Social Sciences, Humanities and Education Journal (SHE Journal)
Volume 3 (3) 526 – 536, September 2022 | ISSN: 2720-9946 (Online) ISSN: 2723-3626 (Print)
The article is published with Open Access at: http://e-journal.unipma.ac.id/index.php/SHE

ESTIMATING THE DEMAND FUNCTION OF RICE PRODUCTION IN NIGERIA (1981 – 2018)

Amalu Emeka Melvin ✉; Department of Agricultural Economics' University of Calabar, Calabar, Nigeria.
Uzoigwe Amara; Department of Agricultural Economics, University of Calabar, Calabar, Nigeria.

Abstract: The study estimated the demand function for rice in Nigeria from 1981 to 2018. The objective was to estimate the short run and long run demand function (including price elasticities) of rice in Nigeria from 1981 to 2018. Secondary time series data were used for the study. The data were analyzed using inferential statistics of which the Johansen Maximum likelihood method of cointegration was used. The results revealed that the previous years' demand (0.353) and price of close substitute (0.182) significantly affected demand in the short-run with an ECM (-1) of -0.653 while for long run price of close substitute (0.118), population (1.68) and policy (-0.186) affects demand. The results also showed that the price elasticity of rice demand in the long-run and short-run were -0.033 and -0.093 and were both non-significant at 5 percent level. The demand for rice is price inelastic.. It was recommended that adequate policy framework aimed at increasing supply of local rice should be pursued as this will reduce the prices of local rice brands and invariably enhance demand for local rice by households as rice was estimated to be own price inelastic.

Keywords: Demand function, Rice, Short-run, Long-run

✉ amaluemeka07@gmail.com

Citation: Melvin, A.E. & Amara, U. (2022). Estimating the demand function of rice production in nigeria (1981 – 2018). *Social Sciences, Humanities and Education Journal (SHE Journal)*, 3(3), 526 – 536. DOI: 10.25273/she.v3i3.14168

INTRODUCTION

Rice is an important staple food crop in Nigeria, such that every household; both the rich and the poor, consumes a great amount. The production and consumption of rice, specifically the locally cultivated rice, have been taking place in Nigeria for a long time (Akinbile et al, 2008). A combination of various factors seems to have triggered the structural increase in rice consumption over the years with consumption broadening across all socio-economic classes, including the poor. Rising demand is a s a result of increasing population, income level, and changing consumer preferences (GAIN 2012; Nwanze, Mohapatra, Kormawa, Keya, & Bruce-Oliver, 2006).

During the 1960s, Nigeria had the lowest per capita annual consumption of rice in the sub-region at an annual average of 3kg. Since then, Nigerian per capita consumption levels have grown significantly at 7.3 percent per annum. Consequently, per capita consumption during the 1980s averaged 18kg and then 22 kg in 1995-2000 (Ogundele & Okoruwa, 2006). The demand for rice in Nigeria has been increasing at a much faster rate than in any other African countries since the mid- 1970s (Daramola, 2005). Nigeria is basically an agrarian nation (Agbachom and Amalu, 2016) and agriculture shows a high potential as vehicle for industrialization, sustained economic growth and development. However, since crude oil was discovered in the mid-1950s, the oil sector has been prioritized over the food and agriculture sector. (Amalu, Amalu, Jack-Rabin & Amalu, 2022). Irrespective of this situation, the rice production sub-sector has witnessed some remarkable developments, particularly in the last ten years. Both rice production and consumption in Nigeria have rapidly increased during the aforementioned period (Ojehomon, Adebayo, Ogundele, Okoruwa, Ajayi, Diagne, & Ogunlana, 2009). About 29 states are currently engaged in the cultivation of rice as part of the plan of the federal government to make the nation an agricultural zone for the production of rice in the world. The land set aside for rice cultivation was increased from a 3.17million hectares to 3.90million hectares from 2016 to 2018 and this brought about an increased total output by 7 percent (Odunsanya,2018). Rice-producing states in Northern Nigeria are Kebbi, Borno, Kano and Kaduna while in the southern region, rice-producing states include Enugu, Ebonyi, and Cross River State while in the middle belt it comprises of Taraba and Benue states (Ikenwa, 2019). The leading rice producing states in Nigeria are Kebbi (2million MT), Jigawa (2.1million MT), Kaduna (2million MT), Kano (1.6million MT), Ebonyi (1.5million MT), and Benue (500,000MT). (FAOSTAT, 2018).

Rice has changed from being a luxury to a necessity whose consumption will continue to increase with per capita GDP growth, thus implying that its importance in the Nigerian diet as a major food item for food security will increase as economic growth continues (Ojogho and Alufohai, 2010). To confront this, agricultural production needs to increase, at the least, by 75% worldwide, and by almost 100% in developing countries, in order to meet growing food demand)Aalu and Agbachom, 2016). Over the years, Nigeria has relied upon the importation of rice to meet its growing demand for rice but the increased demand in recent years reflects more increases in the demand for imported rice brands partly to meet the shortfalls in domestic demand and partly to meet consumers demand in the urban areas. The importation of rice to bridge the demand-supply gap is worth N365 billion (Ayanwale and Amusan, 2012) and this implies a loss of considerable foreign exchange for the country. Rice imports have generally grown faster than both production and population with the latter two growing at about the same pace. The growing dependency on rice imports threatens to deplete a country's scarce foreign currency reserves, increases its vulnerability to global price shocks, and raises overall concerns about food insecurity.

The Nigerian government's agricultural policy, particularly on rice, seeks to achieve food security by increasing domestic production and export as well as enhancing the welfare of its citizens (Olayide et al., 2015). This was done to boost rice production to substitute rice imports (Ebuehi and Oyewole, 2007; Gyimah-Brempong and Kuku-Shittu, 2016). Irrespective of several schemes and policies (such as Anchor Borrowers' schemes, National Accelerated Food Production Project, National Fadama Development Project, Structural Adjustment Programme etc.) aimed at attaining self-sufficiency in the production of these crops, especially rice, Nigeria is still not self-sufficient. (Ibirogba, 2019). Considering the many food policies, including import substitution, as well as food nutrition and security targets, it is important to obtain updated elasticity estimates to make proper policy decisions. This paper aims to provide new empirical evidence on the short run and long run demand functions (including rice elasticity estimates) for Nigerian households. This paper adds to the existing literature on rice demand with a focus on Nigeria.

METHODOLOGY

Study Area

Nigeria, a country with a total land area of 923,768 square kilometers and a population estimated at about 198 million (NPC, 2018). Nigeria is located between latitudes $4^0$16'and 13^0 53'North and longitudes $2^0$40'and $14^0$41' (NBS, 2018). It is located within the tropics and therefore experiences high temperatures throughout the year. The mean temperature for the country is 27^{o}C and average maximum temperatures vary from 32^{o}C along the coast to 41^{o}C in the far north. (NBS, 2018) The climate of the country varies from a very wet coastal area with an annual rainfall greater than 3,500 mm to the dry land savannah and Sahel region in the north, with annual rainfall less than 600mm.

Data collection and Analysis

Secondary time series data were used for the study. Data on the consumption of rice were obtained from United States Department of Agriculture (USDA) Database. Data on population, Agricultural Gross Domestic Product (AGDP) were obtained from Central Bank of Nigeria (CBN) Statistical Bulletins for the years 2015 and 2017 while prices of rice and cassava were obtained from FAOSTAT database. This dataset covered the period from 1981-2018. The data were analyzed using inferential statistics (co-integration.)

Model specification

Modelling long-run and short-run relationship

Given that the study used time-series data, a preliminary analysis of the unit root test of each variable under investigation using Augmented Dickey Fuller (ADF) test was carried out to avoid a spurious regression. Subsequently, the Johansen's Maximum likelihood (1991, 1995) cointegration technique was employed to examine the relationship amongst the variables. Finally, the short-run relationship was estimated through Vector Error Correction Model (VECM). Each estimation technique is discussed hereafter.

Unit root test

A unit roots test analysis of each of the time series of the chosen variables was undertaken to ascertain the order of integration. Here, the order of integration for all the variables must be known prior to co-integration analysis to ensure that the variable is not integrated to the order greater than one (Abbott, Darnell and Evans, 2000). Unit root test was conducted using the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979). This was used to test if the selected variables are stationary or not. A stationary series is one with a mean value which will not vary within the sampling period. A non-stationary series will exhibit a time varying mean (Juselius, 2006). The test formula for the ADF is shown in equations 1

$\Delta Y_t = \alpha + \partial Y_{t-1} + \Sigma\gamma\Delta Y_{t-j} + e_t$ .... (1)

Where:

Y = series to be tested

ΔY_t = first difference of Y_t, ∂ = test difference coefficient, j = lag length chosen for ADF, e_t = white noise and t = time or trend variable

Here, the significance of ∂ was tested against the null that $\partial = 0$. Thus if the hypothesis of non-stationarity cannot be rejected, the variables were differenced until they become stationary, that is until the existence of a unit root is rejected. We then proceed to test for co-integration.

Test for Co-integration

There are several techniques in the literature for testing for co-integrating relationships including Engle-Granger two step test (Engle and Granger, 1987), Autoregressive Distributed Lag Bound approach (Pesaran, Shin & Smith, 2001) and the Johansen Maximum Likelihood procedure (Johansen & Juselius, 1990). Of these techniques, the Johansen & Juselius (1990) Maximum Likelihood test procedure is the most efficient because it identifies the number of co-integrating vectors between the non-stationary level variables in the context of a vector autoregressive term (VAR). The study employed the maximum-likelihood test procedure established by Johansen and Juselius (1990). The starting point for Johansen co-integration test is the Vector Auto Regression (VAR) of order *p* given by:

$$Z_t + \phi + A_1 Z_{t-1} + \ldots + A_p Z_{t-p} + \varepsilon_t \text{ .... (2)}$$

This VAR can be re-written as:

$$\Delta Z_t + \phi + \sum_{i=1}^{n} \Gamma_i \Delta Z_{t-1} + \Pi Z_{t-1} + \varepsilon_t \text{ ...... (3)}$$

Where,

$$\Pi = \sum_{i=1}^{p} A_i - I, \text{ .... (4)}$$

$$\Gamma_i = -\sum_{j=i+1}^{p} A_j \text{ .... (5)}$$

Z_t (LnDm) is a (n x 1) vector of all the non-stationary l(1) variables in the study, ϕ is a (n x 1) vector of parameters (intercepts), ε_t is an kx1 vector of innovations or random shocks. Γ and Π are (n x n) matrices of parameters, where Γ_i is a (n x 1) vector of coefficients of lagged Z_t variables. Π is a *(n x 1)* is a long-run impact matrix which is product of two *(n x 1)* matrices. If the coefficient matrix Π has reduced rank *r<n*, subsequently there exist *(n x r)* matrices α and β each one with rank *r* such that $\Pi = \alpha\beta'$ and $\beta' Z_{t}$is stationary. The *r* is the number of co integrating relationships, the elements of α is known as the adjustment parameters in the vector error correction model and each column of β is a co-integrating vector.

It is revealed that for a known *r*, the maximum likelihood estimator of β defines the combination of Z_{t-1} that yields the *r* largest canonical correlations of ΔZ_t with Z_{t-1} after correcting for lagged differences and deterministic variables once present. Johansen (1995) suggested two different likelihood ratio tests, the trace test which tests the null hypothesis of *r* co-integrating vectors against the alternative hypothesis of *k* co-integrating vectors and maximum eigenvalue test, which tests the null hypothesis of *r* co-integrating vectors against the alternative hypothesis of *r + 1* co-integrating vectors.

Vector Error Correction model (VECM)

If the Johansen co-integration test shows that co-integration exists among the variables, the VECM is used for the evaluation of a short-term adjustment which adjusts towards the long-run equilibrium in each time period. Based on this, the vector error correction mechanism (VECM) is specified as follows:

$$\Delta LnDr_t = \delta_0 + \sum_{i=1}^{q1} \delta_1 \Delta LnDr_{t-1} + \sum_{i=2}^{q2} \delta_2 \Delta LnPr_{t-1} + \sum_{i=3}^{q3} \delta_3 \Delta LnPs_{t-1} + \sum_{i=4}^{q4} \delta_4 \Delta LnAGDP_{t-1} + \sum_{i=5}^{q5} \delta_5 \Delta LnPOP_{t-1} +$$

$$\sum_{i=6}^{q6} \delta_6 Policy1 + \rho ECM_{t-1} + \mu_t \text{.................................} \quad \textbf{(6)}$$

Where;

LnDr = Natural logarithm of quantity of rice demanded (metric tons)
LnAGDP = Natural logarithm of Agricultural Gross Domestic Product proxy for consumer income (in millions of naira)
LnPr = Natural logarithm of own producer price of rice (naira/tons)
LnPs = Natural logarithm of price of substitute (cassava) (naira/tons)
LnPOP = Natural logarithm of Population (in millions)
Policy1 = Nigeria's trade policy for rice (0 = import quota (1981-1984), 1= period of outright ban (1985-1995), 2= post ban (1995-2018)
Ut = Stochastic residual term

From equation (6), δ_0 is the drift; $\delta_1 - \delta_7$ represent the short-run dynamics coefficients of the model's convergence to equilibrium. ECM_{t-1} is the Error Correction Model. ρ is the coefficient of the Error Correction Model which measures the speed of adjustment to obtain equilibrium in the event of shocks to the system.
U_t = error term

***A priori* expectations**

The *a priori* expectation of the signs of coefficients (equation 6) is that $\beta_1 < 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 >/< 0$, $\beta_6 > 0$, $\beta_7 > 0$, $\beta_8 > 0$, $\beta_9 > 0$

RESULTS AND DISCUSSION

Short-run and long-run estimates of demand function of rice in Nigeria

Stationarity test

The result of the Augmented Dickey-Fuller (ADF) test of unit root is presented on Table 1. The test was applied to each variable over the period of 1981 -2018 without a time trend at the variables level and at their first difference. Most variables became stationary after first differencing. The findings of the study provide the justification for the Johansen co-integration Approach.

Table 1: Results of ADF Test

Variable (at levels)	ADF(stat)	Variable (1st diff)	ADF(stat)	Order of integration
LnDr	-1.467	DLnDr	-6.585***	I(1)
LnAGDP	-0.129	DLnAGDP	-5.881***	I(1)
LnPs	-1.694	DLnPs	-7.282***	I(1)
LnPOP	-0.400	DLnPOP	-7.789***	I(1)

Source: Results are based on calculations from Eviews 10. NOTE: * and *** is significant level at 10% and 1LnDr = Natural logarithm of quantity of rice consumed (metric tonnes) and LnAGDP = Natural logarithm of Agricultural Gross Domestic Product(millions) LnPs= Natural logarithm of price of substitutes(cassava)(naira/tons), LnPOP = Natural logarithm of Population(millions),

Co integration test result

Johansen co-integration test was utilized to address the existence of long run relationship among variables in this study. The Johansen co-integration rank test results are presented in Table 2. Both the trace statistics and eigenvalue statistics in the Table 2 shows that there is a unique long run relationship among the variables because in both cases the test shows at most one co-integrating equation at 5 percent level of significance. Thus, the Johansen co-integration test confirms the existence of a unique long run relationship among the variables. Consequently, co-integration test results as shown in Table 2 indicates that the dependent variable is co-integrated, as such the test statistics strongly reject the null hypothesis of zero co-integrating vectors in favour of the alternative hypothesis that there are at least one co-integrating vectors. This is in line with the findings of Hallam & Zanoli (1993). They explored the relevance of the error correction specification to agricultural supply modelling. They discovered that, where only one co-integrating equation exist, its parameters can be interpreted as estimate of long run co-integrating relationship between variables concerned. Also Kargbo (2005) stated that the higher the number of co-integrating vectors, the stronger the relationship between the variables in the system.

Table 2: Results of Multivariate co-integration tests for rice demand

		Trace			Maximum Eigenvalue				
				Rice Demand					
Null hypothesis	Eigenvalue	Trace statistic	Critical value	Prob**	Hypothesized No. of CE(s)	EigenValue	Max-Eigen Statistc	Critical Value	Prob**
None *	0.81	143.6	69.819	0.000	None *	0.831	58.766	33.87	0.000
At most 1*	0.79	84.59	47.856	0.000	At most1*	0.779	49.827	27.54	0.000
At most 2 *	0.49	34.72	29.797	0.016	At most 2	0.469	20.867	21.12	0.054
At most 3	0.35	13.85	15.495	0.086	At most 3	0.322	12.806	14.25	0.084
At most 4	0.01	1.029	3.841	0.313	At most 4	0.031	1.029	3.841	0.310

* denotes rejection of the hypothesis at the 5% level.

Long-run and short-run estimates for rice demand

The existence of co-integration between the dependent variable and independent variables necessitated the specification of VECM for rice demand as well as its estimation in the study. Table 3 shows the results of the VECM estimates for rice demand. Both the short-run and long-run estimates as well as diagnostics statistics are presented. The model was chosen on the basis of the following criteria: data coherence, parameter consistency with theory and goodness of fit. The underlying model pass diagnostic tests of no heteroscedasticity, and no serial correlation, but fail to pass normality test (Table 3).

The price elasticity of rice demand in the long-run and short-run were -0.033 and -0.093 and were both non-significant at 5 percent level. The demand for rice is price inelastic. This reflects the reluctance of the consumers to change the quantity purchased in spite of price savings. This result is in line with the a priori expectation and could be attributed to the fact that consumers tend to buy less of a commodity (normal goods) as the price of such commodity increases. This result does not conform to the findings of Bamba *et al.* (2010) who found that price of rice represents a significant factor of rice consumption as it is one of the major determinants of rice consumption in Nigeria. But it agrees with findings of Rahji & Adewumi (2008). They obtained a price elasticity of -0.841 indicating that the demand for local rice is price inelastic. Oyinbo *et al.,* (2013) obtained compensated (-0.792) and uncompensated (-0.889) own price elasticity for rice demand, indicating that rice price was inelastic. Makama *et al.* (2017) reported that own-compensated price elasticity for rice was negative (-0.554).

The result indicated the price elasticity of close substitutes (cassava) in the long-run to be 0.119 and it was significant at 10 percent level, while in the short-run it was 0.182 and was significant at 5 percent level. This result implies that a 10 percent increase in the price of close substitutes (cassava) will lead to 11.87 percent and 18.24 percent increase in the demand for rice for long run and short run periods, respectively. The result of this analysis indicates that people in Nigeria most times consume cassava (in its processed form) as a food staple for rice substitute. This suggest that the rise and fall of the price of cassava will affect the domestic consumption of rice.

Table 3: Long and Short run VECM estimates of rice demand in Nigeria

Variables	**Coefficient**	**Standard Error**	**t-statistics**
Long-run			
C	-23.139	7.149	-3.237**
DLnPs	0.1187	0.060	1.972*
DLnPr	-0.033	0.080	-0.408
LnAGDP	-0.039	0.204	-0.191
LnPOP	1.685	0.563	2.995***
POLICY	-0.186	0.080	-2.310**
Short-run			
C	-0.071	0.079	-0.890
D(LnDr(-1))	0.354	0.199	1.772*
D(LnPs)	0.182	0.078	2.347**
D(LnPr)	-0.093	0.088	-1.055
D(LnAGDP)	-0.033	0.249	-0.131
D(LnPOP)	2.765	1.827	1.514
POLICY	0.006	0.037	0.167
ECM(-1)	-0.653	0.202	-3.231***
Diagnostics		**Decision**	
R^2	0.400510		
Jarque-Bera(normality)	45.829 (0.000)	Evidence of normality	
Bruesch-Godfrey	1.319 (0.285)	No higher-order autocorrelation	
Bruesch-Pagan	1.492 (0.211)	No heteroscedasticity	

Durbin –Watson	2.149	No autocorrelation

Source: Results are based on calculations from Eviews 10
Note: * and *** is significant level at 10% and 1%, LnDr = Natural logarithm of quantity of rice consumed (metric tonnes), LnPr =Natural logarithm of own price of rice, LnPs = Natural Logarithm of price of substitute (cassava)(naira/tons), LnPOP = Natural logarithm of population(millions), LnAGDP = Natural logarithm of Agricultural Gross Domestic Product, ECM= Error Correction Mechanism R^2 = coefficient of determination

The result (Table 3) showed that rice demand is 0.006 affected by policy on a short-run, although not significant. However, its long-run effect is negative (-0.186) and significant at 5 percent level. The negative influence could be attributed to policy inconsistency, instability and changes in government. In fact, the country's policy on rice over the years had been inconsistent and has oscillated between import tariff and imports restriction. This is in line with the findings of Emodi and Madukwe (2008). They captured this scenario when they said "during the SAP in 1986, ban on rice imports were put in place. It was illegal to import rice into the country but for the porous nature of Nigerian border made it ineffective. While between 1995 all through to 2013, these official restrictions on rice importation were lifted, with more liberal policy put in place. However, in 2013 the Nigerian government announced that they will place ban on the importation of rice with effect from 2015. The minister of agriculture and rural development said "we want to discourage those who import rice as traders. We want those who are going to go in and have commercial farms, produce rice, buy domestic paddy rice and mill it for us". The government is looking at the tariff policy to discourage importers of rice, while encouraging those going into local production, processing and milling of rice (Udo,2014). Whatever the policy decision government may come out with, it is imperative to note that, rice remain an important inevitable diet for domestic consumption in Nigeria and more importantly, one of the food commodities consumed globally.

The results for the long-run estimates shows that the coefficient of population (1.685) was positively signed and related to rice demand, and statistically significant at 5 percent ($p<0.05$) probability level, while the short-run elasticity is also positive (2.765) but not significant. This suggests that on the long-run, 1% increase in population will result to 1.68 percent increase in the demand for rice and vice versa. This finding suggests that increase in population has the propensity to increase rice consumption because as population increases, there tends to be increased demand for the commodity. This result is in line with the findings of Akande (2003) who studied the overview of Nigerian rice economy and concluded that combinations of factors have triggered the increase in rice consumption, one of which was as a result of increasing population growth. Onu *et al.* (2015) studied the empirical assessment of the trends in rice production and imports in Nigeria (1980 – 2013) and found that population growth and urbanization were the principal factors driving increased rice demand in Nigeria.

The elasticity of previous year demand of rice in the short-run was positive (0.354) and significant at 5 percent level. This implies that, a 10 percent increase in previous year demand will increase the current year demand by 3.54 percent. The error correction coefficient was estimated to be -0.653. This measures the speed of adjustment towards long-run equilibrium, and it carries the expected negative sign and it was significant at the 1 percent level. The coefficient indicates feedback of 65.30 percent of the previous year's disequilibrium from the long-run values of the independent variables. The ECM (-1) coefficient indicates that more than 65.30 percent of the adjustment towards long-run equilibrium for rice demand is completed in one period. This implies that 65.30 percent of dis-equilibrum is dissipated (disappears) before the next time period and 34.7 percent remains.

CONCLUSION AND RECOMMENDATION

This paper used the Johansen maximum likelihood test to cointegration to estimate the short-run and long run demand functions for rice in Nigeria from 1981 to 2018. The result of Short and long run VECM estimates of rice demand in Nigeria revealed that the previous years' demand (0.353) and price of close substitute (0.182) significantly affected demand in the short-run with an ECM (-1) of -0.653 while for long run price of close substitute (0.118), population (1.68) and policy (-0.186) affects demand. The results also showed that the price elasticity of rice demand in the long-run and short-run were -0.033 and -0.093 and were both non-significant at 5 percent level. The demand for rice is price inelastic. This reflects the reluctance of the consumers to change the quantity purchased in spite of price savings. Thus, the results obtained in this study could be essential in examining the impact of government policy measures on the rice industry. The study recommends that adequate policy framework aimed at increasing supply of local rice should be pursued as this will reduce the prices of local rice brands and invariably enhance demand for local rice by households as rice was estimated to be own price inelastic.

REFERENCES

Agbachom, E. E., Amalu E. M., Uzoigwe A., Otu, E. & Ubi, G. M. (2019). Strategic Policies in Expanding Frontiers of Food Security among Cassava-based Farmers in Cross River State, Nigeria. *Annual Research & Review in Biology*, *33*(5), 1-12.https://doi.org/10.9734/arrb/2019/v33i530133

Agbachom E. E & Amalu, E. M. (2016). Promoting Implementation of Sustainable Development Goals in Rural Nigeria: I Poverty issues and its determinants among cassava-based farming households in Akpabuyo Local Government Area, Cross River State, Nigeria. *Global Journal of Pure and Apllied Science,* 22: 7-9

Akinbile, L. A., Akinwale, J. A., & Ashimolowo, O. R. (2008). Determinants of productivity level among rice farmers in Obafemi-owode local government area of Ogun State, Nigeria. *Journal of New Seeds*, 8(4), 79-90. doi.org/10.1300/j153v08n04_06.

Amalu, E. M. & Agbachom E. E (2016). Promoting Implementation of Sustainable Development Goals in Rural Nigeria: II Food Security issues and their determinants among cassava-based farming households in Akpabuyo Local Government Area, Cross River State, Nigeria. *Global Journal of Pure and Apllied Science,* 22: 21-31

Amalu,N. S., Amalu, E. M., Jack-Rabin, Y. I., Amalu, M. (2022). The Food and Agricultural Organization of the United Nations'(FAO) Intervention to the Covid-19 impacts on food security in Nigeria, 2019-2021. *Jurnal Sosialisasi: Jurnal Hasil Pemikiran, Penelitian dan Pengembangan Keilmuan Sosiologi Pendidikan*, 1(2), 10-19

Ayanwale, A.B. Amusan, C.A. Gender Analysis of Rice Production Efficiency in Osun State: Implication for the Agricultural Transformation Agenda. Paper presented at the 13th National Conference of the Nigerian Association of Agricultural Economists, Obafemi Owolowo

University, Ile – Ife, Nigeria, September 25th – 27th. 2012.

Bamba, I., Diagne A., Manful J. & Ajayi, A. (2010). Historic Opportunities for Rice Growers in Nigeria. Grain de sol, No. 51 July – September 2010

Daramola, B. (2005). Government policies and competitiveness of Nigerian rice economy. *Paper presented at the `Workshop on Rice Policy and Food Security in Sub- Saharan Africa'* organized by WARDA, Cotonou, Republic of Benin.

Ebuehi, O. A., & Oyewole, A. C. (2007). Effects of cooking and soaking on physical characteristics, nutrient composition and sensory evaluation of indigenous and foreign rice varieties in Nigeria. African Journal of Biotechnology, 6(8), 1016-1020. doi.org/10.1108/003466508108 47972

Emodi A. I. & Madukwe M. C. (2008). A review of policies, acts and initiatives in rice innovation system in Nigeria. *Journal of Agricultural Extension,* 12 (2):20-31

Food and Agricultural Organization Statistics (2018). *Nigeria population projection.*www.fao.org/faostat/en/Rome; FAO.

Global Agricultural Information Network. Nigeria Grain and Feed Annual Report. GAIN Report Number: NI1204. 2012

Gyimah-Brempong, K., & Kuku-Shittu, O. (2016). Evolution of Rice Consumption and Demand Patterns. In: K Gyimah-Brempong, M Johnson & H Takeshima, The Nigerian Rice Economy: Policy Options for Transforming Production, Marketing, and Trade. Philadelphia: University of Pennsylvania Press. pp. 21-50

Hallam D. & Zanoli R. (1993). Error correction models and agricultural supply response. *European Review of Agricultural Economics.* 20 (2): 151 -66

Ibirogba F. (2019) "Nigeria is not self sufficient yet, says Africa Rice centre". Business Agro. Retrieved from http://www.guardian.ng

Johasen S. (1995). Identifying restrictions of linear equations with application to Simultaneous Equation and Co-integration. *Journal of Econometrics* 69(1):111-132

Juselius, K. (2006). *The Co-integrated VAR Model: Methodology and Applications*. Oxford University Press (manuscript).

Kargbo J. (2005). Impact of Monetary and Macroeconomic factors on food process in West Africa. AGREKON 44(2)

Makama, S.A., Ilu, I.Y., Suleiman, N.J., Isiaku, S. & Isah, M.A. (2017). Demand Analysis of Rice in Nigeria. *Nigerian Journal of Agricultural Extension*, 18(3): 71-75

National Bureau of Statistics (2018). Annual Report, Abuja. www.nigerianstat.gov.ng/-cached

National Population Commission (2018). Demographics and Health survey of Nigeria. Retrieved from http:/ www.nationalpopulation.gov.ng

Nwanze, K. F., Mohapatra, S., Kormawa, P., Keya, S., & Bruce-Oliver, S. (2006). Rice Development in sub-Saharan Africa. Journal of the Science of Food and Agriculture, 86(5), 675-677

Odunsanya, R (2018). How import of maize I Nigeria has influenced profitability of its production. Accessed online at http://www. Researchgate.net

Ogundele O. & Okoruwa V. (2006), Technical Efficiency Differentials in Rice Production Technologies in Nigeria, African Economic Research Consortium.

Ojehomon, V.E., Adebayo, S. B., Ogundele, O.O., Okoruwa, V.O., Ajayi, O., Diagne, A. & Ogunlana, O. (2009). Rice Data Systems in Nigeria: National Rice Survey.

Ojogho, O., & Erhabor, P. O. (2011). Rice demand pattern and its intervening factors in Nigeria. International Journal of Agricultural Research, 6(11), 769-779. doi.org/10.3923/ijar.2011.769. 779

Oyinbo, O., Omolehin, R. & Abdulsalam, Z. (2013). Analysis of the demand for rice in Kaduna State, Nigeria.*Agris on-line Papers in Economics and Informatics*, 5(3):1-8.

Rahji, M. A. Y., & Adewumi, M. O. (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.

Udo B. (2014) Confusion trails Nigeria's rice policys as Okonjo Iweala, Adesina express divergent views. Available from http: www.premiumtimesng.com/news/156375-cofusion-trails-nigeria-rice-policy-okono-iweala-adesina-express-divergent-views.html(Accessed30/5/2021)