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# **DO DOMESTIC FOOD PRODUCERS IN FOOD DEFICIT COUNTRIES BENEFIT FROM INTERNATIONAL TRADE? EVIDENCE FROM RICE MARKETS IN FIVE WEST AFRICAN COUNTRIES**

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## **ABSTRACT**

*Motivated by the negative impact of the 2006-2008 food crises on rice consumer prices and welfare, the impact of international trade on producer prices of rice in food deficit countries was examined using data collected from five randomly selected West African countries and analyzed with econometric GARCH estimation procedure. The finding shows that domestic rice producers in food deficit countries benefit from international prices in countries where market liberalization is not significantly associated with instability in domestic producer prices. Further evidence leads to the conclusion that: urbanization results into preference for imported rice and low producer prices in some areas; market information system, market access infrastructure and integration of domestic markets with regional and global types are poorly developed; official development assistance (ODA) is an important policy tool for development of rice sector in these areas; and that policy efforts in these countries at controlling producer price volatility during the 2006-2008 food crises were largely effective. The study suggests that in order to ensure a competitive domestic rice market, curb producer price volatility and benefit from international trade, a concomitant heavy public investment in agriculture, development of market access infrastructure, market information system as well as market integration are necessary policy actions in these countries.*

**Keywords:** Producer prices; market liberalization; price transmission; producer price volatility

## **1. INTRODUCTION**

The pursuance of market liberalization or free trade policy globally is premise on the assumption that interchange of commodities across political boundaries without restrictions-such as tariffs, quotas or foreign exchange conditions-will increase wealth of nations. This is because, with market liberalization, countries will be able to purchase maximum amount of commodities it wants at the lowest possible price. In other words, each nation is expected to increase its wealth by exporting goods that it produced cheaply and importing goods that was produced cheaply elsewhere. However, unrestricted imports could hurt domestic producers in importing country in the absence of tariff and favorable foreign exchange regime. In contrast, consumers often gain when import price is lower based on comparative production advantage in the exporting country.

In line with the argument that developing countries have comparative advantage in agricultural production, thus needing only to forward their export of agricultural produce to the rich markets so as to gain from trade liberalization, many West African countries initially invested in capital intensive technologies in a pattern similar to the green revolution in Asia with the aim of benefiting from international trade in future. This pattern was later modified based on the new expectation that market reforms such as removal of price controls, deregulation of agricultural marketing, closure of state owned enterprises that monopolized agricultural trade and changes in the foreign exchange market will provide greater incentives for export and improve price incentives for farmers. Additionally, it is expected that reduced government intervention in the agricultural sector would be enough to generate a supply response and allow well-functioning markets to emerge quickly (Kherallah et al. 2000).

Boxes 1-5 describe the steps taken in the direction of market reform by some sampled West African countries:

## **BOX 1: BURKINA FASO**

According to Ruijs (2002), the implementation of Structural Adjustment Programme in this country started in the early 1990s while the country devaluated its currency in 1994. In this view, the government of Burkina Faso liberalized the cereal market in 1992 with the objectives of improving the accessibility of the populace to cereals and to increase food security. Accordingly, the cereal board OFNACER (Office National des Céréales) was abolished and a number of measures were announced to create an environment favorable for efficient cereal trade. These measures included 1) setting up an organization to manage a national security stock of cereals (SONAGESS; Société Nationale de Gestion des Stocks de Sécurité), 2) informing producers, consumers and traders about current market prices (via the price information system SIM; Système d. Information sur les Marchés), 3) permitting a free circulation of cereals over the country, 4) encouraging banks to facilitate credit granting to cereal traders, and 5) enforcing competition between traders.

Though studies by Deybe and Robilliard (1996); Egg et al. (1997); Ki-Zerbo (1997); Ki-Zerbo and Ancey (1997), Yonli (1997); AHT (1999); Danagro (1999); Bassolet (2000); Sirpé (2000) have argued that cereal market after market liberalization has functioned in a way to increase competitions between cereal traders, improved market transparency, and increase price-consciousness of producers, Ruijs (2002) notes that despite these improvements, many difficulties persist. These include challenges due to partial implementation of measures or malfunctioning of policy institutions. Others due to the peculiar characteristics of the cereal market in Burkina Faso include thin or fragmented market structure which inflates marketing costs; none existent, unreliable and inaccessible marketing information; and non-transparent

and arbitrary official information (Bassolet, 2000) which makes traders to stick to their individual marketing networks nested in geographical regions.

## **BOX 2: GHANA**

Agriculture is the most important economic sector in Ghana, contributing about 36% to overall GDP and employing about 70% of the total workforce (ISSER, 2005). Processing, transport, and trade of agricultural products and materials are also linked to this sector while 90% of value-addition within agriculture comes from small-hold farmers, using rudimentary technology (Khor and Hormeku, 2006; GoG, 2003)

A historic account of the implementation of market reform in Ghana by Beltow and Schuithes (2007) shows that the country has several histories of economic reforms since its political independence in 1957 and had adopted a flexible exchange rate system by 1986. According to this view, Ghana's agricultural policy, in the early stage of reform was guided by the objective of food security and maximization of export earnings through increased producer prices, subsidies for inputs, and institutional development. Consequently, in the early phase of reform in the 1990s, subsidies were removed and guaranteed prices abolished with a view to move towards complete market orientation policy. Tariff reduction in Ghana was arranged in 1983, when the tariffs were cut to rates of 30, 25, and 0%. The second phase of the liberalization programme (beginning in 1986) promoted the further liberalization of imports, reduced domestic price distortion, and deregulated the commodity and service markets. An increased growth rate, reduced budget deficit, devaluation of the currency, and a lower rate of inflation were parts of the programme which aims at increasing Ghana's exports and diversifying its export base. The current applied tariffs for the country in agricultural

sector (for example, 20% for rice, poultry and tomato) were introduced in 1992. The termination of the import licensing system and the progressive reduction of tariffs also meant that the imports of goods into the Ghanaian market increased rapidly, thus making Ghana farmers to become more exposed to competition from cheap imports.

In the case of rice economy in Ghana in the era of market liberalization, imported rice has a 20% ad valorem tariff to which a 12.5% VAT is added. And, in response to rice import surge an increase in tariff from 20% to 25% was considered in 2003 but was eventually not retained due to the willingness of the government to maintain an economic policy that complies with the recommendations of Bretton Wood's institutions as the country has often been counted as a prime example for good reforms (BMOS AGRO-CONSULT, 2003; GoG, 2003).

Lancon and Benz (2007) adduced the reason for surge in rice import and rapid demand for imported rice in Ghana to be related to structural changes in consumers' behavior. This is induced by a continuous increase in per capita income as this society becomes radically more urban in its way of living and leaving gradually behind a diet inherited from rural areas. Thus, the combination of increasing urbanization, income growth in synergy with the increasing availability of imported rice are the factors responsible for bringing the average urban population in this country to pass a threshold and accelerating their transition to a rice diet.

Another important aspect of market reform in Ghana is the step-by-step removal of input subsidies. However, Kor and Kormeku (2006) argue that the removal of subsidies on fertilizer down to zero in 1990 made prices on fertilizers to increase astronomically and its consumption reduced. Similarly, Oduro and Kwarzo (2003) earlier revealed that the removal

of fertilizer subsidies had a negative effect on some crops as their production went through a decline, and that the removal of subsidized credit for agriculture in 1987 had devastating effects on small-scale farmers. Bertow and Schutheis (2007) on the other hand, revealed that removal of minimum guaranteed prices affected several crops, especially those competing with subsidized imports

### **BOX 3: MALI**

Mali is a land-locked country with 70% of its population being rural and agricultural (Moseley et al. 2010). Cotton is the dominant cash crop, accounting for over 80% of export revenues of Mali (World Bank, 2008). Rain-fed cereals (mainly millet, maize, and sorghum) constitute 85% of cereal calories, with rice providing the remaining 15%. However, rice is more important in urban areas, accounting for half of cereals consumed (Moseley, 2010).

Mali produces 80% of its own rice, compared with 15% for The Gambia and 40% for Côte d'Ivoire. Thus, while Mali imports rice, it is not a net food importer in most years (World Bank, 2008). Carney (2001); Moseley *et al.*, (2010) further attributes this situation to the fact that Mali's inland Niger Delta is one of the oldest rice production site in the world, the zone where African rice (*O. glaberrima*) was likely domesticated coupled with the fact that much of the rice traditionally grown in southern Mali's seasonal wetland are for home consumption. Moseley *et al.* (2010) attributes the higher level of national food self-sufficiency in Mali that made it one of the few African countries least hit by 2007-2008 food crises to be due to: the country's landlocked status which made imported rice relatively more expensive in favor of domestic rice producers; Mali's improved internal road network in recent years which reduces the cost of getting local rice to the market (Koenig, 2005); and

the fact that local rice producers are aided by urban consumers who prefer local to imported rice, even when (to a point) local rice is more costly.

According to Moseley (2010) explains the shifting mix of imported vs. local grains consumed in Mali (particularly by urban dwellers) to be due to the increased availability imported rice made possible by the modest tariff barriers in place coupled with the conditions created by drought and food shortages in the early 1970s and mid-1980s. Koenig, (2005) corroborates this view by noting that the increasingly urban nature of Mali's population (30% of the population) could partially explain a shift from coarse grains to rice. Studies by Seck (2008); Koenig (2005), indeed show that rice is favored by Mali urban dwellers because of the ease and speed of preparation- a perception that rice is a more desirable foodstuff for middle-class households, and the ability of rice to expand greatly when it is cooked.

As in Côte d'Ivoire, policies giving priority to rice in Mali national development strategies date to the French colonial period with Office du Niger (ON) in charge of irrigation scheme for cultivation of cotton and rice (Moseley *et al.* 2010; Van Beusekom, 2002). Consistent with the modernization approach of the time, the state sought to capture surpluses from agriculture (including coarse grain trade) via marketing boards to invest in industry (Dembele and Staatz, 2002). However, the adoption of market liberalization policy in the 1980s and 1990s in the form of structural adjustment made the country to make concerted efforts to liberalize cereals marketing (Moseley *et al.*, 2010). Accordingly, tariff barriers on imported grains were reduced, government control of fertilizer marketing and rice importation before the reform were substantially abolished after the implementation of market reform (World Bank, 1994). The grain marketing board [Office des Produits Agricoles du Mali (OPAM)], which



had controlled consumer and producer prices, was also forced to relinquish its monopoly control. Though this loss of monopoly control by OPAM created a much larger official space for private grain traders, however, Moseley *et al.* (2010) reports that OPAM continued to market much of the rice produced by the ON even though it was losing money and draining state resources (because the state retained management of this scheme). Nevertheless rice from the ON remained competitive because of donor investments in the scheme and Malians' taste preference for local rice.

#### **BOX 4: NIGERIA**

The 1986 budget in Nigeria introduced the trade liberalization regime as a component of the structural adjustment programme, SAP, (Adubi and Okumadenwa, 1999; Ojehomon *et al.* 2009). The regime included abolition of the import licensing system, reduction of import restrictions, modification of advance payment of import duties, overhauling of custom and excise duty schedules, establishment of tariff review board, allowance of domiciliary accounts operation, abolition of export prohibition, dissolution of commodity boards, and establishment of an export development fund, guarantee scheme, insurance scheme and export promotion zone (Adubi and Okumadenwa, 1999)

The ban on rice importation in Nigeria remained in effect till 1995 when it was lifted in line with the World Trade Organization agreement on trade liberalization. Since the ban was lifted, government has resorted to the use of tariff measures (Lancorn and Benz, 2007) to control the ever increasing rice imports. For instance, following the rice import ban removal in 1995, rice imports was imposed a tariff of 100% and reduce by half in the following years. Ojehomon *et al.* (2009) further reports that the tariff on rice in Nigeria increased from an average of 50% during the 1996-1999 period to 100% in 2002 and 150% in 2003. The report specifically

shows that in 2009, the tariff was adjusted down to 30% (which consists of 20% tariffs and 10% tax) for milled rice and 10% tariffs for brown rice in line with the ECOWAS agreement on unified tariffs on tradable commodities.

A detailed description of exchange rate policy in Nigeria by Ojehomon *et al.* (2009) shows that before the introduction of SAP, exchange rate and foreign exchange allocation policies acted as major sources of price distortion and disincentive towards farming enterprises. This was because past governments had pursued exchange rate policies that kept nominal exchange rate constant, even in the face of widening and divergence between rising domestic inflation and relatively stable international price level. According to this view, exchange rate was fairly stable between 1960 and 1970, especially when domestic inflation kept pace with international inflation until the advent of monetary expansion in the 1970s when domestic inflation began to outstrip international inflation rate. The result of this over-valued exchange rate was the alteration of the competitiveness and profitability of farm business in favor of other activities (NCEMA (2008), Ojehomon *et al.*, 2009). Moreover, Ojehomon *et al.*, 2009 reports that the anticipated increase in rice production, for instance, could not be achieved as a result of astronomic increase in prices of agricultural inputs resulting from the exchange rate policy.

Rice consumption in Nigeria is characterized by a rice diet transition already completed to a large extent in the seventies (Lancorn and Benz, 2007). Osiname (2002) further shows that the substitution of rice for coarse grains and traditional roots and tubers fuelled growth in demand for rice in Nigeria. Lançon *et al.* (2002) on the other hand notes that Nigerian consumers preferred to purchase imported rice for its cleanliness and homogeneity even at a price that is 20% to 30% higher than the local rice, and do not consider the two products as

equivalent, given the price gap between the imported and local rice. The implication is that the expansion of the imported rice market share may not be backstopped by a price battle between rice importer and local rice dealers in this country.

Fertilizer market in Nigeria is characterized by marketing control and price subsidization before and after the implementation of reform (World Bank, 1994; Idachaba, 2000). Given these situations, it can be deduced that Nigeria has only been involved in partial implementation of market liberalization policy

#### **BOX 5: TOGO**

Togo is a least developed country in West Africa, a member of the GATT (1964) and is one of the original members of the WTO (WTO, 1999; UN, 2000). The agricultural sector represented 34% of Togo's GDP in 1996 while food production constitutes about two-thirds of agricultural GDP.

Economic and trade liberalization in Togo started in the 1980s and continued throughout the 1990s. The general objectives of government policies in the agricultural sector include: ensuring food self-sufficiency and food security; increasing agricultural exports and nontraditional tradable products; and improving the income and the living standard of the rural population. According to UN (2001), liberalization of export and import markets is encouraged in Togo by Decree No. 92-092/PMRT of 1992, which provides legal basis for government to take measures such as: suppression of import licenses and export authorization for cereal and livestock; and actions to safeguard and ensure local market supplies in times of difficulties. Given this framework, WTO (1999) reports that Togo

economy remains among the most open in the West African sub region while World Bank, (1994) revealed that, to a large extent, the public monopoly of rice imports before market liberalization disappeared after the implementation of the reforms.

Fertilizer marketing in Togo before the reform was characterized by limited government intervention by buying agents. The coming of reform led to no further government intervention except in food security stocks (World Bank, 1994). However, low investment remains a major problem of this country after the crisis (WTO, 1999). Consequently, between 1990 and 1995, the trade balance of Togo was in deficit, rising to 88 million CFA francs in 1995. Nevertheless, its agricultural trade balance was positive until 1995 and again in 1996, largely due to an increase in cotton exports and the devaluation of the CFA franc (UN, 2000).

However, despite the implementation of market reform in developing countries many authors (Seppala, 1996; Kherallah, 2000; Lancon and Benz, 2007; FAO 2001, 2000) have argued that the implementation of market reform in developing countries has had limited impact on the economies of these countries. FAO (2003) specifically reports that, in many cases, this policy has led to drastic reduction in public resources available for supporting food production and opening-up of markets in these countries to world suppliers. Moreover, many reports in empirical literature on the impact of 2006-2008 food crises points to the fact that food deficit countries could be at the receiving end of negative externalities associated with partial or full implementation of market liberalization policy. For example, the work of Soulé and Blein (2008) shows that Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo together lost between US\$ 690 million and US\$ 1,380 million due to their decision to

suspend custom duties and value added tax in order to check excessively high prices of food between 2006 and mid 2008. A report by FAO similarly revealed that while the food crisis lasts between 2006 and 2008, the cost of food imports for the developing countries increased by 85 per cent while the cost for the low-income food-deficit countries (LIFDCs) increased by 35 per cent, implying that the least developed countries (LDCs) and LIFDCs have had to reduce their volume of imports owing to global hike in food prices. Study by FAO, (2008) further estimates that about 75 million more people have been thrown to a level below hunger threshold as a result of the impact of high prices of 2007, and another 40 million in 2008, bringing the total number of undernourished people to 963 million. Available evidence has also shown that recent food price shocks have contributed to an increase in the incidence and depth of poverty in rural areas of Africa mainly because small farmers in this region are net consumers of food. Further evidence provided by World Food Programme (WFP) revealed that rises in food prices is threatening the food security of the already poor aid beneficiaries in another area of the region leading to an exponential increase in the number of beneficiaries as the already alarming malnutrition situation worsens, especially in areas, where children and girls were highly vulnerable and already facing food insecurity before the crisis (Lambers, 2009). This gives rise to a situation where poorest households are being severely hit, incurring debts, resorting to reduced expenditures in areas such as health and education and to changes in diet to cheaper, less nutritious staples (Lambers, 2009; World Bank *et al.*, 2009), and poor families taking their children out of education and putting them into low paying work (Lambers, 2009).

Moreover, evidence provided from the survey of MENA region by WFP shows that since the onset of food price increases, around 97% of households (in 15 selected governorates) had not had enough money for food and other basic essentials while over 90% had to rely on less

preferred and cheaper food and had reduced the size of their meals (WFP, 2008). Benmehdi (2009) also shows that, with food price increases, ‘Moroccan families – especially those on low incomes who rely on vegetables as a staple due to the high cost of meat – are suffering from the current price hikes with women buying and cooking less food for their families.

This study contribute to the existing literature on the effect of trade liberalization on the prices received by food producers in food deficit countries by examining the questions of whether the international price of rice associated with market liberalization gets transmitted to domestic producers in food deficit countries? what other factors influence rice producer prices in these countries? And, whether government policies in these countries during the 2006-2008 food crises were effective in controlling volatility of producer prices?

## **2. METHODOLOGY**

**Method of Data Analysis:** The study employed regression procedure within the family of the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) regression technique. Additionally, the t-test of means had been used to differentiate between means of volatilities of producer prices before and after the implementation of market reform.

In this study, the GARCH models (Garch -in- mean, Threshold GARCH and Exponential GARCH) have been used to simultaneously estimate the mean and the conditional variance equations of rice producer prices. The GARCH model is a variant of the more general autoregressive conditional heteroskedasticity (ARCH) models introduced by Engle (1982) and generalized as GARCH (Generalized ARCH) by Bollerslev (1986) which are generally used for joint estimation of the mean and conditional variance equations. More specifically, the GARCH

model was developed to capture the heteroskedasticity (empirical evidence of non-constant variance of shocks) observed in many financial and macroeconomic time-series. The form of heteroskedasticity embedded in the GARCH model also allows the variance of the forecast error to depend on the previous period variance and the size of the previous period's shock.

In its general form, an ARCH model is of the form:

$$Y_t = \gamma_i X_{it} + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \omega + \alpha \sigma_{t-1}^2 + \beta \varepsilon_{t-1}^2 + \delta_i X_{it} \quad (2)$$

Where  $Y_t$  is the endogenous dependent variable;  $X_i$  is a vector of exogenous regressors;  $\gamma_i$  are the coefficients associated with the exogenous regressors in the mean equation;  $X_i$  are predetermined regressors;  $\sigma_t^2$  (the GARCH term) is the conditional variance of the dependent variable;  $\omega$  is the mean of conditional variance;  $\varepsilon_{t-1}^2$  (the ARCH term) is the news about volatility from the previous period measured as the lag of squared residual from the mean equation;  $\alpha$  and  $\beta$  are the coefficients associated with the ARCH and GARCH term respectively. Introduction of conditional variance into (1) leads to an ARCH-in-Mean (ARCH-M) model (Engle, Lilien and Russel, 1987) applicable in areas where the expected price of an asset is related to the expected asset's risk.

In this model, the coefficient on the expected risk is a measure of the risk-return tradeoff. Furthermore, higher order GARCH models, denoted GARCH (p, q), can be estimated by choosing either p or q greater than 1. The representation of the GARCH (q, p) conditional variance is of the form:

$$\sigma_t^2 = \omega + \sum_{k=1}^p \alpha_k \varepsilon_{t-k}^2 + \sum_{j=1}^q \beta_j \sigma_{t-1}^2 + \delta_i X_{it} \quad (3)$$

where  $q$  is the order of the GARCH terms and  $p$  is the order of the ARCH term.

Likewise, the TARARCH or Threshold ARCH model as introduced independently by Zakoian (1994) and Glosten, Jagannathan, and Runkle (1993) is usually employed to model returns where asymmetric responses to good and bad news on return are possible. The specification for the conditional variance of TGARCH (1, 1) variant is of the form:

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \varphi \varepsilon_{t-1}^2 d_{t-1} + \beta \sigma_{t-1}^2 + \delta_i X_{it} \quad (4)$$

Where  $d_{t-1} = 1$  if  $\varepsilon_t < 0$ ; and 0 otherwise.

In this model, good news ( $\varepsilon_t > 0$ ), and bad news ( $\varepsilon_t < 0$ ), are assumed to have differential effects on the conditional variance—good news has an impact on  $\alpha$ , while bad news has an impact on  $(\alpha + \varphi)$ . If  $\varphi > 0$ , a leverage effect exists in that bad news increases volatility. If  $\varphi \neq 0$ , the news impact is asymmetric.

The EGARCH or exponential GARCH model, on the other hand was proposed by Nelson (1991). The specification for the conditional variance is:

$$\log \sigma^2 = + \square \log \sigma_{t-1}^2 + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad (5)$$

In this specification, the left-hand side of the conditional variance equation is the *log* of the conditional variance. This implies that the leverage effect is exponential, rather than quadratic, and that forecasts of the conditional variance are guaranteed to be nonnegative. The presence of leverage effects can be tested by the hypothesis that  $\gamma > 0$ . The impact is asymmetric if  $\gamma \neq 0$

## **Estimation**

The dependent variable in the estimated mean equation is the natural logarithm of domestic producer price of paddy rice in each of the sampled countries. The regressors in the mean



equation were also transformed into their natural logarithm forms. These consist of one year lagged value of the dependent variable; domestic rice yield in tonne per hectare (tonne/Ha); price of milled imported rice in thousand-dollar per tonne; exchange rate measured as the ratio of local currency to a U.S. dollar; percentage of the urban population in the total population of the country; fuel imports measured as percentage of value fuel import of the total merchandise imports of the country; current final household consumption expenditure in local currency unit (LCU); and, the net official development assistance (ODA) in current US dollar. Furthermore, aside from the ARCH and ARCH terms in the conditional variance equation, a dummy variable, representing domestic policy actions of the country against the 2006-2008 food crises was also included as regressor to examine the role these policy played on price volatility. This was measured with value of 1 for year between 2006 and 2008, otherwise zero

### **Residual test**

In order to ensure that the true variance process in the data is not different from the one estimated, the Ljung Q-diagnostic tests of the standardized residual in ordinary forms was conducted to detect the presence of auto correlation in the variance. This is based on the assumption that, if there are no ARCH left in the variance, and the variance equation is correctly specified all the Q –statistics should not be significant.

**Sampling Technique and Sources of Data:** The sample consists of five countries randomly selected from West African Region. These consist of Burkina Faso, Ghana, Mali, Nigeria and Togo. Data on these countries spanning between 1966 and 2009 were collected from the websites of FAO ([www.faostat.fao.org](http://www.faostat.fao.org)) and the World Bank ([www.worldbank.org](http://www.worldbank.org)).

#### **4. REGRESSION RESULTS**

##### **Do the domestic rice producers in food deficit countries benefit from international rice price?**

The results summarized in tables 1-3 indicate that in Burkina Faso and Nigeria cases where market liberalization is associated with significantly higher producer price volatility, no positive causal influence could be established between international rice price and domestic producer prices of the commodity, suggesting that the investment decision of farmers in this countries are negatively affected by market liberalization. In contrast, evidence of positive transmission of international prices to rice producers were found in Mali, Ghana and Togo where market liberalization significantly lowers domestic producer prices of the commodity.

##### **What other factor(s) influence rice producers' prices in food deficit countries?**

The impact of increases in yield of local rice on domestic producer prices ranged from the significantly negative effects in the cases of Ghana and Togo to the lack of influence in the cases of Burkina Faso, Mali and Nigeria, suggesting the existence of sub-optimal level of market access infrastructure, market information system and integration of local rice market with regional and international markets in these countries. Moreover, evidence that favorable exchange rate through its effect on international price leads to increases in producers' prices was found in the case of Ghana while the result for Nigeria is suggestive of the fact that high exchange rate drives producers prices through its effect on cost of domestic rice production.

Furthermore, the result for Togo and Ghana provide evidence that urbanization could decrease consumption of local rice in preference for imported rice; and that increases in final consumption expenditure of households could lead to increases in rice producers' price in food deficit countries. Moreover, the findings concerning the role of official development assistance (ODA) in the sampled countries show that, in most cases, higher levels of ODA are associated with

higher levels of domestic rice producer prices, suggesting that international financial assistance and food aids are desirable instruments for development of rice sub sector in food deficit countries.

### **How effective were the policy measures of food deficit countries against food price volatility during the 2006-2008 food crises?**

Except in the case of Ghana, known for *de jure* market liberalization policy, which shows significantly higher producer price instability during the crises, policy measures adopted by government in other sampled countries during the food crises significantly reduced the volatility of rice producer prices, suggesting that removing import tariff, imposing import quotas and monitoring of early warning signals are important mechanisms for avoiding and managing food crises in countries where partial market liberalization are practiced.

## **5. CONCLUSION AND RECOMMENDATION**

The finding in this study leads to the conclusion that domestic rice producers in food deficit countries benefit from international prices in countries where market liberalization is not associated with instability in domestic producers' prices, suggesting that the investment decisions of domestic rice producers in food deficit countries are in some cases disturbed by market liberalization. Further evidence leads to the conclusion that: urbanization results into preference for imported rice and low producers' prices in some of these countries; market information system, market access infrastructure and integration of domestic markets with regional and international ones are poor developed; official development assistance (ODA) is an important tool for development of rice sector in these areas; and that policy efforts aimed at controlling producer price volatility in these countries during the 2006-2008 food crises were largely effective. The study suggests that concomitant heavy public investment in agriculture,

development of market access infrastructure and market information system and integration of domestic rice markets with regional and international types in food deficit countries are necessary ingredients to curb producers' price volatility and benefit from international trade in rice.

**TABLE 1: GARCH ESTIMATE OF PARAMETERS OF RICE PRODUCER PRICE AND ITS VOLATILITY IN WEST-  
AFRICA**

VARIABLE	Burkina Faso	Ghana	Mali	Nigeria	Togo
	Coefficient (z-value)	Coefficient (z-value)	Coefficient (z-value)	Coefficient (z-value)	Coefficient (z-value)
<b>MEAN EQUATION</b>					
GARCH	-	-0.81(-2.76)***	-	-	-
SGR(GARCH)	-1.75(-1.28)	-	4.01(2.66)	1.68(2.65)***	-
CONSTANT	-1.05(-0.32)	2.89(1.02)	0.36(0.17)	-5.08(-2.00)**	-4.46(-3.85)***
PRODUCERS'PRICE(-1)	0.42(1.81)*	0.03(0.24)	0.64(11.79)***	0.62(4.15)***	0.37(3.99)***
RICE YIELD	0.02(0.94)	-0.03(-1.68)*	0.03(0.49)	0.32(1.48)	-0.12(-1.86)*
IMPORT PRICE	0.02(0.54)	0.09(1.67)*	0.07(1.84)*	0.04(0.73)	0.17(9.15)**
EXCHANGE RATE	0.16(1.04)	0.07(0.90)	0.33(4.13)***	0.28(2.72)***	0.09(0.86)
URBAN POPULATION	-0.41(-1.30)	-2.11(-2.06)**	0.41(0.84)	1.13(1.15)	-0.96(-2.86)***
FUEL IMPORT	0.16(0.85)	-0.20(-3.77)***	0.19(3.11)***	-0.07(1.72)*	0.14(3.42)***
HOUSEHOLD FINAL EXP.	-0.01(-0.04)	1.05(5.80)***	-0.11(-0.71)	-	0.50(5.41)***
NET ODA	0.39(3.93)***	-0.13(-1.72)*	0.13(2.85)***	0.02(0.76)	0.07(1.73)*
<b>VARIANCE EQUATION</b>					
MEAN GARCH	0.01(2.78)***	0.00(1.69)*	-5.95(-5.44)***	0.02(4.21)***	0.01(2.82)***
ARCH(1)	0.07(0.82)	0.06(0.70)	-	0.10(0.83)	0.26(0.77)
(RESID<0)*ARCH(1)	0.02(0.07)	-	-	-	-0.36(-1.05)
[RESID/SGR[GARCH](1)	-	-	0.36(2.20)**	-	-
RESID/SGR[GARCH](1)	-	-	-0.25(-2.95)***	-	-
EGARCH(1)	-	-	-0.17(0.73)	-	-
GARCH(1)	0.50(2.42)**	0.73(16.25)***	-	0.52(4.52)***	0.45(1.82)*
ADJUSTMENT POLICY DURING 2006-2008 FOOD CRISES	-0.01(-3.96)***	3.27(4.17)***	-0.53(-1.52)	-0.02(-4.86)***	-0.01(-2.80)***
<b>MODEL FITNESS PARAMETER</b>					
ADJ. R2	0.93	0.92	0.98	0.99	0.94
S.E REGRESSION	0.18	1.06	0.11	0.24	0.16
DURBIN WATSON STAT.	1.91	1.80	1.89	2.23	1.61
AIC	-0.57	0.52	-1.35	0.06	-0.88
F-STAT(PROB.)	42.68(0.00)***	40.45(0.00)***	163.15(0.00)***	271.07(0.00)***	59.36(0.00)***

Source: Data Analysis, 2011

\*\*\*(\*\*)(\*)-Significant at 1%(5%)(10%)

Figure in parenthesis are t- values

**Table 2: Autocorrelations of Standardized Residuals from GARCH Model**

S/NO	Burkina Faso			Ghana			Mali			Nigeria			Togo		
	AC	Q-stat	Prob.	AC	Q-stat	Prob.	AC	Q-stat	Prob.	AC	Q-stat	Prob.	AC	Q-stat	Prob.
1	0.10	0.49	0.48	0.18	1.45	0.23	0.11	0.58	0.45	-0.17	1.19	0.28	0.11	0.60	0.44
2	0.06	0.66	0.72	0.20	3.30	0.19	-0.04	0.67	0.71	-0.00	1.19	0.55	0.14	1.49	0.47
3	-0.21	2.76	0.43	0.01	3.31	0.35	-0.02	0.69	0.88	0.03	1.24	0.74	0.16	2.73	0.44
4	-0.02	2.78	0.60	0.01	3.31	0.51	-0.24	3.49	0.48	-0.12	1.85	0.76	0.10	3.20	0.53
5	-0.19	4.52	0.48	0.00	3.31	0.65	-0.05	3.61	0.61	0.14	2.75	0.74	0.01	3.20	0.67
6	-0.04	4.58	0.60	0.03	3.35	0.76	0.05	3.73	0.71	0.13	3.65	0.73	0.04	3.29	0.77
7	0.09	5.02	0.66	-0.04	-0.05	0.84	0.07	3.96	0.79	-0.20	5.64	0.58	-0.06	3.46	0.84
8	-0.21	7.43	0.49	-0.01	3.44	0.90	-0.03	4.02	0.86	-0.00	5.64	0.69	-0.14	4.49	0.81
9	-0.01	7.43	0.59	0.01	3.45	0.94	0.05	0.07	0.90	-0.13	6.50	0.69	-0.11	5.22	0.82
10	-0.02	7.44	0.68	-0.02	3.47	0.97	0.14	5.30	0.87	-0.13	7.40	0.69	0.07	5.54	0.85
11	0.17	9.26	0.60	-0.04	3.58	0.98	-0.19	7.57	0.75	0.09	7.83	0.73	0.01	5.55	0.90
12	-0.08	9.70	0.64	-0.02	3.60	0.99	-0.05	7.71	0.81	0.03	7.88	0.80	-0.37	13.92	0.31
13	0.07	10.04	0.76	-0.03	0.64	0.99	-0.11	8.45	0.81	-0.07	8.15	0.83	-0.03	13.98	0.38
14	-0.00	10.04	0.76	-0.05	3.79	1.00	-0.15	9.89	0.77	-0.06	8.39	0.87	-0.33	21.03	0.10
15	-0.08	10.66	0.78	-0.04	3.90	1.0	0.06	10.12	0.81	-0.11	9.18	0.89	-0.19	23.52	0.07

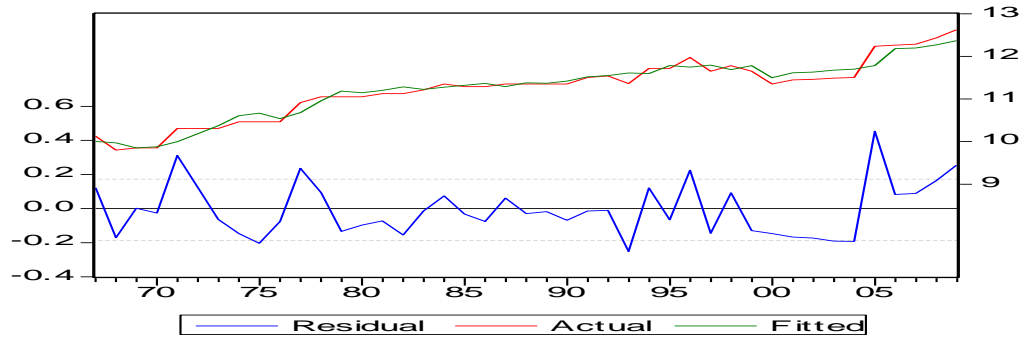
Source: Data Analysis, 2011

*Table 3. : T-test of difference in Mean Volatility of Rice producer Prices, Before and After Implementation of Market Reform*

Country	Mean Volatility Before Market Reform	Mean Volatility After Market Reform	t-statistic	Prob.
Burkina Faso	0.02	0.02	-3.09	0.01
Ghana	0.24	0.01	2.67	0.01
Mali	0.01	0.01	-1.50	0.14
Nigeria	0.002	0.008	-8.08	0.00
Togo	0.02	0.01	3.06	0.01

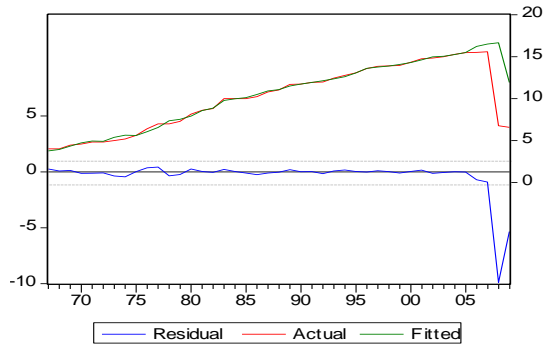
Source: Data Analysis, 2011

Note: Core market liberalization policy in these countries was assumed to start from 1990

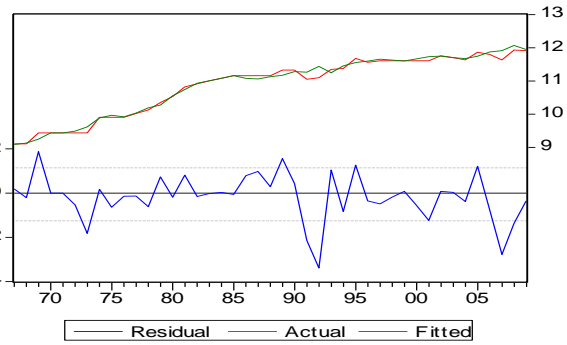


A: BURKINA FASO

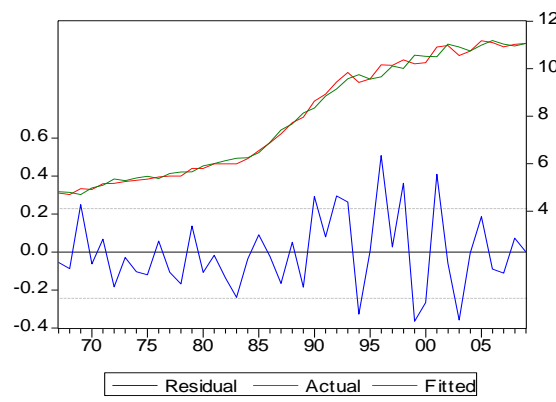
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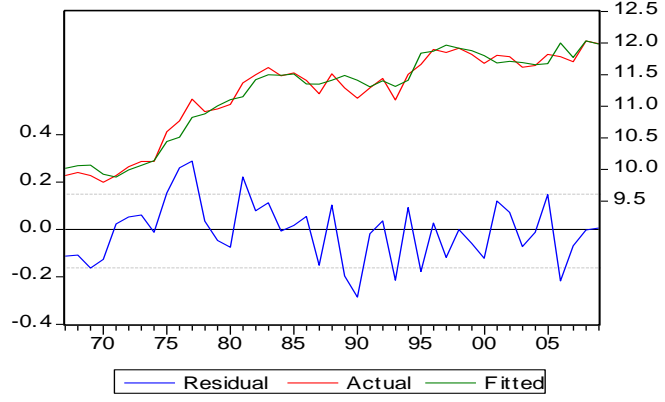
B: GHANA



C: MALI

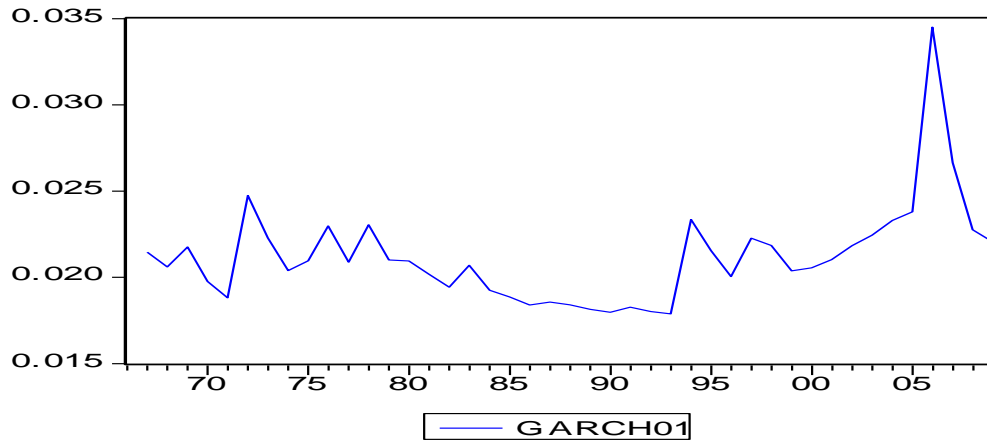


D: NIGERIA

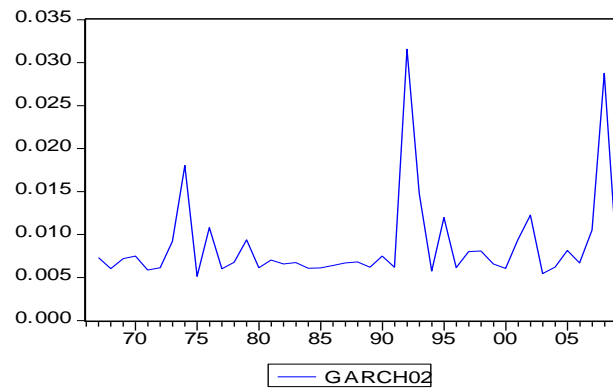
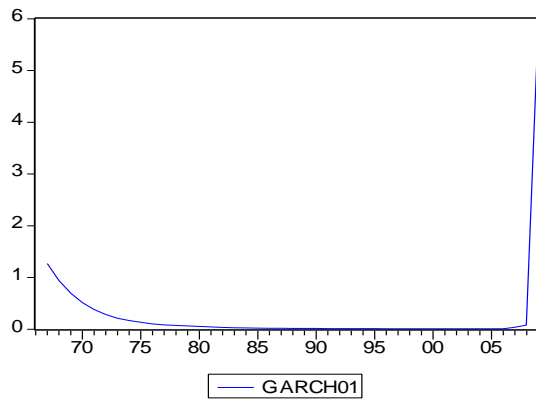


E: TOGO

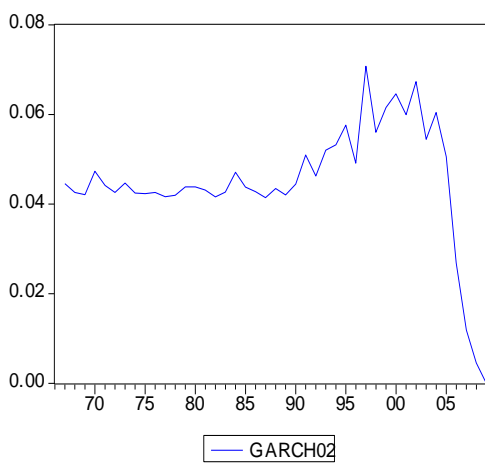
FIGURE 1: RESIDUAL, ACTUAL AND FITTED RICE PRODUCER PRICES (1966-2010)



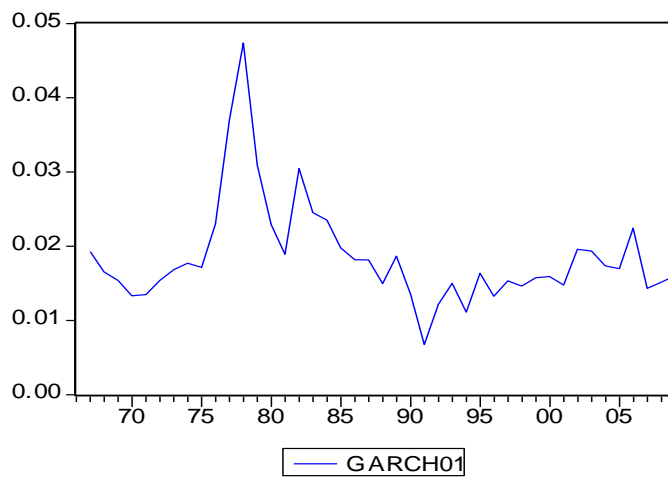
A: BURKINA FASO



B: GHANA



C: MALI



D: NIGERIA

E: TOGO

FIGURE 2: VOLATILITY OF RICE PRODUCER PRICES (1966-2010)



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