VECM is estimated allowing for a non-zero constant and a trend. The results are presented in Table 4. In addition, the results of Granger causality test between the prices of the two grades of rice within the major hinterland markets and from the port market to the hinterland markets are included in the last column of Table 4.

As described in Section 3, two forms of the speed of price transmission (adjustment) parameters are estimated in the VECM - $\alpha^m$ which measures the response to price shocks by the imported rice prices to correct disequilibrium and $\alpha^l$ measuring the corresponding price adjustment by the local rice prices to correct disequilibrium following price shocks in the rice market. The two parameters represent the dynamic interactions between imported rice/local rice prices within the hinterland markets or between local rice prices in the five hinterland rice markets – Accra, Kumasi, Techiman, Tamale and Bolgatanga, and imported rice prices in the port market - Tema.

[7] Since the rainfall and yield variables are estimated in their logarithm values.

The findings show that the adjustment processes by local rice prices ( $\alpha^l$ ) to attain equilibrium following price shocks is relatively faster and more robust in all cases than the corresponding adjustment by the prices of imported rice ( $\alpha^m$ ) over the period of the analysis. In all ten cases but two, the estimated significant speeds of price transmission ( $\alpha^l$ ) reveal that about 32% or more of the market disequilibrium is corrected monthly by adjustment of the local rice prices following price shocks. This means, 32% or more of the international price changes are passed on to local prices in the long run. On the contrary, only two of the estimated speeds of price adjustments ( $\alpha^m$ ) involving imported rice price in Tema and local rice prices in Techiman and Bolgatanga, error correct significantly towards the attainment of market equilibrium. The two significant estimates ( $\alpha^m$ ) show that only 4.5% and 12% of the changes in the local price are transmitted to the imported and thus world price of rice. Even though the cointegration test shows that imported and local rice prices are integrated in the long run, the VECM results indicate that local rice prices have a higher tendency to respond more rapidly than imported rice prices which are weakly exogenous[8]. In this case, changes in imported (international) prices are sluggishly transmitted to the domestic rice marketing system whereas changes in local rice prices are rapidly transmitted into domestic rice marketing system. Thus, shocks in domestic demand may affect local rice prices more than imported rice prices. The results imply that the imported rice market is weakly exogenous, and prices of the imported rice exhibit rigidity to supply-demand shocks on the price of local rice. It is a case of partial transmission of market shocks whereby changes in international prices of rice are transmitted through the border or imported prices into local rice prices, but not the other way round. In this case, local rice producers may not benefit from especially price increases sooner than observed in the international scene. This is a key empirical basis of concern of the opponents of import liberalisation of rice markets in Ghana.

**Table 4: Estimated Speeds of Price Transmission between Imported and Local Rice Prices (Non-Spatial and Spatial)**

| Markets | Imported Rice ( $\alpha^m$ ) | Local Rice ( $\alpha^l$ ) | Price Leader |
|---|---|---|---|
| Accra –Tema | -0.183<br>[-1.378] | -0.690***<br>[-3.284] | 6.937*** |
| Kumasi-Tema | 0.058<br>[0.816] | -0.381***<br>[-2.967] | 0.440 |
| Techiman-Tema | -0.046<br>[-0.512] | -0.378***<br>[-3.672] | 0.301 |
| Tamale-Tema | -0.121<br>[-1.251] | -0.220**<br>[-2.520] | 0.839 |
| Bolgatanga-Tema | -0.183<br>[-1.378] | -0.328***<br>[-3.284] | 1.987 |
| Tema-Accra | 0.020<br>[0.468] | -0.356 ***<br>[-3.144] | 2.008 |
| Tema-Kumasi | -0.019<br>[-0.830] | 0.218***<br>[3.872] | 1.381 |
| Tema-Techiman | -0.120*<br>[-1.866] | 0.738***<br>[3.889] | 0.2939 |
| Tema-Tamale | -0.124<br>[-1.661] | 1.026***<br>[3.935] | 1.3808 |
| Tema-Bolgatanga | -0.045*<br>[-1.763] | 0.320***<br>[3.671] | 1.557 |

Source: Own estimation with MoFA- Ghana data

*Notes: *, ** and *** indicate significance of the test statistics (r = 0 and r = 1) and the cointegration coefficient ( $\beta$ ) at the 10%, 5% and 1% respectively. The values in parenthesis are t-statistics of $\beta$.*

[8] Given this property of the imported rice prices, I could actually stop from testing for Granger causality from the imported to local rice prices.

The negative and the corresponding positive signs of the estimated adjustment parameters or vice versa are expected because in order for the price adjustment process to achieve equilibrium, positive adjustment by a market in the pair in each model must be accompanied by a corresponding negative adjustments by the other market in the same pair.

Lastly, test for long run Granger causality from imported rice prices to local rice prices show that imported rice prices generally do not Granger cause or lead local rice prices[9]. The low and largely insignificant causality test statistics means rice market participants in Ghana, namely producers, arbitrageurs and consumers, do not use information in the imported rice prices in determining the price of locally produced rice. It may also be due to gaps in the quality and taste of the two grades of rice or in the incomes of consumers of both grades. In any case, it is evident that even though there exists long run relationship between local and imported rice prices in Ghana, and import price have considerable influences on local rice prices, the former does not dominate the latter.

## 5. Conclusion

The findings of this study provide strong evidence of long run relationships between imported and local rice prices in Ghana. This means that over the long run, the two price categories co-move and may be driven by common stochastic processes including both local and possibly international price and output shocks. The findings also reveal that partial long run integration between the prices of the two rice grades exists; with considerable integration of local to imported rice prices, but a weak linkage from the imported to local prices of rice. Meaning that even though in the long run, changes or shocks in the local price may be transmitted to imported rice prices, these signals are too weak to strongly drive the imported rice price formation significantly.

It is easy to see how the relative volatility in international and hence import rice prices affect prices of locally produced rice while the reverse is not the case. Local rice takes less than 30% of the share Ghana's rice market and price changes in the local rice sector in which consumption is largely by poor households is not expected to influence the prices of imported rice with 70% of the market share and consumed by high income households.

Against the above evidence, imported rice prices do not Granger cause local rice prices significantly. This shows that participants in the local rice market do not use information on imported rice prices to determine the level of the latter. It is thus possible, as demonstrated by Rapsomanikis et la (2004) in Egyptian wheat markets, that imported rice price changes affect only the level of price risk and price changes for local rice producers (whose produce is not competitive enough) rather than affecting price formation.

In conclusion, it may be seen that import liberalisation policy does not hinder market integration. Similarly, import liberalisation left alone is not enough incentive to get Ghana's locally produced rice markets strongly connected to the international rice market. This can only happen with increase output and export of local rice. Thus banning rice imports or slapping imports with high tariffs in line with public opinion in Ghana might not be an option to consider. Rather integrating local rice prices to the international rice price by directly encouraging quality improvement of local rice through modern processing techniques and consequently enhancing competition between the two grades of rice at the domestic scene must be a key concern of government.

For now, organised producer and rice stakeholder groups may pursue their interest collectively, but this should exclude lobbying for import bans or the placement of high tariffs on imports since producers stand to benefit from positive international price shocks if they increase the output and quality of their produce more competitively. This is especially necessary since global food prices have since 2007 has been rising.

## References

Abdulai, A. (2000) "Spatial Price Transmission and Asymmetry in the Ghanaian Maize Market", *Journal of Development Economics,* 63: 327-49.

Abdulai A., 2007. "Spatial and Vertical Transmission in Food Staple Marketing Chains in Eastern and Southern Africa: What is the Evidence?". Paper Presented at the FAO Trade and Markets Division Workshop on Staple Food Trade and Market Policy Options for Promoting Development in Eastern and Southern Africa, Rome, March 1-2, 2007.

Ackah, C. and S. Appleton, (2007). "Food Price Changes and Consumer Welfare in Ghana in the

[9] I did not test the reverse hypothesis since my focus is to indicate whether or not imported prices play a price leadership role in price determination in Ghana's rice markets.

1990s".University of Nottingham Credit Research Paper. http://www.nottingham.ac.uk/economics/credit/research/papers/CP0703.pdf Date accessed: (12/9/09)

African Economic Review (2009). "Ghana: Recent Economic Developments". http://www.africaneconomicoutlook.org/en/countries/west-africa/ghana/. Date accessed (12/9/09)

Aker, J. C (2008) "Does Digital Divide or Provide? Information Technology, Search Costs and Cereal Market Performance in Niger" (May 2008). *BREAD Working Paper* No. 177.

Alderman, H. (1992) "Inter-commodity Price Transmittal", *Oxford Bulletin of Economics and Statistics,* 55(1): 43-64.

Alderman H. and G. E. Shively, (1996). "Economic Reforms and Food Prices – Evidence from Ghana". *World Development;* Vol. 24, No. 3. Pp. 521 -534.

Badiane, O. and G. E. Shively (1998). "Spatial Integration, Transportation Costs, and the Response of Local Prices to policy Changes in Ghana"; *Journal of Development Economics*, 56: 411-31.

Berry, S. (1997). "Tomatoes, Land and Hearsay: Property and History in Asante in the Time of Structural Adjustment". World Development Vol. 25, No. 8, Pp. 1225-1241.

van Campenhout, B. (2006) "Modelling Trends in Food Market Integration: Method and an Application to Tanzanian Maize Markets" *Food Policy,* 32, 112-27.

Deaton A. and G. Laroque (1996). "Competitive storage and commodity price dynamics". Journal of Political Economy, 1996, vol. 104, no. 5

Dercon, S. and van Campenhout, B. (1998) "Dynamic Price Adjustment in Spatially Separated Food Markets with Transactions Costs" Discussion Paper of the Centre for Economic Studies. March 1999.

Fackler, P. L. and Goodwin, B. K. (2001). "Spatial Price Analysis" in Gardner, B. and Rausser, G. (Edits). *Handbook of Agricultural Economics*, Vol. 1. Elsevier Science B.V.

FAO (2006) "Briefs on Import Surges" Issues, No 5, Ghana: Rice, Poultry and Tomato Paste. PP 4.

Golleti F.(1994). "Market liberalisation and integration of maize markets in Malawi". *Agricultural Economics,* Vol. 11, No 2-3, P. 311-324.

Golleti F. And E. Christina-Tsigas (1995). "Analysing Market Integration" in Prices, Products and People (Gregory. J. Scott, Ed); P. 325 -342.

Goodwin, B. K. and N. E., Piggott, (2001) "Spatial Market Integration in the Presence of Threshold Effects". *American Journal of agricultural Economics*, 83(2): 302-17.

Greene, R. H.(1988). "Structural Adjustment in Ghana". Food Policy Report; February, 1988.

Jebuni, C. & Seini, W. (1992) "Agricultural input policies under structural adjustment: their distributional implications". Cornell Food and Nutrition Policy Program Working Paper. Ithaca, NY, USA, Cornell University.

Mabaya E. (2003) "Smallholder Agricultural Markets in Zimbabwe: Organization, Spatial integration and Equilibrium" A Doctoral Thesis presented to the Cornell University, Ithaca, N.Y.

McCullock, N. L., Winters A. and Cirera X, 2001. A Handbook on Trade Liberalisation and Poverty. Centre for Economic Policy Research.

Motamed M., K. A. Foster and W. E. Tyner (2008) "Applying Cointegration and Error Correction to Measure Trade Linkages: Maize Prices in the United States and Mexico", *Agricultural Economics, 39:* 29-39.

Rapsomanikis G. and Sarris A. (2005). "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.

Rashid S. (2004) "Spatial Integration of Maize Markets in Post-Liberalised Uganda" Markets, Trade and Institutions Division (MTID) of IFPRI Discussion Paper No. 71.

Rickard, B. J. and D. A. Sumner (2006) "EU Support Reductions would benefit California Tomato Growers and Processors"; California Agriculture, Vol. 60 No. 4, Pp. 207-210.

Stiglizt J. E. (2002). "Globalization and its Discontent". Penguin Group (Pub.); Pp 320

World Bank (2008). "Agriculture for Development" in World Bank Development Report 2008; Pp 96-136.