Do Source and Quality matter in the Demand for Imported Rice in Côte d'Ivoire?

By:

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Abstract

The first difference Almost Ideal Demand System is used to estimate the Ivorian rice import demand differentiated by sources and qualities. Research findings showed that the import demand of rice for all qualities and sources in Cote d'Ivoire is inelastic. Expenditure elasticities reveal that Thailand has the most to benefit from an expansion of the broken rice and the luxury rice market. India will gain from the growth of the standard rice market. Thailand has almost a monopole in the exports of broken rice to Cote d'Ivoire and thereby differentiation of imports of broken rice by its origin is not relevant. The inelasticity of demand for imported rice in Cote d'Ivoire has strong implications in the tariff policy debates of the ECOWAS custom union.

Keywords: AIDS, source differentiation, rice quality demand, Ivorian imports

Introduction

Rice is a major cereal consumed in Côte d'Ivoire as in other West African countries. Household expenditures share shows that rice plays an essential role in household consumption in Côte d'Ivoire. In 2008, food expenditure was estimated at 3,380 million Euro, with spending on rice representing 17% of the food budget (DSDI and INS, 2011). Consumption of rice has been growing rapidly as a result of increasing urbanization and a growing population. Despite this increasing consumption of rice, the country's production is lagging and unable to meet consumption needs. Heavy reliance on imports to satisfy domestic demand in rice means 935,000 T of rice were imported in 2011, which represents more than 60 percent of the national consumption in rice (PNR, 2012). This made Côte d'Ivoire Africa's third largest rice importing country after Nigeria and Senegal.

Increasing dependence on the world market to satisfy domestic consumption is likely to be unsustainable over time. For instance, in 2008, this import-oriented policy had adverse impact on the national economy following the surge in the international price of rice. International price hikes translated directly into substantial rises in domestic prices that then impacted negatively on consumers' welfare. Dimova and Gbakou (2012) used 2008 household survey data to demonstrate that middle-income households in Côte d'Ivoire are the hardest hit by price shock because of their lack of ability to smooth out price increases by consumption and production of alternative crop varieties. Up to the present time consumers continue to face a higher rice price since prices did not return to their pre-2008 level and are still on an upward trend (Seck et al., 2010) despite the increase in area and yields of local rice.

The rapid expansion of rice imports in Côte d'Ivoire, as in many West African countries, has been classed as a perverse effect of trade liberalization on small producers' livelihoods and one that hampers development of the domestic rice sector (OXFAM, 2005). As a result, producers, with development and lobbying organizations in the ECOWAS customs union, are pushing hard for more protection of the domestic rice sector through an increase in the import tariff. Therefore, an in-depth analysis is needed to guide policy makers on the potential effect of such an increase in import tariff would have on the import demand for rice and on social welfare. This is particularly important given that very little has previously been done in West Africa to estimate import demand elasticity or how the welfare of rice producers and consumers would be impacted by any increase in rice import tariff. It is often argued in the literature, without

providing any quantitative estimate of the demand elasticity, that import demand for rice is inelastic in sub-Saharan Africa and import-dependent countries will therefore be harmed by higher import tariffs or international prices for rice. Lack of quantitative estimates of demand elasticity limits assessment of the true impact of policy changes on domestic demand for rice and for social welfare.

Given that Côte d'Ivoire has been seen to be particularly vulnerable to price shocks in global rice markets, the objective of this paper is to provide an estimate of the demand elasticity for different qualities of rice imported into Côte d'Ivoire from different points of origin. Source differentiation will enable investigation of the influence of origins of imports on the demand for imported rice. A source-differentiated AIDS that has not – to the best of our knowledge – previously been used to estimate import demand elasticity for agricultural commodities in West Africa is now used for this purpose. As a result, this study is of significant methodological contribution in the estimation of import demand elasticity and policy relevance in West Africa. Indeed, from the findings of the import demand elasticity, policy implications regarding the impact of a change in tariff on imported rice and population welfare will be assessed.

The paper is organized as follows. First, a historical overview of rice policies in Côte d'Ivoire is presented. Then, a model of Ivorian source-differentiated rice demand is developed, followed by a description of the data and estimation procedures. The ensuing section is devoted to a presentation of the results and discussion. Concluding remarks and policy implications are provided in the final section.

Rice policies in Côte d'Ivoire

Rice policy in Côte d'Ivoire has undergone several development periods responsible for changes over the years.

From 1960 to 1977, rice policy was essentially producer-oriented. The government made large public investments to boost the rice sector and achieve self-sufficiency in rice. Parastatal companies, namely SODERIZ and SATMACI, were in charge of leading development of the rice supply chain. At the upstream level of the supply chain, these companies were involved in distributing inputs (improved seeds, herbicide and fertilizer) to increase rice productivity and in facilitating access to mechanization to modernize rice production systems. Downstream, SODERIZ implemented institutional purchase of rice at a floor price designed to provide

incentives to producers to invest in rice production. Rice processing was handled by modern mills controlled by SODERIZ. These various investments paid off and imports of rice declined to 2,000 T/year from their level of 47,800 T/year before 1970 (WARDA and REI, 2005). Those imports originated chiefly from Thailand and Taiwan, but imports from Italy were also countable. The effectiveness and success of the rice development programs enabled Côte d'Ivoire to export 32,000 T of rice in 1976. However, this 'golden age' of local rice lasted only a few years and in 1977, SODERIZ was dismantled because of managerial difficulties.

From 1978 to 1994, the government intervention in the rice sector steadily decreased through a reduction of public support. More private investment was allowed and the private sector began making inroads with processing and marketing activities. This coincided with a decline in the international market price of rice, which encouraged Côte d'Ivoire to turn to the world market to meet national demand for rice. Providing rice at an affordable price to consumers and augmenting public finances through import tariffs became the main orientations of national rice policy. Imports rose from an average of 57,800 T per year in the 1970s to an average of 350,000 T/year in the 1980s and 1990s (WARDA and REI, 2005). During this period, the USA became the dominant supplier of rice to Côte d'Ivoire with 36 percent of rice imported. The remaining rice imports were shared between Thailand, Vietnam and Pakistan.

Liberalization and privatization were phased in during the ensuing period starting from 1995 until 2008. Under the prevailing structural adjustment programs and with the devaluation of the local CFA currency, donors pressed for full liberalization of the rice sector. Production, processing and marketing activities were privatized. Rice imports were also liberalized and imports of rice extended to brown rice and broken rice. Total liberalization of the rice sector occurred in 1997 with the elimination of annual quotas on rice imports. Tariffs on rice imports started declining up to 1999 but stabilized after 2000 (see Table 2) although often revised to reflect realities on the ground. Rice imports increased substantially and were estimated at 616,530 T/year from 1995 to 2008. Rice imports essentially comprised three main types: brown rice, 0–15% broken rice (luxury rice), 16–35% broken rice (standard rice), and more than 35% broken rice (broken rice). The largest share of imports (average of 74%) was represented by 16–35% broken rice (PNR, 2012). The USA's share of rice importations decreased at this time while that of Asian countries such as Thailand, India, Pakistan and Vietnam recovered to make them the main exporters of rice to Côte d'Ivoire.

The painful experience of the 2008 food crisis prompted the Ivorian government to reduce its heavy reliance on rice imports and undertake to provide a significant boost to domestic production. An emergency plan for development of the rice sector was drafted in 2008, and this program mainly emphasizes the production side of the value chain through distribution of seeds, fertilizer and agricultural equipment to farmers. However, program implementation was limited by funding issues and the impact on domestic production was very weak. Côte d'Ivoire continues to import very large quantities of rice, estimated at 64 percent of rice consumption in 2011 (PNR, 2012). In 2012, the original 2008 rice sector development program was revisited to formulate more realistic objectives achievable within a specific time frame and to address the main challenges across the different nodes of the rice value chain. This resulted in a national rice development strategy for the time span 2012–2020. Reduction of rice imports still remains a main challenge for this strategy; imports averaged 862,165 T/year from 2008 to 2011. Standard rice is still the largest quality grade of rice imported, and Thailand the main supplier of rice.

Methodology

A source-differentiated linear approximation of the almost ideal demand system (AIDS) is used to estimate the demand elasticity for the imported rice by quality of rice and origin. The model AIDS was first developed by Deaton and Muelbauer (1980) as the linear approximation of an almost ideal demand system (LA/AIDS). This model has been extensively used by several authors (Eales and Unnevehr, 1988; Green and Alston, 1990; Fulponi, 1989; Hayes et al., 1990) because it provides a flexible functional form and is relatively easy to estimate. Moreover, it offers an arbitrary first order approximation to any demand system, satisfies the axiom of choice, and under certain conditions, aggregates perfectly over consumers. Yang and Koo (1994) innovated by specifying a source-differentiated AIDS model, as differentiation by origin is important to consider in import demand analysis. Other models such as the Armington model and the Rotterdam model have been also used for source differentiation import demand analysis. However, the advantage of the source-differentiated AIDS model over the Armington model is that the former does not impose block separability in source differentiation. This assumption can be tested within the framework of the source-differentiated AIDS model. Also, the Armington model imposes restrictive assumptions of a single constant elasticity of substitution (CES) and homotheticity which may generate biased parameter estimates (Yang and Koo, 1994).

The approach we use in this research closely follows the source-differentiated AIDS model proposed by Yang and Koo (1994). The unrestricted source-differentiated model AIDS model (SAIDS) is expressed as follows:

(1) $\quad w_{i_h} = \alpha_{i_h} + \sum_j \sum_k \gamma_{i_h j_k} \, lnp_{j_k} + \beta_{i_h} \ln(E/P)$

α, β, γ are parameters. The subscripts i and j denote rice quality imported. h and k represent different origins; w_{i_h} denotes the budget share for good i imported from origin h; p_{jk} represents represents the price of imported commodity j from country k; P is the Stone price index identified as $\ln(P) = \sum_i \sum_h w_{i_h} \ln(p_{i_h})$. To avoid the problem of simultaneity caused by the presence of w_{i_h} in the right hand side and the left hand side, lagged share will be used as in Eales and Unnevehr (1988).

Common conditions of adding up, homogeneity and symmetry are imposed to satisfy the general demand theory

(2) $\quad \sum_i \sum_h \alpha_{ih} = 1; \qquad \sum_i \sum_h \gamma_{i_h j_k} = 0; \qquad \sum_i \sum_h \beta_{ih} = 0 \qquad$: Additivity

(3) $\quad \sum_j \sum_k \gamma_{i_h j_k} = 0 \qquad\qquad\qquad\qquad\qquad\qquad$: Homogeneity

(4) $\quad \gamma_{i_h j_k} = \gamma_{j_k i_h} \qquad\qquad\qquad\qquad\qquad\qquad\qquad$: Symmetry

The Marshallian uncompensated price elasticity can be written as:

(5) $\quad \varepsilon_{i_h j_k} = -\delta_{i_h j_k} + \gamma_{i_h j_k}/w_{i_h} - \beta_{i_h}(w_{j_k}/w_{i_h})$

Where $-\delta_{i_h j_k} = 1$ if $i=j$ and $h=k$ and zero otherwise

The expenditure elasticity is defined as follows:

(6) $\quad n_{i_h} = 1 + \beta_{i_h}/w_{i_h}$

Conditions of adding up, homogeneity and symmetry are imposed to satisfy the general demand theory.

Previous empirical studies (Eales and Unnevehr, 1988; Henneberry and Hwang, 2007) have found that dynamic adjustments driven by changes in consumer behavior are important and should be represented in demand models. Thus, dynamic changes have been included in the model, following Eales and Unnevehr (1988) in the form of first difference as follows

(7) $\quad \Delta w_{i_h} = \sum_j \sum_k \gamma_{i_h j_k} \Delta lnp_{j_k} + \beta_{i_h} \Delta \ln(E/P)$

Data and Estimation Procedure

The study used monthly data from 1996 to 2011 to estimate the SAIDS. Data consist of quantities, values and tariff rate of three main qualities of imported rice, namely luxury rice (0–15% broken rice), standard rice (16–35% broken rice), broken rice (more than 35% broken rice). The different qualities of rice were imported from numerous origins (countries). Qualities here refer to the level of brokenness in imported rice. The data were collected from the Statistics Department of the Ivorian Customs Service (Direction Générale des Douanes Ivoiriennes/Departement des Statistiques). Domestic rice could also have been included in this study but monthly data limitations over the study period preclude the introduction of data on domestic rice to the analysis. In addition, market segmentation exists in the distribution of local and imported rice with local rice usually sold by small retailers in market places while imported rice is distributed through various marketing channels, including wholesalers, semi-wholesalers, retailers in grocery stores and small outlets. Also, as Yang and Koo (1994) pointed out, the unit value of domestic prices is not usually what consumers pay. It is therefore difficult to construct budget share using import data with domestic prices. For all these reasons, the study assumes weak separability between imported rice and domestic rice, an assumption that has been commonly imposed on import demand analysis (Weatherspoon and Seale, 1992; Henneberry and Hwang, 2007; Balagtas et al., 2007). Summary statistics of the variation in quality of imported rice by origin are reported in Table 1. "Other source" of import sources relates to an import source representing less than 10% of the total import origins.

Results of the summary statistics show that, as expected, the import rice market in Côte d'Ivoire is dominated by standard rice (16–35% broken rice). However, the volume of imports for this quality of rice has decreased relative to broken rice over time. Vietnam and Thailand are by order of importance the main exporters of standard rice to Côte d'Ivoire, followed by India and China. Broken rice (more than 35% broken rice) is the second most important quality of rice consumed in the country. Thailand has a near monopoly in supplying broken rice to Côte d'Ivoire, with a market share for broken rice of more than 90%. Luxury rice, mostly coming from Thailand, Vietnam and the USA, accounts for a very small proportion of the imported rice market with a 6% market share.

The estimation procedure was based on a Seemingly Unrelated Regression (SUR) system with one equation, which is broken rice imported from the rest of the world, dropped from the model

to prevent the problem of singularity in the equations. The coefficients of the dropped equation were retrieved by using the additivity condition. The estimated coefficients of this last equation were also found to be invariant of which equation is dropped from the model.

Product aggregation

In this study, imports of rice have been disaggregated by origin because of the assumption that prices of rice from different sources of imports are not homogeneous and quality attributes of rice related to origin may influence consumers' choices. This assumption is further supported by the observation that the trademark for imported rice in Côte d'Ivoire is often associated to the origin of imports and is used by business companies as a marketing tool to differentiate their products from those of their competitors and for successful marketing of their products to buyers. The assumption of product aggregation needs to be tested and the test used for this purpose follows the procedure of Yang and Koo (1994). The null hypothesis is that each product of rice can be aggregated across sources to obtain the three main qualities of rice which do not source-differentiate. The restrictions for the test are written as follows:

(8)
$$\alpha_{i_h} = \alpha_i \qquad \forall\, h \in i$$
$$\gamma_{i_h j_k} = \gamma_{ij} \qquad \forall\, h, k, \in i, j$$
$$\beta_{i_h} = \beta_i \qquad \forall\, h \in i$$

Where α_{i_h}, $\gamma_{i_h j_k}$, β_{i_h} are the estimated intercept, own-price and cross price coefficients, expenditure coefficients from the source-differentiated model. $\alpha_i, \gamma_{ij}, \beta_i$ are the estimated parameters from a non-source-differentiated, aggregate AIDS model.

Block separability

This work also tests for quasi-separability of the cost function for the source-differentiated AIDS model following the methodology developed by Hayes et al. (1990) and applied by Yang and Koo (1994) as well as Mutondo and Henneberry (2007). The restriction implied by quasi-separability of the cost function is given as follows:

(9)
$$\gamma_{i_h j_k} = \overline{w}_{i_h} \overline{w}_{j_k} \gamma_{ij}$$

Where $\gamma_{i_h j_k}$ is the cross-price parameter between quality i of rice imported from source h and quality j of rice imported from source k. $\overline{w}_{ih}\ and\ \overline{w}_{jk}$ are the mean budget shares of rice i

imported from source h and of rice j imported from source k, respectively. γ_{ij} is the cross price coefficient between group i and j from an aggregate AIDS model.

From equation (9) above, group i and j may be considered as separable if substitutions between the two groups due to a price change are proportional to their expenditure shares.

The idea behind the test of separability is to see whether the three qualities of rice at the aggregate level (non-source differentiated) could be separated from each other and demand for a specific quality of rice could be analyzed independently from the other qualities. The null hypothesis for this test is that each block of rice is separable from all other blocks. Rejection of the null hypothesis for example between luxury rice and standard rice would imply that these two qualities of rice could not be analyzed separately.

Structural change

Subsequent to the rice sector liberalization that was effective from 1997, tariffs on imported rice were progressively reduced (table 2) and have stabilized at 10 % since 2001. The impact of these low tariffs was an escalation (see Figure 1) of the volume of imports, thereby reinforcing the assertion of development NGOs that trade liberalization has exacerbated rice import flows in developing countries' markets and degraded smallholders' means of living. Hence, in order to capture the impact of the change in import tariff after 2001, parameter stability before and after the year 2001 is analyzed through a Chow test. The two sub-samples will be tested against the overall sample going from 1996 to 2011. Rather than applying a typical single equation test that would miss correlation between lagged errors in other equations, an adjusted likelihood ratio test as proposed by Italianer (1985) is used in the singular SUR system.

Results and Discussion

Test results for product aggregation, block separability and structural change are presented in Table 3. The Wald test for product aggregation rejects the null hypothesis that products can be aggregated across sources of supply at a 1% level of confidence for luxury rice and standard rice, but fails to reject the hypothesis of product aggregation for broken rice. Thus, the importance of source-differentiated products for luxury rice and standard rice is justified while for broken rice there is no strong evidence that broken rice imported from Thailand and from the rest of the

world should be differentiated. This latter result was predictable since 90% of the imports of broken rice in Côte d'Ivoire originate from Thailand.

Furthermore, test results of the null hypotheses that the three qualities of rice are separable from each other indicate a rejection of the null hypotheses at a 5% level of confidence for luxury rice and 1% level of confidence for standard rice and broken rice. These findings support the estimation of the source-differentiated model with price of the three qualities of rice included.

With regards to the parameter stability test, the null hypothesis of no structural change after 2001 is rejected at a 1% level of confidence. Therefore, the results imply that change in the tariff policy (reduction in tariff) after 2001 might have influenced imports of rice into Côte d'Ivoire. In fact, a decrease of import tariff to achieve a stable value of 10% entails a reduction in the imported rice price, which creates incentives for importers to increase their supply of rice from the international market. Thus, the results give support to allegations by producers' organizations and NGOs that trade liberalization is stimulating massive imports and constitute a *de facto* hindrance to the development of domestic production. A paper by WARDA and REI (2005) looking at the economic impact of domestic and world trade liberalization in Côte d'Ivoire revealed that local rice consumption quantities would have been as much as 28% higher if domestic trade liberalization measures were not implemented.

Marshallian demand elasticity for rice imported from different sources shows that all instances of expenditure elasticity for rice are positive and statistically significant except for luxury rice imported from the rest of the world, which is positive but not statistically significant. Overall, the results of the estimation reveal that as expenditure on rice increases, Côte d'Ivoire imports more broken rice from Thailand. This result is quite unexpected as it might be expected according to the theory that consumers' preference will be oriented toward luxury rice as income increases. But this inclination to favor a lower quality of rice (broken rice) over time, as depicted by Figure 2[1], might be explained by some unobserved factors, particularly urbanization and income distribution across households. Indeed, as revealed by Dimova and Gbakou (2012), in urban areas of Côte d'Ivoire, poor households are characterized by the greatest dependence on purchased rice that is mostly poor quality imported rice. This evidence provides support to the

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[1] In Figure 2 imports of broken rice have rapidly evolved in recent years and becoming a major rice product imported into the Ivorian rice market, competing with imports of standard rice traditionally preferred by consumers in Côte d'Ivoire.

suggestion that the growth in preference for broken rice might be triggered by an increase in the percentage of poor households in urban areas.

Concerning the standard rice expenditure elasticity, expenditure elasticity of standard rice imported from India exhibits the highest value relative to the other sources of imports. Thus, a rise in expenditure for standard rice will be associated with an increase in standard rice originating from India. In the luxury rice market, the USA is the most preferred source of imports.

Own price elasticity are all negative in consistence with demand theory and significant at generally a 1% level of confidence. Demand for all products of imported rice are found to be inelastic with own price elasticity of luxury rice imported from the USA being relatively less inelastic than the other types of products. Importers will therefore shift easily to imports of rice from other origins if the price of USA luxury rice increases. This analysis is validated by a study from WARDA and REI (2005) revealing that the increase in price of rice imports from the USA by mid-1995 led to a progressive decline of the market share for this product to the benefit of imports from Thailand and Vietnam. Overall, the inelasticity of demand of imported rice is as expected and confirms observations made by Lançon and Benz (2007) that consumers in West Africa exhibit low sensitivity to the prices of imported rice based on the results of a survey conducted by Diagana et al. (1999) in four West African countries (Nigeria, Senegal, Mali and Côte d'Ivoire). These results highlighted that consumers responded to the rise in imported rice prices following the CFA currency devaluation in 1994 by a decrease in consumption of other food commodities, including wheat flour and meats, but they maintained or reduced their consumption level of imported rice relatively less. Hence, the inelastic demand for imported rice highlights the greater value attributed to imported rice relative to other domestic substitutes, particularly local rice. In Côte d'Ivoire, marketing of rice, especially to urban buyers is dominated by imported rice that is perceived as of higher quality than local rice. Rice import demand is inelastic because of poor availability of alternative domestic supply. Supply of local rice is insufficient, of low quality and mostly limited to a rural marketplace. As a result, to satisfy domestic demand for rice, which is considered as the main cereal consumed in Côte d'Ivoire, the country has to depend on the international market.

Cross-price elasticities are generally not significant, with few exceptions. The non-significant relationship may indicate differences in quality attributes or in market segments where these

products are sold. Furthermore, the results show that relations among products are often characterized by complementarity. The predominance of unexpected complementary effects are not uncommon; they are often observed in source-differentiated demand studies (see Yang and Koo, 1994; Henneberry and Hwang, 2006) and may be explained according to Yang and Koo (1994) by the restrictions imposed on the model parameters and/or different product attributes. These later authors reported that if the prices of two products differ substantially and own-price elasticity of a product is less than 1, a decrease in the price of one product may result in an increased consumption of both products with a relatively fixed expenditure on the group. Given the inelastic demand for all rice products, rice does not substitute much across products. Changes in prices of different quality grades of rice will not translate significantly into changes in the demand for rice products.

In the luxury rice market, rice imported from Thailand shows complementary relationship with rice originated from Vietnam but substituted with broken rice imported from Thailand. Luxury rice imported from the rest of the world is a substitute for luxury rice originating from the USA and to standard rice imported from the rest of the world.

With regards to standard rice, imports from Vietnam reveal a complementary relationship with luxury rice imported from Vietnam and from the Rest of the World (ROW). Standard rice from Vietnam also shows complementarity with broken rice imported from Thailand but is a substitute for standard rice imported from the rest of the world. Imports from India exhibit a complementary relationship with luxury rice imported from Thailand and from the ROW. The same relationship is observed between standard rice from India and standard rice originated from Thailand, China and from the ROW. Standard rice imported from China is complementary to standard rice imported from Vietnam and India. Standard rice from the ROW substitutes with standard rice from Vietnam and is complementary to standard rice imports from India and broken rice imported from Thailand.

In the broken rice market, the complementarity relationship is observed between broken rice imported from Thailand and most standard rice products.

Conclusion and Policy Implications

Côte d'Ivoire is a small player in the international rice market and exposed to the adverse effects of policies implemented by the rice exporting countries. Current trade policy debates in the ECOWAS custom union revolve around increasing import tariffs with the aim of regulating the flow of rice imports and stimulating the development of the local rice economy. In this context, this study assesses the impact of quality and sources on the Ivorian demand for imported rice in order to predict the effect of higher tariffs on this demand for imported rice. A source-differentiated Almost Ideal Demand System (AIDS) was used to achieve this objective. Product aggregation and block separability hypotheses were tested to assure that the model specification was suitable for the analysis. Parameter stability was also tested to examine the impact of reduced tariffs from 2001 to 2011 on rice imports. Test results of product aggregation and block separability supports the use of the AIDS model differentiated by quality of imported rice and sources of origin, except for broken rice. Parameter stability results indicate that the lower import tariff from 2001 is a factor that enhanced the imports of rice from various sources. The results on estimated expenditure and price elasticity confirmed consumers' preferences for Thai rice; more particularly, current trends favor broken rice instead of the traditional standard rice. The USA will benefit from an expansion of the luxury rice market and India will gain from the growth of the standard rice market. Demand for rice imported from all sources is found to be inelastic.

The findings that import demand for rice is inelastic have two main important implications.

First, in the context of the current debates related to the increase of the import tariff in the ECOWAS custom union, all the inelasticity associated with imported rice suggests that demand for imported rice will not decrease as much as many people expect. With an inelastic import demand, it is going to be difficult for Côte d'Ivoire singlehandedly to reduce the rice market shares of its major import sources, particularly Thailand, the USA and India, through a higher import tariff. However, within a regional setting, bulk purchase of rice carried out by ECOWAS[2] might increase market power and an optimal tariff could be charged. The welfare impact on Ivorian consumers from an optimal tariff charged by the ECOWAS custom union deserves further investigation.

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[2] West Africa countries import almost 40% of rice traded in the international market. So, it is not inconceivable that, by aggregating the procurement of ECOWAS member countries, this organization exercises buyer market power (see Fiamohe et al., 2012).

Also, demand for imported rice from all major sources is likely to remain high if no policies are implemented to boost the local rice sector but more importantly to improve the quality of locally produced rice to reach standards that can compete with those of imported rice. Indeed the main challenge in the local rice economy is not so much a problem of productivity increase but rather a problem of quality in the post-harvest operations. Progress made in rice research that translated into the adoption of higher yielding rice varieties and diffusion of improved agronomic technologies research have led to an improvement in yields (AfricaRice, 2012) and producers' cost efficiency. Over time, producers have increased their competitiveness in rice production with lower Domestic Ratio Costs achieved in 2009 compared to the years 1980s. (Pearson et al., 1981; AfricaRice and MSU, 2011). The battle now is to emphasize on enhancing the quality of post-harvest handling, processing, and marketing techniques. Improving post-harvest handling will rely on greater mechanization through an upgrade of harvesters and threshers to preserve the homogeneity of the grains.

More efficient processing practices will be based on investment in milling machines with destoning, polishing and sorting capacities (AfricaRice, 2011). Enhancing the marketing of local rice will be dependent on building further road infrastructure to link rural and urban markets, developing storage facilities to increase the availability of local rice in all seasons, and promoting packaging and local branding to compete with imported rice standards.

Second, inelasticity of demand for imported rice will imply that trend in local rice price will largely follow trend in global rice production, which is influenced by weather risk and the policies of the exporting countries. Hence, contraction in aggregate rice supply will entail large price increases in Côte d'Ivoire and harm consumers. The extent of consumers' welfare losses due to such price increases, particularly in Thailand and India, or adoption of higher import tariffs in Côte d'Ivoire, will need further investigation.

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Table 1. Summary Statistics for Expenditure Share of Ivorian Rice Imports (1996–2011)

| Variable	Mean	SD	Minimum	Maximum
Luxury rice	0.0646	0.0661	0.0070	0.2423
Thailand	0.0336	0.0211	0.0062	0.0903
Vietnam	0.0100	0.0164	0.0000	0.0494
USA	0.0138	0.0368	0.0000	0.1142
Rest of the world	0.0072	0.0115	0.0001	0.0360
Standard rice	0.7317	0.0477	0.6544	0.8458
Vietnam	0.1914	0.1152	0.0214	0.4126
Thailand	0.1632	0.1081	0.0296	0.3520
India	0.0985	0.1118	0.0000	0.3157
China	0.0980	0.1019	0.0000	0.3782
Rest of the world	0.1806	0.0535	0.1011	0.2836
Broken rice	0.2037	0.0760	0.0215	0.3281
Thailand	0.1892	0.0712	0.0127	0.3260
Rest of the world	0.0144	0.0128	0.0002	0.0365

Source: Author's calculations using data from Ivorian Customs Service, Department of Statistics, 2012.

Table 2. Ivorian Import Duties for Rice 1996 to 2001

	1996	1997	2000	Since 2001
	Import duties including taxes	Import tariff including taxes	Import tariff including taxes	Import tariff including taxes
Luxury rice (0-15% broken rice)	25%	25%	10%	10%
Standard rice (15-35% broken rice)	15%	15%	10%	10%
Broken rice (> 35% broken rice)	15%	15%	10%	10%

Source: WARDA and REI (2005)

Figure 1. Self-sufficiency Indices, Production and Import Trends in Côte d'Ivoire
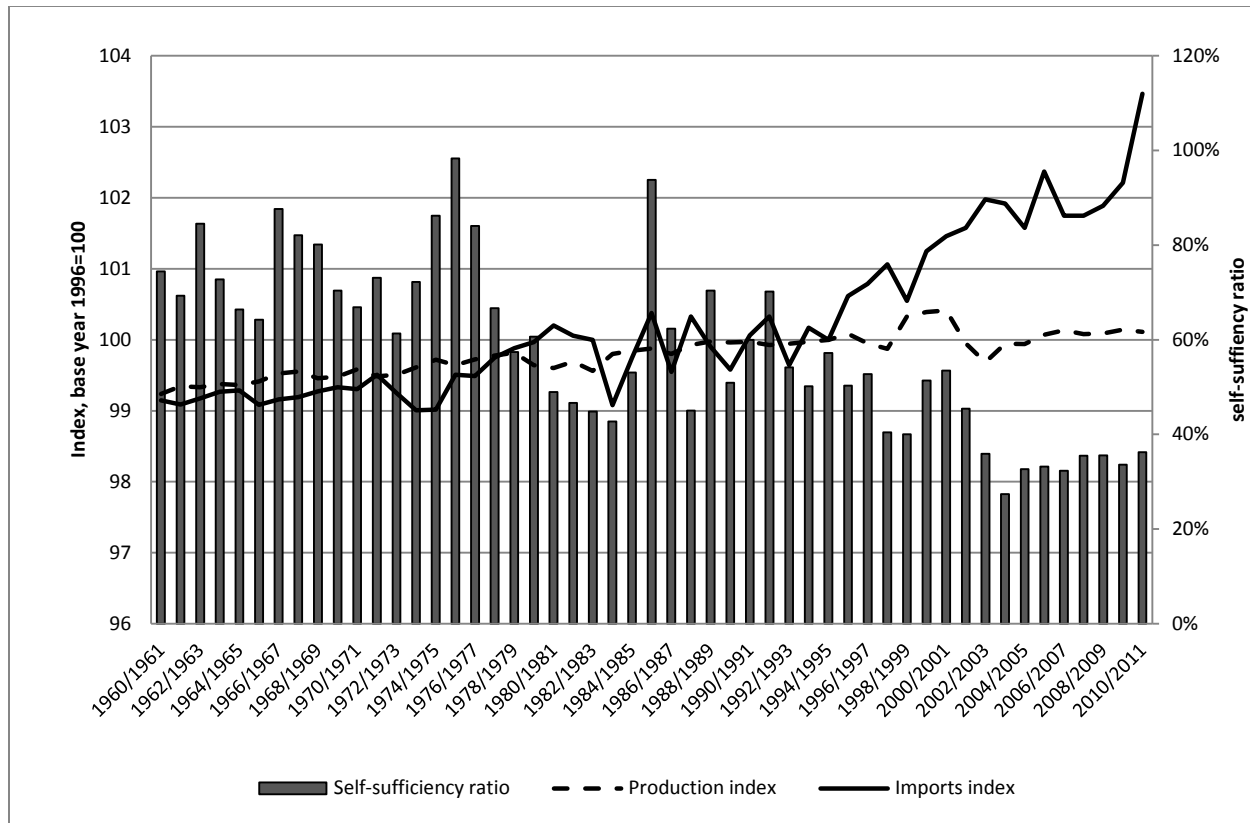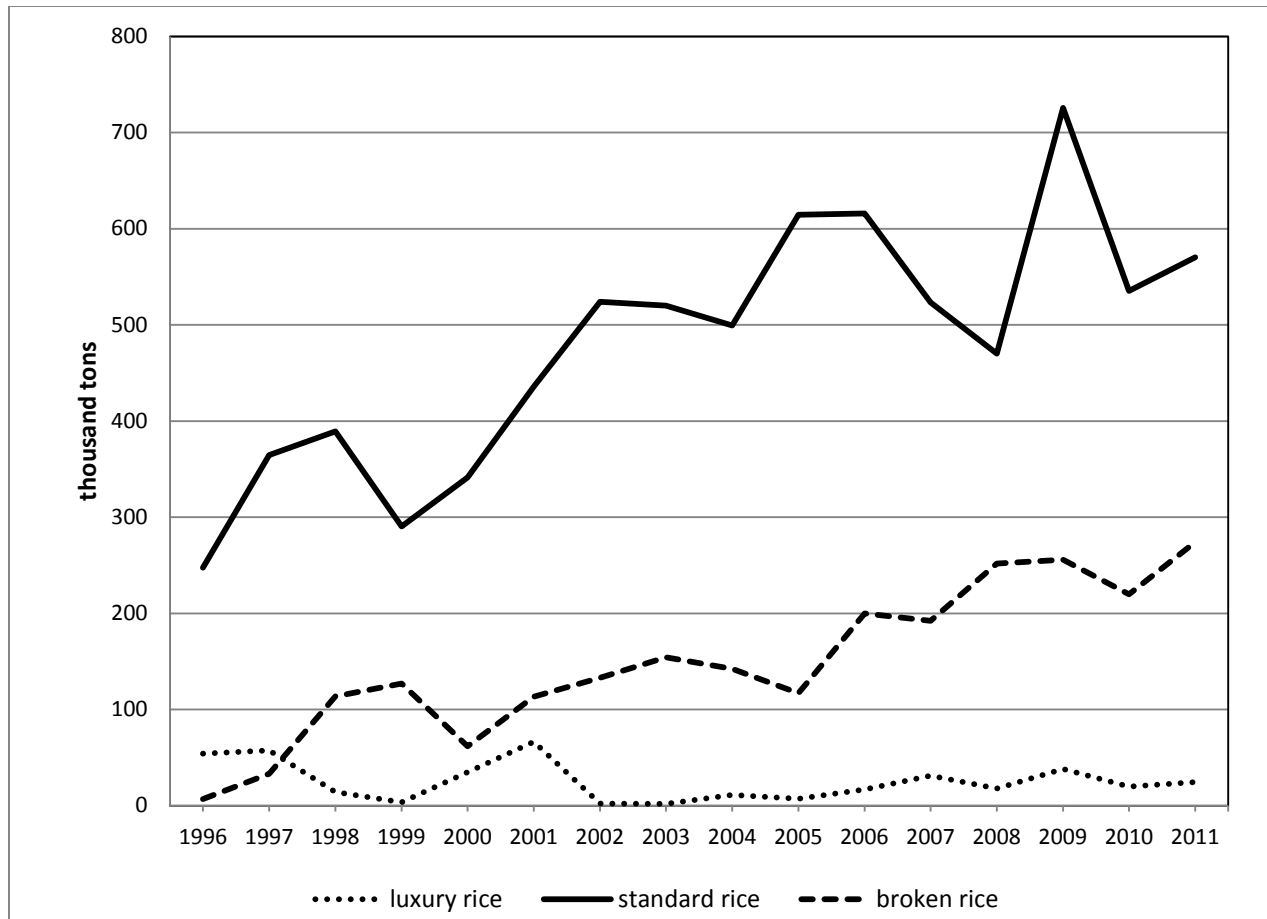

Source: Author's own design based on USDA data PS&D, 2012

Table 3. Test Results for Ivorian Source-differentiated AIDS Model

Product Aggregation
H0: Luxury rice can be aggregated
Wald Chi Statistic = 5296.86***   D.F=32
H0: Standard rice can be aggregated
Wald Chi Statistic = 1277.67***   D.F=15
H0: Broken rice can be aggregated
Wald Chi Statistic = 4.51   D.F=2
Block Separability
H0: Luxury rice is separable from all other qualities of rice
Wald Chi Statistic=49.14** D.F=24
H0: Standard rice is separable from all other qualities of rice
Wald Chi Statistic=103.34*** D.F=25
H0: Broken rice is separable from all other qualities of rice
Wald Chi Statistic=68.07*** D.F.=9
Parameter Stability
H0: There is no structural change after 2001
Adjusted Likelihood ratio statistics=2319.19*** D.F.=39

* indicates statistical significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Figure 2. Imports of rice 1996–2011

Source: Author's own design based on Ivorian Customs Service Data, Department of Statistics, 2012

Table 4: Elasticities Results

	Luxury Rice				Standard Rice					Broken Rice	
	Thailand	USA	Vietnam	ROW	Vietnam	Thailand	India	Chin	ROW	Thailand	ROW
Prices											
Luxury rice											
Thail.	-0.763***	0.119	-0.036	0.082	-0.018	-0.019	-0.571***	0.002	0.001	0.025*	-0.211***
USA	0.036	-1.009***	-0.010	0.139*	0.005	-0.014	0.010	0.004	-0.001	-0.015	-0.058
Viet.	-0.011	-0.011	-0.423***	0.025	-0.015*	0.001	-0.0005	-0.004	-0.006	-0.006	-0.001
ROW	0.012	0.109	0.024	-0.951***	-0.015*	0.008	-0.020***	-0.009	0.008	0.003	0.031
Standard Rice											
Viet	-0.036**	0.040	-0.135	-0.067	-0.819***	0.009	-0.026	-0.032*	0.054***	-0.081***	-0.125*
Thail.	-0.067	-0.148	0.015	0.128	-0.022	-0.784***	-0.077***	0.015	-0.018	-0.031*	0.222***
Ind.	-0.201***	0.159	0.076	-0.122	-0.022	-0.062*	-0.829***	-0.048*	-0.053**	0.032	0.031
Chin	0.036	0.067	-0.008	-0.006	-0.047	0.093**	-0.066***	-0.896***	-0.008	-0.071***	0.050
ROW	0.011	-0.038	-0.352	0.336*	0.092**	0.012	-0.102***	-0.030	-0.822***	-0.136***	-0.092
Broken Rice											
Thai	0.161**	-0.224	-0.075	0.240	-0.130***	0.016	0.035	-0.064	-0.100***	-0.844***	0.101
ROW	-0.102***	-0.099	-0.003	0.066	-0.029**	0.040***	-0.006	-0.003	-0.015	0.0002	-0.538***
Expend.	0.923***	1.035**	0.599**	0.130	1.020***	0.701***	1.136***	1.066***	0.957***	1.121***	0.591**

* indicates statistical significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

ROW=rest of the world