TRADE LIBERALIZATION AND IMPORT DEMAND FOR RICE IN NIGERIA: A DYNAMIC MODELLING

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Abstract

The study examined the effects of various trade policy instruments such as tariff, import restrictions, outright ban on rice import and other determinants on the import demand for rice in Nigeria between 1960 and 2007. Adopting a dynamic modeling approach, the unit root test of the series used in the model showed that they are all integrated of order one . Result of the long run equilibrium analysis showed that there is a long run relationship among the variables included in the model as the unit root test of the residual generated from the analysis was stationary at the level. Also, in the long run equilibrium model, three of the variables; exchange rate, per capita income and local output of rice were statistically significant at alpha 0.05 and all affected rice import demand positively. The short run dynamic model (ECM) result further confirmed the significance of per capita income and local output as major positive determinants of rice import in Nigeria. The significance of the coefficient of the error correction term confirmed the appropriateness of the error correction approach which also showed that ignoring the long run relationship is detrimental. The speed of adjustment measured by the coefficient of the error term indicated 99% instability in the growth rate of rice import in Nigeria during the period under study. Though the responsiveness of import demand for rice was particularly elastic with respect to exchange rate and per capita income, the most effective policy variable that can be focused on in the short run is the local output of the commodity. Thus, at primary production level, efforts should include subsidies of various form at various levels targeted at rice farmers while at secondary production level, efforts should include providing an enabling environment for private sector to invest in rice processing.

Keywords: *Trade liberalization, Import demand, Rice, Dynamic modeling*

1. INTRODUCTION

Development economists commonly argue that trade protection brings down the level of industrial and agricultural sectors' efficiency. First, in markets characterized by entry barriers, the absence of foreign competition allows local firms to enjoy monopoly power and excess profits. The consequence is that domestic producers usually fail to produce at minimum cost (to achieve allocative efficiency) and/or to get maximum possible output from their input bundles (to achieve technical efficiency) (Rodrik, 1988 and Njikam, 2003). Second, in markets characterized by Chamberlinean competition, trade protection usually attracts inefficiently small producers, causing increases in production costs. Indeed, the lack of competitive pressure generally induces costs to rise above the minimum level, owing to imperfect agency relationships within the firm. Also, resources are wasted through rent-seeking activities

undertaken to procure advantages against actual or potential competitors. Finally, production capacity is often left idle because of lack of concern for strict cost accounting.

To make industries free from the above symptoms, they need to be exposed to competition. This is because the competitive pressure forces firms to try to minimize their cost. Thus, liberalization of trade is expected to have several advantages for an industry. First, exposure to foreign competition will improve performances as the exposure to world market often increases the elasticity of demand that domestic producers face. This will in turn, causes firm to lose market power and forces them to move down their average cost curves (Tybout and Westbrook, 1995). Second, greater exposure of domestic firms to foreign trade activities is viewed as a means not only of generating foreign exchange, but also of leaning superior techniques of management and marketing, the infusion of modern technology and know-how through the cooperation of local firms with foreign counterparts. Hence, it is believed that an open trade regime will facilitate the flow of technical information. Also, openness, coupled with a liberal incentive structure, would inspire greater foreign investment inflow, and hence technology inflow into the economy (Oyejide, 1997).

Various trade policies that have been adopted in Nigeria in the past include tariff, import restrictions, and outright ban on rice import. During the 1970s and early 1980s, increased export earnings coupled with the highly over valued naira exchange rate made it possible for Nigeria to finance huge food imports. The high naira exchange rate cheapened food imports and consequently, lowered the domestic prices. In 1986, the Structural Adjustment Programme (SAP) was introduced and the main policy instrument in this regard was the ban on food importation, especially rice. Consequently the index of bias in protection shift in favour of rice. Even though, farmers were able to respond to this policy by way of increased production, the high cost of production could not made them cope with the increasing demand for the product.

Hence, to make up for the resulting gap in demand and supply, rice came into the country through illegal importation. The ban continued till 1995 before it was lifted in line with the WTO agreement on trade liberalization. However, because of the weak capacity of Nigerian rice farmers to response very quickly to policy initiatives, government had resorted to the use of tariff measures as a way of protecting the farmers. Since the ban was lifted, the tariffs on imported rice have increased from an average of 50% during the 1996-1999 to 100% in 2002. In 2003 the government increased the tariffs to 150% and proposed to ban the importation of the commodity by 2007. This, however, could not be achieved due to the astronomic increase in prices of rice as a result of the global food crisis. Even then, the intention of the proposed policy reversal was to protect the Nigerian rice farmers from foreign competition. Given the experience of the past, one is not sure that the best option for the country today is outright ban on importation of the commodity. It is obvious that no amount of protective measures will gear up the capacity

of the local farmers in the face of week institutional and social infrastructure. Also a reversal of policy without critical examination of the effects of past policy on the performance of the sector is not likely to yield the desired result.

To date in Nigeria, only a few studies have specifically examined the determinants of import demand for some specific commodities. The pioneering work of Olayide (1968) focused on some selected commodities (rice included) for Nigeria's imports in the period 1948-1964. The methodology involved the estimation of linear, curve-linear and power functions. Evidence of multiple regression models indicates that term of trade, real income (measured by GDP) and index of trade restriction had fairly good parameter estimates. Apart from the fact that this study is now outdated, some of the selected commodities have fizzle out of Nigerian import basket. Among the commodities that have remained persistently in the import basket is rice and there has not been any recent attempt to examine the determinants of import of this commodity in spite of various policy that have been put in place over the years to address importation. This study, in addition to improving on the analytical approach also elucidated more on the behaviour of rice import and its determinants during the two trade regimes in Nigeria. Thus, the main objective of this study is to examine the determinants of import demand for rice in Nigeria by comparing the period of government intervention in trade with the period of trade liberalization.

2. **Methodology**

2.1. ***Data***

The study made use of secondary data from various publications of the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), Food and Agricultural Organization (FAO), United Nation Centre for Trade Administration and Development (UNCTAD), Ministry of Agriculture and Natural Resources (MANR), National Population Commission (NPC) and Ministry of Commerce and Trade (MCT). Information sought for included total areas of rice (ha) harvested annually, annual domestic paddy supply, rice imports, and the retail price of rice, the world price and the nominal effective exchange rate among others. The data covered the period between 1970 and 2006.

2.2. ***Analytical framework***

The theoretical model adopted in this study followed Shiells, Stern and Deardorff (1986). The methodology of Shiells *et al* has recently become a point of focus to researchers that conduct analyses on import demand and its elasticities at disaggregated level. Its main attraction is that it treats different products symmetrically so that import demand functions derived for one product group are consistent with import demand functions in other product groups. It also accounts for the effects of changes in relative prices on the consumer's allocation of expenditures between imported and domestic products groups. Such changes may come from a variety of sources, like changes in tariffs, non-tariff barrier, exchange rate, domestic prices and wages, for which trade liberalization may be a basic stimulus. These are desirable qualifications to obtain reliable elasticities. The estimates of Shiells *et al* have widely been used in literature, especially in testing the political economy of import demand and trade models. Goldberg and Maggi (1999); Gawande and Bandhopadhyay (2000) and Thomakos and Ulubasoglu (2004) are the recent studies that have adopted this framework.

According to the framework; Let there be i=1,2,…,k product groups. Import demand for product group i, is such that Q is a function of import price P_i^m , domestic rice P_i^d and expenditure E. domestic demand and expenditures are similarly functions of import and domestic prices. Import supply is given as a function of the price received in the foreign market for imported goods, foreign output prices, factor prices, wages and capital rents, all measured in foreign currency (thus, the nominal exchange rate enters the import supply equation). Domestic supply is given as a function of the price of domestic output as well as domestic factor prices, wages and capital rents approximated by an interest rate. As commonly employed in previous studies, a log-linear specification is usually taken to be an adequate approximation of the functional form of the import demand equation. Given the above scenario, the import demand equation to be estimated, for product group i, (in this case rice) is given by:

$$q_{it}^m = \beta_{i0} + \beta_{i1} p_{it}^m + \beta_{i2} p_{it}^d + \beta_{i3} e_{it} + \mu_{it} \qquad (1)$$

where lower case letter denote natural logarithms and β_{i0} = C_i + In α I , for some constant C_i . The approximation error term μ_{it} is assumed to follow stationary autoregressive process:

$$U_{it} = \sum_{j=1}^{p} P_j u_{it-j} + \varepsilon t_{it}, \varepsilon_{it} \qquad N \ , \ \vartheta \ (^2 \qquad (2)$$

This model was adjusted appropriately to capture other variables that can determine import demand for rice such as local output, domestic retail prices and exchange rate while expenditure is proxies by the gross national product (GNP) per capita.

In this study, one of the key issues that were investigated empirically is the impact of per capital income on import demand for rice in Nigeria. The per capita Gross National Product (GNP) and the per capita National Income (NI) are two common approaches that can be used to arrive at the per capita income. Another important issue that was investigated in the study is the exchange rate. In this study the nominal effective exchange was used and the index has weights based on a methodology that takes into account each country's trade in both manufactured goods and primary products with its partners or competitor countries. When nominal effective exchange rate is computed, it is a weighted average consumption basket for all trading partners and the home country. The *a priori* expectations are that import demand for rice is expected to vary directly with per capita income (GNP). On the other hand, increase in domestic output, nominal effective exchange rate, and import price are expected to have negative effects on import demand for rice. Also the increase in retail price of local rice is expected to shift demand in favour of imported rice. The basic model is expressed in functional form as shown in equations 3. In equation 3, a dummy variable has been included to capture the effect of liberalization and structural shift in policy. These equations will be estimated for both the long and short run equilibrium.

$$RMP = F (GNP, IMP, LRQ, EXN, LRP, DM) + V_3. \quad (3)$$

(both periods combined)
Where
RMP = quantity of rice import ('000 tones)
GNP = gross national products (per capita) (N)
IMP = price of imported rice (naira per kg)
EXN = nominal effective exchange rate (1985=100)
LRQ = local output of rice ('000 tones)
LRP = average retail price of local rice (naira per kg)
V_1 = is the error or disturbance term.
DM = Dummy variable representing 1 for the period of trade regulation and 0 otherwise.

Estimation procedures

The procedure for estimating the above equations drew largely from co-integration analysis and the error correction model (ECM) which has been used to explore several economic phenomena (Adam, 1992: Egwaikhide, 1999 and Mafimisebi, 2002). The basic idea behind this analytical framework is the determination of characteristics of the time series variables. Most importantly, to ascertain the order of integration and, therefore, the number of times a variable has to be differenced to arrive at stationarity. The underlying principle behind econometric estimation method is the thinking that the mean and variance computed from such economic variables that are stationary would be unbiased estimates of the unknown population mean and variance. However, due to fluctuations in the World economy, non-stationarity has become an

extremely common phenomenon in macro-economic variables. The implication of non-stationarity in econometric modeling is grave as it leads to spurious regression. This often manifest when regression of unrelated non-stationary series indicate that the series are correlated (Adam, 1992). Egwaikhide (1999) argued that using one or more non-stationary series in a regression equation could produce biased estimates, thereby leading to incorrect statistical inferences when such series are estimated at their levels, except in the case of a co integration relationship. Therefore, identification of the time series properties of model variables assists in avoiding the problem of spurious estimates.

Stationarity test

A series is said to be stationary if the means and variances remain constant over time. It is referred to as I(0), denoting "integrated of order zero". A stationary series tends to constantly return to its mean value and fluctuation around this means value has broad amplitude. Hence, the effect of shocks is only transient. On the other hand, a series is not stationary if the means and the variances vary over time and the variances are infinite. It is said to be integrated of order'd'. In this case, shocks have permanent effects.

Among fairly sophisticated methods for evaluating the time series characteristics of macro-economic variables are the Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF), and Sargan-Bhargava Durbin-Watson (SBDW) tests. The ADF test was adopted in this study. The DF test is applied to a regression of the following form

$$\Delta Y_{it} = \beta + \beta_{it} + \delta P_{t-1} + e_{it} \qquad (4)$$

Δ = First difference
t = time or trend variable

The null hypothesis that $\delta = 0$ implies existence of a unit root in P_{it} or that the time series is non-stationary. When the lagged difference terms in equation (4) are increased, the DF test in this case is called ADF test and equation (4) will be modified as:

$$\Delta Y_{it} = \beta_1 + \beta_{2t} + \delta_{tt-1} + \alpha_{ii} \sum_{i=1}^{m} \Delta P_{it-1} + e_{it} \qquad (5)$$

The null hypothesis of a unit root or non-stationary is still that $\delta = 0$. The critical values which have been tabulated by Dickey and Fuller (1979), Engle and Yoo (1987) are always negative and are called ADF statistics rather than t-statistics. If the value of the ADF statistics is less than (ie. more negative) the critical value, it is concluded that P_{it} stationary ie. $P_{it} \sim I(0)$. When a series is found to be non-stationary, its first-difference (i.e. series $\Delta P_{it} = P_{it} - P_{it-1}$) is obtained and the ADF test is repeated on the first differenced series. If the null hypothesis of the ADF test can be rejected for the first differenced series, it is concluded that $P_{it} \sim I(1)$. All the variables in equation 3 will be investigated for their order of stationarity.

Co-integration test

Two or more variables are said to be cointegrated if each is individually non-stationary (i.e. has one or more unit roots) but there exists a linear combination of the variables that are stationary. This implies the existence of long run equilibrium between the two variables. In any two cointegrated variables, deviations from the short-run equilibrium may occur in the short-term, but their linear combination will return eventually to a constant mean. The concept of cointegration has been used in many ways to define equilibrium (Silvapulla and Jarasuriya, 1994). Robust methods for testing whether macroeconomic variables are cointegrated have been put forward by Engle and Granger, (1987); Stock and Watson (1989); Johansen and Juselius (1992). The Engle-Granger two-step procedure is used to test the existence of cointegrating relationship due to its simplicity. This require testing unit root (DF, ADF and SBDW) on the individual series; and when the variables of interest were found to be I(1), a static model was estimated for the co integrating regression. The second stage involved evaluating the order of integration of the residual generated from the static model. The satisfaction of a battery of tests justified the application of the error correction model. This study investigated for co-integration among the variables included in equation 3.

3. **Results and discussion**

3.1. ***Summary of property test of the series***

In order to test for the stationarity properties of the series, unit root test was performed on each of the variables. The ADF test is based on the regression equation (5) while the result of the unit root test is presented in Table 1. It is clear from Table 1 that all the series are integrated of order 1 except per capita income. In other words, all the variables were differenced once before becoming stationary except per capita income which required to be differenced twice.

Table 1
Unit Root Statistics of the series

Variables	Level	1st difference	Remark
LRMPQ – Rice import	-3.1844	-3.1607	I(1)
LEXN – Exchange rate	0.3813	-3.5073	I(1)
LGNI – Per capita income	-3.3902	-2.9532	I(2)*
LLRP – price of local rice	0.5561	-4.3041	I(1)
LLRQ – Local rice output	-0.7513	-3.3901	I(1)
LIMPN- Price of imported rice	-0.8741	-4.123	I(1)

*ADF- Critical value at 5%= 2.9627 * Not stationary at first difference*

3.2. ***Equilibrium relationships and co-integration***

Having established the evidence of a unit root in the variables, testing for the existence of long run relationship (cointegration) among the series will be required in order to guide against possible misspecification. When series are individually non-stationary, cointegration is premised on the properties of the residual from the Ordinary Least Square (OLS) regression. Therefore, the null hypothesis of non-cointegration is that the residual is non-stationary. Hence, the series are cointegrated should the residual be stationary. The result of the long run equilibrium analysis showed that there is long run relationship among the variables as the unit root test of the residual generated from the analysis was stationary at the level (-3.7001). The result of the lung run equilibrium in displayed on Table 2.

Table 2

Long Run Equilibrium (Cointegration) Regression Result

Variable	Coefficient	Std. Error	t-Statistics	Probability
C	-824117.40	236050.70	-3.49*	0.00
LEXN	5939.17	1450.56	4.09*	0.00
LGNI	965.62	423.16	2.28*	0.03
LIMPN	5430.86	5602.02	0. 96	0.34
LLRP	1324.37	4283.38	0.31	0.76
LLRQ	0.24	0.12	2.08*	0.04

R-square 0.7979, Adj. R-Square 0.7605, Log likelihood -442.7246, DW stat 1.8195

In the long run static equilibrium equation, three out of the five explanatory variables were statistically significant. These are the nominal exchange rate, per capita income and local output of rice. In terms of the signs of these variables, only the per capita income carried appropriate positive sign. Prices of both imported and locally produced rice were found not to exert any significant influence on rice import. This confirmed the fact that imported rice and local rice are not direct substitutes and such, the cross price elasticity for the substitution of imported rice for local rice is less than one (0.240)-inelastic. Hence, there appeared to be segregation in the market demand for the two commodities. While the imported rice is been consumed by the middle and high income earners, the local rice is consumed mainly by the low income earners. The positive sign of per capita income further confirmed that imported rice in Nigeria is more of luxury than of "Giffen" or inferior goods. Thus, the higher the per capita income the higher the demand for imported rice in Nigeria. The fact that increase in nominal exchange rate did not reduce importation of rice is an indication of the insensitivity of rice import to Nigerian exchange rate policies. The fitness of this long run model is attested to by the R-Square and adjusted R-square of 0.79 and 0.76 respectively. This shows that the independent variables explained close to 80% variation in import demand for rice in Nigeria.

3.3. ***Short –run dynamic relationship***

In order to examine the dynamic relationships among the series, an error correction model was specified. The essence of this is to be able to see in the short term what variable is more sensitive to policy adjustment and to measure the speed of adjustment of rice import to policy changes. Thus, the lag value of the error term generated from the residual of the long run equation was included in the short run equation. Other variables included are the one period lag value of per capita income and a dummy variable to capture the effect of trade liberalization. The result of the ECM is presented in Table 3.

Table 3
Short Run Dynamic Model (ECM) Result

Variable	Coefficient	Std. Error	T-Statistics	Probability
C	0.16	0.32	0.50	0.62
DLEXN	1.27	0.41	0.64	0.52
DLGNI	3.30	1.32	2.49*	0.02
DLGNI(-2)	-2.61	1.07	-2.42*	0.02
DLIMPN	0.40	0.42	0.94	0.35
DLLRP	-0.72	0.74	-0.96	0.34
DLLRQ	3.11	0.99	3.13*	0.01
DMV	0.41	0.33	1.21	0.24
ETERM(-1)	-0.99	0.20	-4.85*	0.00

R-square 0.58, Adj. R-square0.42, Log likelihood -32.01, Dw –Stat. 1.55
** Significant at alpha 0.05*

The result further confirmed the significance of per capita income and local output as major determinants of rice import in Nigeria. The R-square and the Adjusted R-square showed that the model still explained a significant variation in rice import and such the model can be exploited for policy purpose. As expected, the coefficient of the error correction term (Eterm (-1)) has negative signs and is statistically significant at 5% level, which confirmed the appropriateness of the error correction approach. Thus, ignoring the long run relationship is detrimental. The speed of adjustment measured by the coefficient of the error correction term is 0.99 which indicates 99% instability in the growth rate of rice import in Nigeria during the period under study. The dummy variable representing the effect of trade liberalization was not significant at 5% which indicates that the increasing trend in the demand for imported rice in Nigeria cannot be adduced to trade liberalization. This thus, puts to question the rationale of government decision to place ban on importation of the commodity by the end 2007.

3.4. *Responsiveness of import demand for rice in Nigeria*

The responsiveness of import demand for rice in Nigeria can be measured by the rate at which import demand adjust to volatility or variation in the exogenous variables during the period under investigation. This, is in other words refers to as elasticity. Thus, elasticity of import demand is measured as the responsiveness of import demand to a percentage increase in the explanatory variables and this is derived from the short run dynamic model and the result is presented in Table 4

Table 4
Elasticity of Import Demand for Rice in Nigeria

Variable	Elasticity	Inferences
DLEXN	1.27	Elastic
DLGNI	3.30	Elastic
DLIMPN	0.40	Inelastic
DLLRP	-0.72	Inelastic
DLLRQ	3.11	Highly elastic

Computed From the Short Run Dynamic Model Result

It is obvious from the Table that import demand for rice in Nigeria was highly elastic with respect to local output and per capita income. Thus, percentage increase in per capita income in Nigeria will increase import demand for rice by 3.30 per cent. Similarly, a percentage increase in nominal exchange rate will increase import demand for rice by 1.27 per cent. Import demand for rice was however, inelastic with respect to prices of both imported and local rice. This shows that the local rice is not a perfect substitute for imported rice. Also, increased price level will not be adequate to curb importation of rice which equally shows that imported rice is becoming more of "Luxury" in Nigeria as its consumption increases with increase in per capital income. The fact that increased output of local rice will not bring down importation as demonstrated by the positive sign of the local output variable (DLLRQ) further confirmed that local rice and imported rice are not perfect substitutes.

4. **Conclusion**

The two most important policy variables emanating from this study are the per capita income and local output of rice. Both variables, however, require appropriate and conscious policy decisions. In the light of food self sufficiency and national food security or poverty reduction, no country will like to embark on policy that will adversely affect the per capita income in an attempt to discourage importation of one food item. Similarly, to impose total ban on importation of rice will contradict government plan to pursue a market led economy. Therefore, the only viable option is for government at various levels to concentrate on those factors that can lead to increase in local supply of the commodity.

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