



Research Paper

Econometric Analysis of the Effect of Rice Production and Importation on Domestic Consumption in Nigeria (1999-2013)

A. H. Wudil, *Y. N. Katanga and A. Nasiru

Department of Agricultural Economic and Extension, Federal University Dutse, Jigawa State, Nigeria.

*Corresponding Author E-mail: yaunuhu@yahoo.com

Received 20 November 2015; Accepted 6 December, 2015

The research examined the econometric effect of rice production and importation on domestic consumption in Nigeria. Secondary data of yearly production, importation and domestic consumption of rice (1999-2013) were collected and used in the study. Result of co-integration reveals that the variable Total National Rice Importation, (TNRI), Total National Rice Production, (TNRP) and Total National Rice Consumption (TNRC) are co integrated and stationary. Regression result shows that local rice production and rice importation were statistically significant at 1% level. It further shows that, the variables (importation and production) are important determinant of rice consumption. Meaning that, local production alone cannot meet the ever increasing demand for rice in the country. As such the policy decision to completely ban rice importation will create more problems if rice production is not significantly increase to cater for ever increasing

consumption. The coefficient of 0.869 and 1.035 for imports and local production suggests that a unit increase in any of the variable will amount to an increase in the domestic consumption by 0.869 and 1.035. Result of the Granger causality shows a unidirectional relationship between TNRI and TNRC, TNRI and TNRP but no causality between TNRP and TNRI. The study recommend that, Nigeria need to improve its local rice production in order to meet the ever increasing domestic consumption owing to its significance as the main diet of typical Nigerians as well as the main source of livelihood to its value chain actors in the country.

Key words: Econometric, Rice production, Rice importation, Rice consumption and Nigeria.

INTRODUCTION

Rice (*Oryza sativa*) is a cereal which has become a staple food of considerable importance in many African Countries, where its consumption among urban and rural poor households has increased considerably (WARDA, 2003). Rice is the second most important cereals in the world after wheat in terms of production (Olaf and Lancon, 2003). Nigeria ranks the highest as both producer and consumer of rice in the West Africa Sub-region (Gani and Omonona, 2000). It is the most consumed staple food by Nigeria's over 174 million people across states and geo-political zones. There is lopsidedness in the level of production of rice in Nigeria as compared to its consumption pattern. The implication is that, to meet up

with the high demand for its consumption, the rice has to be imported and these have been on the high side.

The rice sector in Nigeria is one of the most important remarkable agricultural developments over the decades. In the light of this, Frederic et al. (2003) observed that, with rice now being the structural component of the Nigerian diet, and rice imports making up an important share of Nigeria's agricultural imports, there is considerable political interest in increasing the consumption of local rice. This has made rice a highly political commodity.

To respond to the prevailing rice production and consumption deficit situation in Nigeria, successive

governments intervened in the rice sector by increasing tariffs so that local production could be encouraged. Akaeze, (2010) maintained that, Nigeria is the highest consumer of rice within the West African sub-region. He further argued that, the quality of production of rice which is mostly imported in Nigeria is far better than the locally produced rice. That its consumption to some individuals is a habit; while to others is quality preference over the locally produced rice. The Nigerian population is by far greater than the rest of the West African countries; most homes depend on rice consumption and having it as an everyday meal.

The Government also established the Federal Rice Research Station (FRRS) at Badeggi in 1970 and the National Cereal Research Institute (NCRI) in 1974. Also established were the National Seed Service (NSS) with the assistance of the Food and Agriculture Organization (FAO) in 1975 and Operation Feed the Nation (OFN). Challenges in Nigeria rice production are many some of which include high input cost, cost of credit, and high cost of imported equipment including agrochemicals due to tax tariff and duties. There is also problem of policy instability (ban, unban tariffs) that make decision making and planning highly uncertain and put investments at a great risk. The average annual rice production in Nigeria is dominated by small holder farmers who cultivate small hectares of land using traditional methods of farming. Yields are low and hence the wide gap of demand and supply.

Akpokodje *et al.* (2001) maintained that, a comprehensive and up to date picture of rice sector in Nigeria in general and rice production, processing and consumption in particular is lacking. It can be seemingly noticed that, despite its agricultural potentials, Nigeria is yet to harness its vast land resources suitable for agriculture, to not only improve its export on rice, but even to cater for its domestic consumption which will invariably serve for sufficient food security. This is evident from the fact that, rice consumption in Nigeria increases over decades and in alarming rates. Although, the total rice production is increasing recently due to high demands; the recorded increase however, have not been sufficient to meet the increasing demand from the rapidly growing population.

Osagie, (2014) observed that Nigeria currently spends about a billion Naira daily importing rice, a development which the Minister of agriculture and rural development (Mr. Adesina), says is helping to put farmers to work in countries like USA, India, and Thailand; (countries where Nigeria mostly imports rice); while putting farmers out of work in Nigeria.

Nigeria's milled rice production in the year 1999 (on return to democracy) was only 0.05% for its market capacity and by 2013 only 16.96% was recorded (Terwase and Madu, 2014). This did not improve significantly to meeting the high demand and consumption of rice in the country. However, rice

importation in 1999 was 950 thousand metric tonnes, but this continues to increase by years and in the year 2013 about 3 million metric tonnes were imported, this is quite alarming. Terwase and Madu, (2014) further reported that, In 1999, about 2.8 million metric tonnes representing 1.81% were consumed domestically, but this skyrocketed to 6 million metric tonnes representing 13.21% in 2013. The Nigerian government recently came up with a policy decision to ban rice importation completely by 2015. The question is how prepared is the government towards ensuring that, this policy intentions are actualized? Considering the fact that, the United States Department of Agriculture reveals that, Nigeria's rice imports in 2012 to 2013 alone were estimated to reach about 3 million tones. This was mainly because, the projected increase in rice production in 2012 to 2013 falls short of consumption requirements.

Emodi and Dimelu (2011) observed that, "there will be an encouragement of the local producers of rice when a ban is put in place on the importation of rice in Nigeria. Perhaps adequate steps need to be taken by the government to ban the importation of rice and at the same time create an avenue for the foreign investors such that rice can be produced locally". Among other things, destoner mills should be established as well as provision of technology which will do the drying and milling of the local rice.

Kebbeh *et al.* (2003) relates a decline in rice production in Nigeria, to the introduction of the Structural Adjustment Programme (SAP) that bedeviled the Sub-Saharan African countries where subsidies were eliminated. The subsidies were known as key support to the farmers. With the aid of the subsidies, the farmers were enabled to acquire the needed support through provision of fertilizers at low costs as well as other inputs for the purpose of domestic rice production. In the area of irrigated rice production which is majorly practiced in the northern part of the country, it became very difficult to purchase the needed inputs since this type of farming requires much money to start the farming system known as irrigation. The problem of irrigated rice production is largely faced by the poor farmers who are in the production sector. This is because access to credit facilities becomes difficult and therefore, there arises the need for the government through a functional system to decentralize a mechanism for the purpose of obtaining credit facilities. The issue of local rice production in Nigeria is now an important goal in order for the government to resolve the demand for rice through self-sufficiency. Since the consumption level is very high, there is need for political-economic impact to be made as taking responsibility on the side of the government as a strategy (Rahji and Adewumi, 2008; Africa Research Bulletin, 2010). This work identified the problems that limit the production of rice locally but there is limited knowledge on rice consumption and empirical data on rice importation, thereby leaving gaps to be filled in this research paper.

METHODOLOGY

Secondary data was used in this research work. For the data consistency and reliability, the study was limited to 15 years (1999-2013), annual data on milled rice production, importation and consumption was collected from Index Mundi, (2014) adapted from United States Department of Agriculture (USDA). Data were analyzed and tested using, Augmented Dickey- Fuller (ADF) Unit Root Test, Co-integration Test, Ordinary Least Square (LSD) models and 'Granger Causality test.

The Augmented Dickey- Fuller (ADF) unit root test was used to test the non-stationary of the time series (Dickey and Fuller, 1979). The test also enables the determination of the order of integration of the series, which is the number of times a series has to be differenced for it to become stationary. A series is integrated of order zero if no differencing is needed to make it stationary and it is integrated of order one if only one differencing is needed to make it stationary. The null hypothesis is that series is integrated of order zero, and the alternate hypothesis is that the series is integrated of order one. If the t-statistics for the coefficient α_1 , is greater in absolute value than a critical value given by ADF critical value, then the null hypothesis is rejected and the alternative hypothesis of stationary is accepted. If the null hypothesis is not rejected, then one must test whether the series is of order of integration higher than just 1, possibly 2. In this case the same regression equation (1) is applied to the second differences.

$$\Delta DCi_t = \alpha_0 + \alpha_1 DCi_{t-1} + \sum_{k=1}^{k=n} \alpha_k + \Delta DCi_{t-k} + Ei_t \dots \dots \dots (1)$$

Co-integration test

After determining the order of integration the co-integration test was applied. The test for co-integration was based on the framework developed by Johansen (1991); and Johansen test determine the numbers of co-integrating equations. This number is called the co-integrating rank. This procedure entails the identification of the rank of the matrix π in:

$$\Delta DCit = \beta_0 + \sum_{i=1}^k \pi i DCj_{t-1} + et \dots \dots \dots (2)$$

We let DC to represent a column vector of the series involved in the analysis. The equation is reparametrized in order to imposed the co integration constraints as follows:

$$\Delta DCit = \beta_0 + \sum_{i=1}^{k-1} \Delta DCi_{t-k} + \pi DCj_{t-k} + et \dots \dots \dots (3)$$

According to Johansen, (1995), the variables are not co-integrated if the rank is zero, However, if the rank = r, then there exists possible independent linear combinations (co-integrating vector).

Regression equation

The rate of National rice consumption depend on local rice production and rice importation:

$$\gamma = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \mu \dots \dots \dots (4)$$

Where

- γ = Consumption
- β_0 = constant
- β_1 and β_2 = the coefficient of explanatory variables
- X_1 = Rice production in 1000 mt
- X_2 = Rice importation in 1000 mt

Granger causality

However, the causal relationship was examined with the help of the Granger causality test represented as:

$$TNRC = \gamma + \sum b_i TNRC_{t-1} \sum b_2 TNRI_{t-1} + v_t$$

$$TNRI = \beta_0 + \sum b_i TNRI_{t-1} \sum b_2 TNRC_{t-1} + u_t$$

$$TNRP = \beta_0 + \sum b_i TNRP_{t-1} \sum b_2 TNRC_{t-1} + u_t$$

$$TNRC = \gamma + \sum b_i TNRC_{t-1} \sum b_2 TNRP_{t-1} + v_t \dots \dots \dots (5)$$

Where TNRC, TNRI, and TNRP are total national rice consumption, total national rice importation and total national Rice production respectively. Also u_t and v_t are serially uncorrelated random disturbance with zero mean. In the above equation, Granger causality test are related to the significance of the g' s and conditional on the optimal lag lengths m,n,q and r (Omotor, 2006). The Eviews 5.1 computer software was used in testing for Granger causality. Eviewa runs a Bivariate regressions of form for all possible pairs of (x,y) series in the group and reports F-statistics. The reported F-statistics are the Wald statistics for the joint hypothesis for each equation. The null hypothesis is therefore that x does not Granger course y in the first regression and that y does not Granger course x in the second regression.

Table 1. Unit root Test.

Variables	Levels	Second Difference
Consumption	1.038	-4.058
Production	-0.961	-4.004
Import	-0.659	-4.058

Source: Field survey, 2013.

Table 2. Unrestricted Co-integration Rank Test (Trace).

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.977025	61.54752	29.79707	0.0000
At most 1	0.579491	12.49416	15.49471	0.1347
At most 2	0.090444	1.232389	3.841466	0.2669

Source: Field survey, 2013.

Table 3. Regression analysis result.

Model	Co-efficient	Std. error	T-value	Significance
Constant	142.015	505.9236	0.280704	0.7837
Import	0.86956	0.176942	4.914498	0.0004***
Production	1.03575	0.288866	3.585579	0.0037***

***significant at 1%,Source: Field survey, 2013, $R^2 = 89.7$,F - value = 51.9533,R- Adjusted = 87.9

Table4. Granger causality test.

Null Hypothesis	Observation	F-Statistic	Prob.
TNRI does not Granger Cause TNRC	15	0.11193	0.0443
TNRC does not Granger Cause TNRI		1.83343	0.2029
TNRP does not Granger Cause TNRI	15	2.56082	0.1378
TNRI does not Granger Cause TNRP		1.00479	0.3377
TNRP does not Granger Cause TNRC	15	0.23236	0.6392
TNRC does not Granger Cause TNRP		6.40975	0.0279

Source: Field survey, 2013.

RESULTS AND DISCUSSION

The unit root test of rice domestic consumption

A time series that has a unit root is a non-stationary time series. The series is stationary if its mean and variance are constant over time and the value of covariance between two time periods depends upon the lag between the two time periods, but not on the actual time on which the covariance is computed (Gujarati, 2004). The research adopted the Augmented Dickey Fuller (ADF) test to test the stationarity. The result indicated the order of integration of each variable. Table 1 revealed that the variables: TNRC is stationary at first difference and the variable is integrated of order I (1). This implies

that the null hypothesis of non stationary for the variables is rejected (Table 1).

Co-integration test

The results of Trace and Maximum Eigen value tests were reported in Table 2 which established the rejection of the null hypothesis of no co- integration at 5% level. This means that the TNRC, TNRP and TNRI are co-integrated and stationary.

Regression analysis

Table 3 presents the results of the regression analysis for

rice consumption. The coefficient of determination R^2 is 0.897, implying that 89.7% of the total variation in the dependent variable are explained by the independent variables included in the model. This supports the findings of Sani *et al.* (2007) who reported the regression coefficient (R^2) value of 93.1%. The adjusted R^2 of 87.9% confirms the fitness of the model. The F-value which measures the joint significant of all the explanatory variables was found to be 51.95%. The result revealed that both rice importation and production were positive in the regression, implying that a unit increase in any of these variables will amount to an increase in the level of output by 0.87 and 1.04 respectively. Result further shows that, rice importation make up an important share of Nigeria's agricultural imports, The policy decision to ban rice importation completely will be a problem if rice production is not significantly increase to cater for ever increasing consumption. This finding is in line with that of the United States Department of Agriculture which reveals that, Nigeria's rice imports between 2012 and 2013 were estimated to reach about 3 million tones, this signifies the extent of rice consumption in the country. t-statistics was used to test for individual significance of the estimated parameters $\{\beta_1, \beta_2\}$. This shows that 4.91 and 3.59 for TNRI and TNRP were greater than 1.960 the t-tabulated, thus implying that , TNRI and TNRP are statistically Significant.

Granger causality

The empirical literature analyses of the causal relationship between Local rice production and rice importation on national rice consumption were through Granger – Causality. TNRC is said to be Granger caused by TNRI and TNRP if TNRI and TNRP helps is the prediction of TNRC or equivalently. Since the coefficient of TNRP and TNRI are statistically significant 0.0443 and 0.0279, respectively. It means TNRI and TNRP granger causes TNRC. The test reveals that causality goes from importation and production to consumption and not the other way. This proves that ban on rice importation can lead to shortage of rice supply in the market for local consumption; hence effort should be made to improve local production before ban is imposed on importation.

Conclusion

The study reveals that, figures of Total National Rice Importation (TNRI), Total National Rice Production (TNRP) and Total National Rice Consumption (TNRC) are co integrated and stationary. Rice production and importation were statistically significant at 1% level, hence these variables were found to be important determinant of rice consumption, similarly local production alone cannot meet the ever increasing

demand for rice in the country. There seems to be a problem when the production is not increase to adequately take care of the local consumption.

Recommendations

Based on the findings the following are recommended:

- (1).Nigeria needs to improve its local production in order to meet her ever increasing domestic consumption due to its rapid population growth.
- (2).As rice remains the main diet of typical Nigerians as well as the main livelihood, farmers in the country, public and private hands are needed to impacts positively on the creation of conducive environment that will favor domestic production and subsequently consumption of the commodity in the country.
- (3).The policy decision to completely ban rice importation will create more problems if rice production is not significantly increase to cater for ever increasing consumption as such some mechanisms need to be on ground to allows for gradual implementation of the policy such as target by years could be set to slowly but sustainably guide the process.

REFERENCES

- Akpokodje G, Lancon E, Erenstein O (2001). Nigeria's Rice Sector: State of the Art. Paper Presented at the NISER/WARDA Nigerian Rice Economy Workshop, Ibadan, 8-9 November, 2001, Bouka, Cote D'ivoire 4-9
- Akazeze HO (2010). Consumer preference for imported rice in Nigeria-perceived quality differences or habit persistence? Thesis Submitted to Michigan State University for the Degree of Master of Science Agricultural, Food and Resource Economics, UMI Dissertation Publishing.
- Emodi IA, Dimelu MU (2011). Strategies for enhancing rice innovation system in Southeast Nigeria. *British Journal of Management and Economics*, 2(1):1-12.
- Frederic L, Ola E, Akande E, Titilola SO, Akpokoje G, Ogundele OO (2003). Imported rice retailing and purchasing in Nigeria: A survey, West Africa Rice Development Association (WARD A) 2 Abidjan, Cote d'Ivoire.
- Gani BS, Omonona BT (2009). Resources use efficiency among small scale irrigation Maize producers in Northern Taraba State of Nigeria. *J. Hum. Ecol.*, 28 (2):113-119.
- Gujarati DN (2004). *Basic Econometrics*, 5th edition New Delhi McGraw-Hill Offices. Government of India (1989). *National Accounts Statistics Sources and Methods*. New Delhi: Pp 783.
- Johansen S (1995). *likelihood-based Inference in co-integrated vector Autoregressive Models*, Oxford University Press.
- Johansen S (1991). Estimation and hypothesis testing of co-integration vector in gaussian vector autoregressive models. *Econometrica*, 59:1551-1580.
- Index Mundi (2014). Nigeria milled rice, production, imports and domestic consumption by year, adapted from United States department of agriculture. Available from <http://www.indexmundi.com/agriculture/?country=ng&commodity=mill edrice&graph imports>.
- Kebbe M, Haefe S, Fagade SO (2003). Challenges and opportunities for improving irrigated rice productivity in Nigeria. West Africa Rice Development Association (WARDA) Bouake, Cote d' Ivoire.
- Olaf E, Lancon F (2003). The Nigeria Rice Economy in a competitive World: Constraints Opporunities and Strategic Choice. Report of the

- Final Technical Workshop. August 20-21, 2003, Ibadan WARDA, Abidjan, Coted'Ivoire.
- Omotor DG (2006). Causality Test of the Relationship between Domestic Savings and Economic Growth: Evidence from Nigeria. *Oceanic Bank Economic. Business J.* 1(1):23-30.
- Osagie C (2014). 2015 rice importation ban: Disregard US report, FG urged. Available from <http://www.thisdaylive.com/articles/2015-rice-importation-ban-disregard-us-report-fg-urged/168731/> [Accessed 17/05/14].
- Rahji MA, Adewumi MO (2008). Market supply response and demand for local rice in Nigeria: Implications for self-sufficiency policy. *Journal of Central European Agriculture*, 9(3): 567-574.
- Africa Research Bulletin, 2010. Economic, financial and technical series (2010, August 3) Rice, Blackwell Publishing Ltd, 47(6): 18742C-18743A. Available from, <http://onlinelibrary.wiley.com/doi/10.1111/j.14676346.2010.03362.x/pdf>.
- Sani A, Yakubu A, Bello HM (2012). *Resource-Use Efficiency in Rice Production Under Small Scale Irrigation* in Bunkure Local Government Area of Kano State. Proceeding of the 23rd annual conference of the Farm Management Association of Nigeria (FAMAN), Usmanu Danfodio University, Sokoto. Pp.292-296.
- Terwase IT, Madu AY (2014). The Impact of Rice Production, Consumption and Importation in Nigeria: the political economy perspectives. *International Journal of Sustainable Development & World Policy.* 3(4):90-99.
- WARDA (West African Rice Development Association) (2003). *Rice trends in sub-Saharan Africa: A synthesis of statistics on rice production, trade and consumption*, UK, Sayce publishing. Pp.1-22.