REGIONAL BULK PURCHASE OF IMPORTED RICE INITIATIVE BY ECOWAS: A FEASIBILITY ASSESSMENT

Rose Fiamohe [a], Ibrahima Bamba [b], Papa A. Seck [a], Aliou Diagne [a]
[a] Africa Rice Center (AfricaRice), 01 BP 2031 Cotonou, Benin.
[b] International Fund for Agricultural Development (IFAD),
Via Paolo di Dono, 44, 00142 Rome, Italy.
[a] Corresponding author: e.fiamohe@cgiar.org

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Abstract: Rice being the leading source of food energy in West Africa and with all ECOWAS member states being net rice importers, the adverse impact of the 2007-2008 food crisis hit the region very hardly. To mitigate its pervasive effect and prevent future international price shocks on domestic markets of the region, a regional bulk purchase of imported rice was considered by ECOWAS in 2008.

In several major rice exporting and importing countries, state trading companies and government-to-government contracts play active roles. Government-to-government rice agreements often involve importing countries such as Malaysia, Indonesia and the Philippines, and exporting countries such as Myanmar, Pakistan, Thailand and Vietnam. In West Africa however, rice is typically imported by each individual country. There is currently no regional instrument for regulating rice imports into West Africa economic regional body like ECOWAS. The trading companies and government-to-government contracts have advantage to permit economies of scale, to increase market power and to reduce transaction costs and uncertainty across stages involved in trading rice in the international market. It becomes therefore imperative for ECOWAS States to implement a regional bulk purchase of imported rice on the international rice market.

This study aims to provide some empirical evidence which support or reject the implementation of regional bulk purchase of imported rice by ECOWAS. Specifically, we estimate the ECOWAS collective market power in the international rice market. The extent to which West African can exploit some market power is determined by estimating both the elasticity of the aggregate West African import demand for rice and the elasticity of supply for major rice exporters like Thailand. Based on the residual demand and supply models, a two-country partial equilibrium rice trade model is applied to the Thailand-ECOWAS and Thailand-Nigeria rice trade. The data employed spanned from 1988 to 2010 and were collected from different sources including United Nations Food and Agriculture Organization (FAO) website, United States Department of Agriculture (USDA) website, OSIRIZ and GIEWS Food Price Data and Analysis tools etc. The primarily empirical results indicate that the ECOWAS region as a whole does possess a strong and significant market power in the international rice export market. These findings imply that bulk purchase of imported rice can confer to ECOWAS member states a greater bargaining power into rice import market. Also, Nigeria possesses more market power than Thailand exporters. Nevertheless, Nigeria market power is not really expressed in Thailand rice market due to the lack of Nigeria's policy instrument for regulating rice imports which could allow Nigeria to face the strong exporter government interference in Thailand rice market.

In conclusion, with the enhancement of the common external tariff on imported rice, which is in perspective within the ECOWAS, the implementation of imported rice bulk purchase would facilitate the rice imports trade and allow a better balance between rice imports and rice production in West Africa countries, giving producers the chance to bring production into line with regional market development. However, the type of regulation, institutional arrangements and coordination needed to ensure the effectiveness of a policy scheme such as the regional bulk purchase of imported rice needs to be further investigated. In addition, further evidence-based research is needed to inform the type of policy and institutional innovations needed in terms of public-private partnership.

***Keywords**: ECOWAS, imported rice market, bulk purchase, market power.*

INTRODUCTION

Rice is the leading source of food energy in West Africa and all members of the Economic Community of West African States (ECOWAS) are net rice importers (Seck *et al.*, 2010). Thus, the 2007–2008 food crisis hit the region very hard. Violent urban riots in connection with rising rice prices were recorded in Burkina Faso, Côte d'Ivoire, Guinea and Senegal (Anon., 2007;Seck *et al.*, 2010). To mitigate the impact of international price shocks on the domestic market of West African countries, a regional bulk purchase of imported rice was considered by ECOWAS in 2008.[1] Other benefits that ECOWAS countries could derive from the policy of regional bulk procurement of rice imports are the reduction of the transaction costs for purchasing rice on the international market and the improvement of the bargaining power of West African countries, which mostly match the 'small country' assumption. International trade theory assumes that a country is 'small' when its volume of import or export does not affect world prices, while changes in the volumes of imports and exports of a 'large' country exert an influence on the international prices (Krugman and Obstfeld, 2003).

According to Brummer (2011), the Organization of Rice Exporting Countries (OREC) — comprising Thailand, Vietnam, Cambodia, Lao PDR, and Myanmar — has the goal of harmonizing rice supply and demand and stabilizing its price for the benefit of both consumers and producers. It would therefore be highly beneficial for ECOWAS states to implement a regional bulk purchase of imported rice on the international rice market. The key assumption behind the regional bulk purchase of rice is that, by finding an appropriate mechanism to aggregate the demand of rice for all West African countries, ECOWAS may be able to exert some influence on the international market price. The extent to which West Africa can exert some market power in the international rice market is determined by estimating both the elasticity of the aggregate West African import demand for rice and the elasticity of supply for major rice exporters like Thailand. These estimates, based on the residual demand and supply schedules, take into account the interaction between exporters and importers.

To achieve this goal, we focus first (section 2) on the rice policy background in major rice exporting and importing countries. Then (section 3), we focus on the West African imported rice market structure to identify its strengths and limitations. In section 4, we give the empirical evidence supporting the bulk purchase initiative as a policy option for dealing with the consequences of rice price volatility in the future and discuss the test results. In section 5, we draw our conclusions and suggest some actions for the implementation of bulk purchasing.

THE WORLD RICE POLICY BACKGROUND

The global economy of rice is characterized by a high geographic concentration of production and aggregate consumption (Calpe, 2006), while the international rice market is also dominated by a limited number of countries (Wailes, 2005). Asia accounts for 90 per cent of world paddy production (Chern *et al.*, 2003; Seck, 2007), and the top four leading rice exporting countries (Thailand, Vietnam, Pakistan and the USA) have accounted for over 75 per cent of the total rice volume exported in recent years. The leading rice-exporting countries are often perceived as possessing power (Jayne, 1993; Siamwalla and Hayken, 1983; Warr, 2001). With 33 per cent of the global exportable surplus in 2009, it is convenient to assume that Thailand holds some market power on the world rice export market.

Another important characteristic of the global rice market is its thinness (Wailes, 2005). The share of world rice production that enters into the global rice market is less than 7 per cent; meanwhile, wheat and maize trade accounts for 19 per cent and 13 per cent of world production, respectively (Calpe, 2004). Out of an estimated global paddy production of 718.3 million tonnes (478.9 million tonnes, milled basis) in 2011, the volume of rice that will be traded on the international market will be 33.2 million tonnes of milled rice (FAO, 2011). The international rice market is strongly segregated by type and quality (Wailes, 2005), with little substitution in consumption and production, which makes the international rice market even thinner (Childs and Hoffman, 1999). In the thin global rice market

structure, any shock affecting supply conditions in the major exporting countries can induce major price swings in the global rice market, particularly when globally held rice stocks are low (Wright, 2009).

High price variability is another salient feature of the international rice markets. Rice prices have traditionally been more variable than those of other cereals because of factors such as the geographic concentration of world rice production, the thinness and fragmented nature of the global rice market where price information is difficult to obtain, and the absence of major actors that stabilize world rice prices through stock and trade policies, as occurs in the wheat and maize markets (Jayne, 1993; Wailes, 2005). Since 2007, the rice sector has suffered a sharp rise in price instability, reflecting greater uncertainty about supply conditions in the global rice economy. The coefficient of variation of the monthly price of Thailand 5 per cent broken milled rice and Vietnam 5 per cent broken milled white rice increased from less than 15 per cent in the 1990s to more than 50 per cent in the 2000s (Seck *et al.*, 2010). In addition to the effects of unpredictable weather patterns and government policy, the sharp decline in the global rice stocks accentuated the instability of price in the international market. The level of global carryover rice stocks declined from a record of 147 million tonnes in 2000–01 to 73 million tonnes in 2004–05 and reached its lowest level in 2007 before rising to 94.4 million tonnes in 2010. Despite the recent buildup of global rice stocks, they remain below the levels reached in the 1990s.

The concentrated international rice market structure, the high price instability, and the thinness of the international market encourage most governments to limit their reliance on the international trade of rice. Several developing and developed countries for which rice is the leading staple food, pursue self-sufficiency policies or actively intervene in their domestic rice market to stabilize price levels (Seck *et al.*, 2012). As a result of pervasive distortive government interventions, rice is one of the most protected and subsidized commodities in the world (Wailes, 2005; Seck *et al.*, 2012). According to the Organization for Economic Co-operation and Development's (OECD) producer support estimate (US$ 16.5 billion in 2008–09; Durand-Murat and Wailes, 2011), rice receives the largest level of support among agricultural commodities. For example, Producer Single Commodity Transfers (PSCT) by value of receipts from rice production in 2009 was estimated at 63.95 per cent for Japan, 15.99 per cent for the European Union, and 1.56 per cent for the USA (OECD, 2011). In Japan, a country that is self-sufficient in rice, the *ad valorem* equivalent of the tariff on imported rice is 778 per cent (Yamashita, 2008). The import tariff rate is estimated at 416 euros/tonne for the European Union, 65 per cent for China, and 11.20 per cent for the USA (Dechachete, 2011). Several countries erected some export restrictions, such as export tariffs, minimum export prices, export quotas, and outright export bans during the rice crisis of 2008 (Durand-Morat and Wailes, 2011).

Moreover, state trading companies and government-to-government contracts play active roles in several major rice exporting or importing countries (Calpe, 2003; Mendez del Villar, 2006). The governments of Pakistan, China, Vietnam, and sometimes even Thailand, actively intervene in the export of rice. Countries in which a state trading agency intervenes in rice imports include, *inter alia*, the Philippines, Malaysia, India, and Indonesia (Economic Times, 2009).

The rationales underpinning the existence of state trading companies are related to both the economic characteristics of the international rice market and the status of rice in several rice exporting and importing countries. State trading companies and government-to-government contracts can permit economies of scale, increase market power, and reduce transaction costs and uncertainty across stages involved in trading rice in the international market (Jayne, 1993).

Another important group of actors in the global rice import markets are multinational grain trading firms. The multinational grain trading firms 'link domestic markets together by buying from exporters and selling to importers. Such international intermediaries exist as distinct from exporters because of the complexities of international marketing which require specialized knowledge in exchange rate conversion, ocean shipping, international legal issues, and particular information about the international market' (McCalla, 1979, cited in Jayne, 1993). Besides exchange and price risks, multinational grain trading firms run several other risks. Calpe (2006) reports that it is not uncommon for a ship to be loaded without knowing the destination of the rice, especially if it is directed to Africa. Traders also carry the financial charges until a buyer is found and the rice delivered. It is possible that some large multinational grain trading firms possess market power in some specific countries or geographical zones. In fact, many multinational grain trading firms specialize in particular geographical areas (Calpe, 2006). According to FAO (2004), these multinational firms are likely to be in a position to exert market power. This could explain the limited transmission of international price changes from exporting countries

to importing countries in West Africa. Specifically, it has been observed that a decrease in the international rice price is not rapidly transmitted or fully transmitted to importing countries in West Africa (Minot, 2011; Lançon *et al.*, 2011). A regional bulk purchase of rice is being considered as a mechanism that could counteract the perceived distortion introduced by rice exporters.

IMPORTED RICE MARKET STRUCTURE IN WEST AFRICA

The West Africa region depends on international imports for some 40 per cent of its rice supply and it bought approximately 20 per cent of the world's rice exports in 2008, amounting to 6.3 million tonnes (Baris *et al.*, 2005; Anon., 2011). It imports mainly from Asia — Thailand, Vietnam, India, and Pakistan. In 2001, Africa accounted for 47 per cent of total Thai rice exports (USAID, 2009). According to *The Rice Trader* (Rice Trader, 2011), Nigeria is the largest importer (30 per cent of imports), followed by Côte d'Ivoire (18 per cent), and Senegal (13 per cent). The West African rice market is not homogeneous, but rather segmented on the basis of quality attributes, which are complex and vary within and across countries. In countries like Guinea, Liberia, Nigeria, and Sierra Leone, consumers tend to prefer parboiled rice. The type of rice consumed in Ghana and Côte d'Ivoire appears to be more diversified, and consumers buy various qualities of white rice — both high and low quality, aromatic rice, and aromatic broken. Senegal and Gambia are principally buyers of 100 per cent broken rice on the international market (USAID, 2009).

Rice is typically imported by each individual country in West Africa, and there is currently no regional instrument for regulating rice imports into the West Africa economic region. In each country, a small number of relatively large firms tend to dominate import and wholesale functions in the rice value chain. Typically, these large firms have more of the financial and management skills needed to deal with the global logistical arrangements than other actors in the domestic rice value chain. In Côte d'Ivoire, SDTM-CI holds 70 per cent of the market share (Ouattara, 2011). Similarly, a few firms import the bulk of rice into Ghana: the top five importers — Royal Bow, CCTC, Cereal Investments Limited, Olam Ghana, and Ezaal Trading Ghana Limited — account for 77 per cent of total imports (USAID, 2009). In Mali, the imported rice market is characterized by a high concentration around two or three major importers, which cover at least two-thirds of annual imports (Baris *et al.*, 2005; USAID, 2009). In Senegal, 66 per cent of all imports flow through just four major importers, with approximately six others being responsible for the remainder (PAM, 2008). In Nigeria, the major rice importers are Stallion, Veetee, and Olam (USAID, 2009).

Rice importation is a high-risk enterprise and finance is one of the most important entry barriers into the rice import industry in West Africa. Only a limited number of actors have the credibility and necessary guarantees requested by financial institutional before they will grant access to credit to finance risky rice import transactions. The most common method for financing rice imports transactions is the letter of credit (L/C) (FAO, 2003). In general, an L/C is proposed by the commercial bank to secure credit provided to large rice importers because of the long time it takes to transport rice from ports in exporting countries to the importation ports. The L/C is also used because of the timing mismatch that exists between the flow of the physical goods and the flow of financial resources. Such a mismatch creates credit risks or a moral hazard problem. For example, if payment is made before the goods arrive, the goods may not be shipped, or the quality or other aspects of the goods may not conform to specifications, but if the goods are only paid for once received by the buyer, the buyer may delay payment. Figure 1 shows the letter of credit (L/C) financing model in which the importer provides most of the financing for the food trade transaction. It illustrates the difficulty faced by rice importers to access credit because there is no mechanism to facilitate import financing.[2]

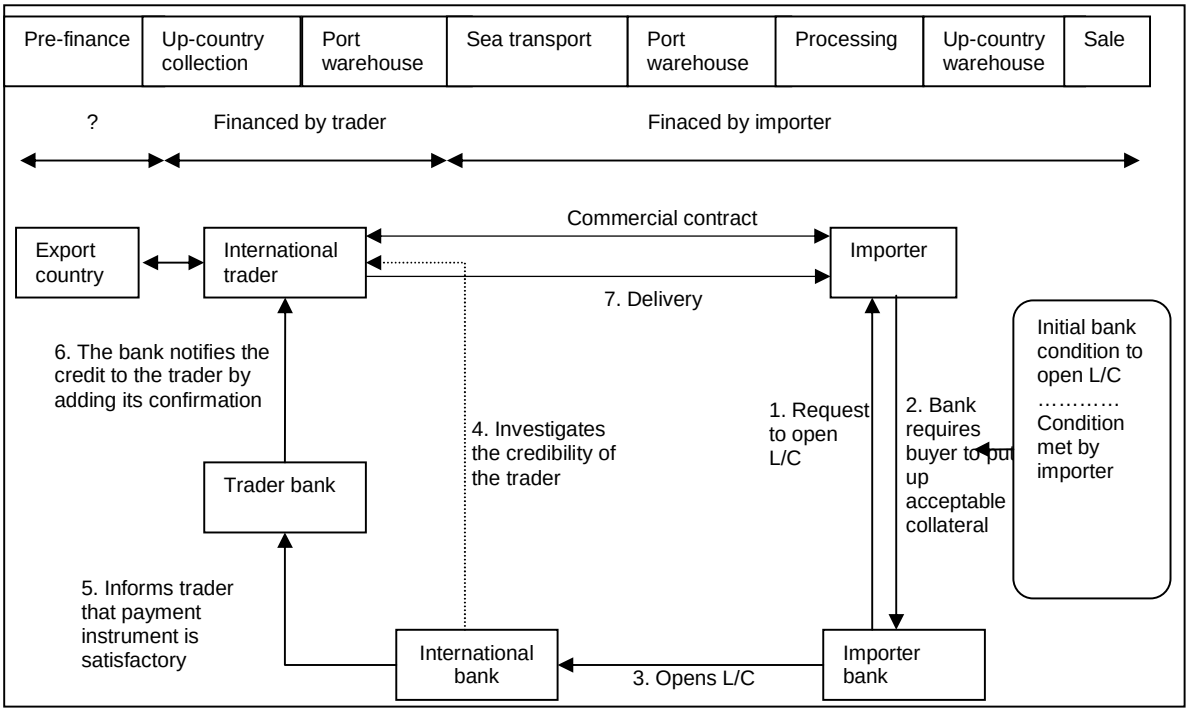

Fig. 1. The rice trading chain with standard Letter of Credit (L/C): The case of West Africa importers. *Source:* Adapted by authors from FAO (2003).

As shown in Figure 1, the buyer is asked to open an L/C under which payment for the goods is made by the importer's bank on behalf of the importer when the seller provides sufficient documentary proof that the contracted commodities have indeed been shipped. This would normally be done when the goods have been loaded onto the ship for sea transport or onto a train to take them to a port. Alternatively, the trader and importer can enter into a contract under which the importer commits to pay on the receipt of the relevant documents.

TESTING FOR THE EXISTENCE OF MARKET POWER IN RICE IMPORTS IN WEST AFRICA

With the concentration observed in the rice export supply chain, some large enterprises can exploit market power (Schroeter *et al.*, 2000; Cooper, 2003; Morrison Paul, 2001; Mingxia and Sexton, 2002). With the exception of Nigeria, the population of which exceeds 140 million, most West African countries are relatively small. By aggregating their procurement of rice on the world rice market, West Africa could be in a position to exert some market power on the international rice import markets or at least improve their bargaining power *vis-à-vis* the multinational grain trading firms or the state trading agencies on the export side.

The residual demand (supply) is the individual firm's demand (supply) which is a portion of market demand (supply) that is not supplied (demanded) by other firms in the market. In other words, the residual demand (supply) curve is the market demand (supply) that is not met by other firms in the industry at a given price. The empirical model of Baker and Bresnahan (1988) is used to specify the residual demand schedule, while the residual supply schedule is based on the approach of Durham and Sexton (1992). This latter approach was used by Anderson *et al.* (2009) to test the supply chain for dried salted cod between Norway and Portugal. According to Durham and Sexton (1992), residual demand models investigate whether the demand faced by a firm or group of firms, having incorporated their rivals' behavior, is sufficiently inelastic to enable the firm or group of firms to exercise market power. If a firm is in a perfectly competitive market, the residual demand price elasticity is very large and the firm cannot influence the market price. According to Durham and Sexton (1992), relatively inelastic residual demand for a group of firms indicates that the group has the collective ability to exercise market

power. Moreover, these authors report that the flexibility of the residual supply function jointly faced by a group of buyers provides a test of the collective market power of the group. While the residual supply equation measures the importers' market power, the residual demand equation estimates the exporters' market power.

EMPIRICAL MODEL AND DATA

Based on the residual demand and supply models, a two-country partial equilibrium rice trade model was applied to the Thailand–ECOWAS rice trade. We test the level of market power considering the trade linkage between Thailand and ECOWAS in using the following hypothesis. Market power is often the result of a highly concentrated supply structure. The leading rice exporter in the world is Thailand with 33 per cent of exportable surplus in 2009. Consequently, Thailand holds a market power in the world rice export market (Warr, 2001). Furthermore, we regard ECOWAS, which imports over 20 per cent of the rice on the international market, as a major importer. This position may thus allow ECOWAS to exert some market power if all the West African countries are able to aggregate their rice imports.

This rice trade model was also applied to the Thailand–Nigeria rice trade in order to compare the ECOWAS collective market power with Nigeria's individual market power. Nigeria is chosen because it is the biggest rice importer in West Africa. The following system of equations is the empirical specific functional form of the model:

$$\begin{cases} p_{Thai}^{Exp} = \emptyset_0 + \emptyset_1 Q_s^{Eco} + \emptyset_2 w + v \\ P_{Eco}^{Imp} = \delta_0 + \delta_1 Q_d^{Thai} + \delta_2 Z + \varepsilon \\ P_{Eco}^{Imp} = \varphi p_{Thai}^{Exp} + e \\ Q_s^{Eco} = Q_d^{Thai} \end{cases} \quad (1)$$

Where

p_{Thai}^{Exp} is Thailand rice export price (FOB),

P_{Eco}^{IMP} is ECOWAS imported rice price,

Q_S^{Eco} is Thailand residual rice supply facing ECOWAS,

Q_d^{Thai} is ECOWAS residual rice demand facing Thailand.

The terms $\emptyset_0$ and δ_0 are, respectively, the inverse of residual supply and demand regression constants. The variables *w* and *z* are other exogenous supply and demand shifters, respectively. The coefficients $\emptyset_1$ and δ_1 of the variable $Q_{(.)}$ represent, respectively, the inverse of residual supply and residual demand elasticities. The parameters $\emptyset_2$ and δ_2 are, respectively, the inverse of elasticity of the exogenous variables *w* and *Z*. These other exogenous variables include Thailand's other supply, ECOWAS's other demand, GDP, End stock, maize price (as a substitute for rice), and trend. The terms *v*, ε and *e* are the normal error terms that capture the improvement in marketing efficiency. Indices *s* and *d* represent supply and demand. The equations are estimated into natural logs to obtain coefficients that express elasticities. To estimate the model above, the time series data covering the period 1988 to 2010 was used, giving a total of 23 observations. The residual rice imports and exports data were provided by the Food and Agriculture Organization of the United Nations (FAO).[3] The end stocks data were obtained from the United States Department of Agriculture (USDA).[4] Thai rice FOB prices and Thai maize (substitute of rice) prices were provided, respectively, by OSIRIZ and GIEWS[5] Food Price Data and Analysis tools. The prices of imported rice and maize prices for ECOWAS target countries were obtained from the national office of statistics of each country, GIEWS Food Price Data and Analysis tools, CountryStat,[6] *AfriqueVerte*,[7] etc. GDP data were provided by Perspective Monde.[8] All rice prices and maize prices were deflated by price index of consumption (basis 2005=100) provided by Perspective Monde. All rice prices were also converted to US dollars per kg at the prevailing exchange rate.

Table 1: Estimation results for Thailand–ECOWAS residual rice trade (1988–2010)

Exogenous variable	Three-stage least-squares regression			Two-stage least-squares regression		
	Residual supply facing ECOWAS	Residual demand facing Thailand	Price linkage (Import price — FOB price)	Residual supply facing ECOWAS	Residual demand facing Thailand	Price linkage (Import price — FOB price)
Thai export to ECOWAS	1.535*** (4.485)[a]			1.532*** (3.472)		
Thai maize price	–0.323 (–1.094)			–0.367 (–0.941)		
Thai GDP	0.847* (1.886)			1.074* (1.824)		
Thai export to other countries	–0.0034 (–0.0264)			–0.017 (–0.0985)		
End stock	0.142 (0.588)			–0.022 (–0.0685)		
ECOWAS import from Thailand		–0.414** (–1.977)			0.029 (0.073)	
ECOWAS maize price		–0.0174 (–0.441)			–0.00037 (–0.0045)	
ECOWAS GDP		0.541 (1.266)			1.454 (1.579)	
ECOWAS import from other countries		–0.209 (–0.959)			–0.605 (–1.248)	
Thai rice price			–0.348*** (–3.450)			–0.369*** (–3.227)
Trend	–0.015 (–0.872)	–0.0076 (–1.072)	–0.0099 (–1.604)	–0.026 (–1.168)	–0.0067 (–0.576)	–0.0097 (–1.465)
Constant	–6.964*** (–5.527)	0.209 (0.197)	–0.833*** (–6.007)	–7.139*** (–4.369)	–1.375 (–0.594)	–0.856*** (–5.552)
Observations	23	23	23	23	23	23
R^2	0.825	0.499	0.392	0.830	0.570	0.387

[a] z-statistics in parentheses.

***1% level of significance, **5% level of significance, *10% level of significance.

Table 2: Estimation results for Thailand–Nigeria residual rice trade (1988–2010)

Exogenous variable	Three-stage least-squares regression			Two-stage least-squares regression		
	Residual supply facing Nigeria	Residual demand facing Thailand	Price linkage (Import price — FOB price)	Residual supply facing Nigeria	Residual demand facing Thailand	Price linkage (Import price — FOB price)
Thai exports to Nigeria	0.135*** (5.34)[a]			0.149*** (4.061)		
Thai maize price	–0.061 (–0.40)			0.0361 (0.123)		
Thai GDP	–0.324 (–0.825)			–0.919 (–1.213)		
Thai exports to other counties	–0.184 (–0.954)			–0.508 (–1.390)		
End stock	0.200 (0.921)			0.351 (0.892)		
Nigeria's imports from Thailand		–0.099** (–2.192)			–0.131** (–2.039)	
Nigeria maize price		–0.0168 (–0.167)			–0.035 (–0.117)	
Nigeria GDP		0.251 (0.367)			1.157 (0.592)	
Nigeria imports from other countries		–0.0705 (–0.937)			–0.139 (–0.531)	
Thai rice price			–0.750*** (–2.607)			–0.980** (–2.664)
Trend	0.040* (1.917)	0.046** (2.447)	0.0582*** (4.628)	0.0766* (1.909)	0.032 (0.814)	0.057*** (4.214)
Constant	–80.21** (–1.975)	–91.68** (–2.413)	–117.1*** (–4.664)	–150.6* (–1.936)	–62.07 (–0.783)	–115.0*** (–4.258)
Observations	23	23	23	23	23	23
R^2	0.61	0.527	0.605	0.635	0.544	0.618

[a] z-statistics in parentheses.

***1% level of significance, **5% level of significance, *10% level of significance.

Due to the larger number of rice varieties imported by ECOWAS countries and consequently the different FOB prices, Thai FOB prices were proxied by the average of both Thai White Broken Rice (WBR), A.1 Super, and Thai 25 prices. ECOWAS imported rice prices were proxied by the average of imported rice prices in its member countries.

EMPIRICAL RESULTS FOR THAILAND–ECOWAS RESIDUAL TRADE

The parameters of the system of equations presented in section 4.1 were estimated using both Two-Stage-Least-Squares (2SLS) and Three-Stage-Least-Squares (3SLS). Bollen (1996) points out that the 2SLS approach is better for small samples. As mentioned in section 4.1, the data samples used are not very large. However, the 2SLS method does not exploit the correlation of disturbances across equations: the main advantage of 3SLS over 2SLS is a gain in asymptotic efficiency (McFadden, 1999). Hamilton (1994) suggests the use of a 3SLS approach, while Greene (2003) illustrates how 3SLS uses an instrumental variable 2SLS approach to produce non-biased estimates to account for the disturbances' contemporaneous correlation structure across equations. These two approaches were used for robustness check measures. The residual supply and residual demand curves were therefore estimated first by 3SLS and then by 2SLS.

The results of the 3SLS and the 2SLS estimations are presented in Table 1. All equations have a fair fit, with R^2 ranging from 39 per cent to 82 per cent. The main parameters of interest are the inverse residual demand $\emptyset_1$ and inverse residual supply δ_2 elasticities. The parameters estimated for both the inverse residual demand and the inverse residual supply elasticities estimated with the 3SLS are significantly different from zero with the expected negative sign (for the inverse residual demand) and positive sign (for inverse residual supply). With 2SLS, the inverse residual supply elasticity is significantly different from zero with the expected positive sign, while the inverse residual demand elasticity is not significant and does not have the expected negative sign. If Thailand and ECOWAS do have market power, then the results from the 2SLS estimation are invalid as the estimated parameters would be inconsistent possibly because of the simultaneity bias caused by the simultaneous setting of price and quantity. We therefore analyze results obtained with the 3SLS estimator only.

In the residual supply equation, the elasticity $\emptyset_1$ is statistically significant with the expected sign, indicating that ECOWAS countries collectively hold some market power in the Thailand market with a magnitude of 1.54. In the residual demand equation, the elasticity is also statistically significant with the expected sign, indicating that Thailand exporters exercise market power with a magnitude of 0.41. Thus, ECOWAS has greater market power than Thailand exporters, which may imply that, collectively, ECOWAS countries could be in a better position to influence the international price of rice in Thailand than Thailand itself.

The implementation of a bulk purchase initiative is worthwhile for ECOWAS because of the potential dominance of either ECOWAS or Nigeria (0.14, Table 2) over Thailand (0.09) in determining price. However, Nigeria's market power is not really evident in the Thailand rice market. This is due to Nigeria's lack of policy instrument for regulating rice imports which could allow the country to face the strong cartel of exporters in the Thailand rice market.

Moreover, relevant variables, such as Thailand's GDP and Thailand's export to other countries, significantly explain the residual trade between Thailand and ECOWAS. For the prices equation, the result indicates the negative relation between FOB prices and import prices. The implication is that Thailand exports the residual quantity when it negotiates FOB prices higher than the reference FOB price, while ECOWAS imports residual quantity when it negotiates import price lower than the reference imported price.

CONCLUSIONS

If West African countries were to aggregate their procurement of rice from Thailand, they could be in a position to exert a strong collective market power on the international rice imports markets and consequently influence prices. The main objective of our study was to test the collective market power of ECOWAS member states with the aim of providing some empirical evidence to support or reject the implementation of regional bulk purchase of imported rice by ECOWAS. The results of the study indicate that West African countries can collectively exert a strong and statistically significant market power on the world rice market. These findings also imply that bulk purchase of imported rice could confer ECOWAS member states with greater bargaining power in the rice import market.

With the enhancement of the common external tariff on imported rice, which is under consideration by ECOWAS, the implementation of imported rice bulk purchase would facilitate the rice import trade and allow a better balance between rice imports and rice production in West African countries, giving producers the chance to bring production into line with regional market development. However, the type

of regulation, institutional arrangements, and coordination needed to ensure the effectiveness of a policy scheme such as the regional bulk purchase of imported rice needs to be further investigated. In addition, further evidence-based research is needed to inform the type of policy and institutional innovations needed in terms of public–private partnership.

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NOTES

1. Extraordinary meeting of ECOWAS ministers of finance, trade and agriculture, Abuja, May 2008.
2. The possibility of the West African Development Bank (BOAD) providing guarantees to reduce risks to commercial banks and importers has been discussed at several regional meeting.
3. FAOSTAT (2012) http://faostat.fao.org/site/537/default.aspx (March 12, 2012).
4. USDA (2012) http://www.fas.usda.gov/psdonline/psdquery.aspx (March 12, 2012).
5. FAO (2012) http://www.fao.org/giews/pricetool2/ (March 12, 2012).
6. Countrystat (2012) http://www.countrystat.org/ (March 12, 2012).
7. Afriqueverte (2012) http://www.afriqueverte.org/index.cfm?srub=59 (March 12, 2012).
8. Perspective Monde is the pedagogical statistical tool for global trends since 1945 under direction of Sherbrooke University and World Bank.

REFERENCES

[1] Andersen, T.B., Asche, F., Roll, K.H. and Tveterås, S. (2009) 'Oligopoly and Oligopsony Power in Concentrated Supply Chains', *Research Working Paper*, CENTRUM Business School, Pontificia Universidad Católica del Perú, Lima, Peru.

[2] Anon. (2007) 'Three Heads are Better Than One', *Rice Today*, Oct–Dec, 34–35.

[3] *Anon. (2011) Crise Rizicole, Evolution des Marchés et Sécurité Alimentaire en Afrique de l'Ouest*, WFP [World Food Programme], [Rome]; CILSS [Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel], [Ouagadougou]; FAO [Food and Agriculture Organization of the United Nations], [Rome]; CIRAD [Centre de coopération internationale en recherche agronomique pour le développement], [Montpellier]; FEWS NET [Famine Early Warning Systems Network], [Washington, DC], http://home.wfp.org/stellent/groups/public/documents/ena/wfp234783.pdf (March 8, 2012).

[4] Baker, J.B. and Bresnahan, T.F. (1988) 'Estimating the Residual Demand Curve Facing a Single Firm', *International Journal of Industrial Organization*, Vol. 6, 283–300.

[5] Baris, P., Zaslavsky, J. and Perrin, S. (2005) 'La Filière Riz au Mali : Compétitivité et Perspectives de Marché', *Document de Travail* no. 5, Agence Française de Développement (AFD), Paris.

[6] Bollen, K.A. (1996) 'An Alternative Two Stage Least Squares (2SLS) Estimator for Latent Variable Equations', *Psychometrika*, Vol. 61, 109–121.

[7] Brummer, M. (2011) '*The Cartel of Good Intentions? OREC and Food Security in Asia*', *Asian Journal of Public Affairs*, Vol. 4, No. 1, 27–41.

[8] Calpe, C. (2003) 'Status of the World Rice Market in 2002', in *Proceedings of the FAO 20th Session of the International Rice Commission, Bangkok, Thailand, July 23–26, 2002*, Food and Agriculture Organization of the United Nations, Rome.

[9] Calpe, C. (2004) 'International Trade in Rice: Recent Developments and Prospects', Paper presented at FAO World Rice Conference, Tsukuba, November 5–7.

[10] Calpe, C. (2006) 'Rice: International Commodity Profile', *FAO Research Working Paper*, Food and Agriculture Organization of the United Nations, Rome.

[11] Chern, W.S., Ishibashi, K., Taniguchi, K. and Tokoyama, Y. (2003) 'Analysis of the Food Consumption of Japanese Households', *FAO Economic and Social Development Paper* No. 152, Food and Agriculture Organization of the United Nations, Rome.

[12] Childs, N.W. and Hoffman, L. (1999) 'Upcoming World Trade Organization Negotiations: Issues for the U.S. Rice Sector', in *Rice Situation and Outlook/RCS-1999/November 1999*, Economic Research Service, United States Department of Agriculture, Washington, DC.

[13] Cooper, D. (2003) 'Findings from the Competition Commission's Inquiry into Supermarkets', *Journal of Agricultural Economics*, Vol. 54, No. 1, 127–143.

[14] Dechachete, T. (2011) 'Composite Index of Market Access for the Export of Rice from Thailand', *Issue Paper* 31, International Centre

for Trade and Sustainable Development (ICTSD), Geneva.

[15] Durham, C.A. and Sexton, R.J. (1992) 'Oligopsony Potential in Agriculture: Residual Supply Estimation in California's Processing Tomato Market', *American Journal of Agricultural Economics*, Vol. 74, No. 4, 962–972.

[16] Durand-Morat, A. and Wailes, E. (2011) Rice Trade Policies and Their Implications for Food Security', Paper presented at the Joint Annual Meeting of Agricultural & Applied Economics Association (AAEA), *Northeastern Agricultural and Resource Economics Association* (NAREA), Pittsburgh, PA, July 24–26.

[17] Economic Times, The (2009) 'India Will Look to Government-to-Government Deals to Get Cheap Rice', http://articles.economictimes.indiatimes.com/2009-11-19/news/28385327_1_g-to-g-rice-imports-tender (February 13, 2012).

[18] FAO (2003) *Financing Normal Level of Commercial Imports of Basic Foodstuffs*, Food and Agriculture Organization of the United Nations, Commodity Policy and Projections Service Commodities and Trade Division, Rome.

[19] FAO (2004) 'Export Competition: Selected Issues and the Empirical Evidence', *FAO Trade Policy Technical Notes on Issues Related to the WTO Negotiations on Agriculture*, Food and Agriculture Organization of the United Nations, Rome.

[20] FAO (2011) *Rice Market Monitor*, Vol. 14, No. 3.

[21] Greene, W.H. (2003) *Econometric Analysis*, fifth edn., Prentice Hall, Upper Saddle River, NJ.

[22] Hamilton, J. (1994) *Time Series Analysis*, Princeton University Press, Princeton, NJ.

[23] Jayne, T.S. (1993) 'Sources and Effects of Instability in the World Rice Market', *International Development Papers, Michigan State University* No. 13, Michigan State University, East Lansing, MI.

[24] Krugman, P.R. and Obstfeld, M. (2003) *International Economics: Theory and Policy*, sixth edn., Princeton University, Princeton, NJ.

[25] Lançon, F., David-Benz, H., Meuriot, V. and Temple, L. (2011) 'Flambée des Cours Mondiaux des Céréales : Une Aubaine pour l'Agriculteur Africain', *Perspective, CIRAD* No. 9, Centre de coopération internationale en recherche agronomique pour le développement, Paris.

[26] McFadden, D. (1999) 'Simultaneous Equations. Economics, Chapter 6, 240B', University of California, Berkeley, CA, http://elsa.berkeley.edu/~mcfadden/e240b_f01/ch6.pdf (February 13, 2012).

[27] Mendez del Villar, P. (2006) *Spécificités des Filières Riz dans le Monde*, Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), Paris.

[28] Mingxia, Z. and Sexton, R.J. (2002) 'Optimal Commodity Promotion when Downstream Markets are Imperfectly Competitive', *American Journal of Agricultural Economics*, Vol. 84, No. 2, 352–365.

[29] Minot, N. (2011) 'Transmission of World Food Price Changes to Markets in Sub-Saharan Africa', *Discussion Working Paper* No. 01059, International Food Policy Research Institute, Washington, DC.

[30] Morrison Paul, C.J. (2001) 'Cost Economies and Market Power: The Case of the U.S. Meat Packing Industry', *Review of Economics and Statistics*, Vol. 83, No. 3, 531–540.

[31] OECD (2011) *Agricultural Policy Monitoring and Evaluation 2011: OECD Countries and Emerging Economies*, OECD Publishing, Paris.

[32] Ouattara, Z.F. (2011) *Impact du TEC de l'UEMOA sur la Compétitivité du riz Irrigué en Côte d'Ivoire*, Programme de Renforcement et de Recherche sur la Sécurité Alimentaire en Afrique de l'Ouest (West Africa Food Security Capacity Strengthening and Research Program, PRESAO), East Lansing, MI.

[33] PAM (2008) 'Sénégal : Commerce du Riz', Rapport d'Analyse de Marché, Programme Alimentaire Mondial des Nations Unies (World Food Programme), Rome.

[34] Rice Trader, The (2011) 'The Rice Trader West Africa Rice Network 2011', *The Rice Trader Annual Conference Report*, Accra, Ghana, April.

[35] Schroeter, J.R., Azzam, A.M. and Zhang, M. (2000) 'Measuring Market Power in Bilateral Oligopoly: The Wholesale Market for Beef', *Southern Economic Journal*, Vol. 66, No. 3, 526–547.

[36] Seck, P.A. (2007) 'Rice Crisis: Myth or Reality?', Presentation to the 28th Session of the Council of Ministers of the Africa Rice Center, Abuja, Nigeria, September 28.

[37] Seck, P.A, Tollens, E., Wopereis, M.C.S., Diagne, A. and Bamba, I. (2010) 'Rising Trends and Variability of Rice Prices: Threats and Opportunities for Sub-Saharan Africa', *Food Policy*, Vol. 35, 403–411.

[38] Seck, P.A., Diagne, A., Mohanty, S. and Wopereis, M.C.S. (2012) 'Crops that Feed the World 7: Rice', *Food Security*, in press.

[39] Siamwalla, A. and Hayken, S. 1983. 'The World Rice Market: Structure, Conduct, and Performance', *Research Report* No. 39, International Food Policy Research Institute, Washington, DC.

[40] USAID (2009) 'Global Food Security Response: West Africa Rice Value Chain Analysis', *MicroReport* No. 161, United States Agency for International Development, Washington, DC.

[41] Wailes, E. (2005) 'Rice: Global Trade and Protectionist Policies, and the Impact of Trade Liberalization', in M. Ataman Aksoy and J.C. Beghin (eds), *Global Agricultural Trade and Developing Countries*, The World Bank, Washington, DC.

[42] Warr, P.G. (2001) 'Welfare Effects of an Export Tax: Thailand's Rice Premium', *American Journal Agricultural Economics*, Vol. 83, No. 4, 903–920.

[43] Wright, B.D. (2009) 'International Grain Reserves and Other Instruments to Address Volatility in Grain Markets', *FAO Policy Research Working Paper* No. 5028, Food and Agriculture Organization of the United Nations, Rome.

[44] Yamashita, K. (2008) *Implications for Japan of the July 2008 Draft Agricultural Modalities*, International Centre for Trade and Sustainable Development (ICTSD), Geneva.