

Trend Analysis of Rice Production, Import and Consumption in Nigeria (1970–2016): Comparative Assessment of Three Economic Reforms Periods (Pre-SAP, SAP and Post SAP)

Onu, D.O. and Simonyan, J.B.

*Department of Agricultural Economics, College of Agricultural Economics,
Rural Sociology and Extension, Michael Okpara University of Agriculture, Umudike,
P.M.B 7267 Umuahia Abia State, Nigeria
Corresponding author: dononu@yahoo.com*

Abstract

This study was carried out to provide empirical evidence on the growth rates of rice production in three sub-periods in Nigeria namely; pre-Structural Adjustment Programme period (1970-1985), Structural Adjustment Program period (1986-1994) and post-Structural Adjustment Programme period (1995-2016). Secondary data were used for the study. Both instantaneous and compound growth rate models were used to estimate the growth rates in the three sub-periods. The result shows that time trend variable was a major factor in determining quantity of rice production, import and consumption in Nigeria during the three periods. The results of the analysis show that the compound growth rates of rice production were 5.79%:9.64% and 2.43% for the periods, respectively.: Rice imports shows 59.36%, -3.63% and 8.22% compound growth rate for the pre-SAP, SAP and post-SAP periods, respectively, while the annual compound growth rate of rice consumption shows increase of 13.20%, 11.18% and 4.6 during Pre-SAP, SAP and Post Sap periods, respectively. There was a significant difference among the mean quantity of rice production, imports and consumption in Nigeria across the three economic periods (Pre-SAP, SAP, and Post-SAP) under study. The study recommends that research be intensified in order to improve rice production technologies significantly in a way that the rate of growth will achieve the needed self-sufficiency in domestic rice production and thereby reduce the amount of money spent in rice imports in this country.

Keywords: Growth rate, Rice consumption, Rice import, Rice Production, Trend.

Introduction

Rice is the second most important cereal in the world after wheat in terms of production. Nigeria ranks the highest as both producer and consumer of rice in the West Africa sub-region (Goni and Amaza, 2006). In fact, the government recognized the unhealthy condition of the Nigerian agricultural sector since 1970, and has formulated and introduced a number of programmes and strategies aimed to remedy this situation. In a bid to increase food production in Nigeria over the years,

several policy reforms have been put in place by successive governments and one of such policy reforms in time past is the Structural Adjustment Programme (SAP) introduced in July 1986.

By the end of the second half of 1986 it was clear that Nigeria had fully adopted the International Monetary Fund (IMF) induced structural economic reforms whose main focus is liberalization among others. The adoption was premised on the belief that the weaknesses of the economics of control trade will prevent the enjoyment of the benefit of

openness (Usman, 2005). The major issue inherent in the Structural Adjustment Programme (SAP) is a reasonable measure of openness to be perceived through liberalization of external sector and deregulation.

Although, the policy was targeted at restructuring the economy away from over dependence on the oil sector (among others) for government revenue and foreign exchange earnings, the spill-over effect of the policy can be traced to the major contending sectors in the economy (Usman and Abdulgafar, 2010).

The SAP aimed at facilitating economic growth as a means of jump-starting the economy towards sustainable economic growth and development. The overall objective of implementing structural adjustment in the agricultural sector was to increase agricultural production and export of agricultural products and because of the relative importance of agriculture to the economy, this was supposed to contribute to improvement in the growth of the economy. In spite of these measures, the development of the agricultural sector has been slow and the impact of this sector on economic growth and development has been minimal (Child, 2008). This slow growth of agricultural production has generated some issues, among them are, the role of agriculture in providing food for the population; its role in supplying adequate raw materials to a growing industrial sector and its roles as a major source of foreign exchange earner.

In Nigeria, rice has assumed a strategic position in the food basket of rural and urban households and is cultivated in virtually all of Nigeria's agro-ecological zones, from the mangrove and swampy ecologies of the River Niger in the coastal areas to the dry zones of the Sahel in the north. The demand for rice in

Nigeria has been increasing at a much faster rate than in any other African country since the mid- 1970s (Daramola 2005). Although the paddy harvest rose from under 1 million tons in the 1970s to 4.2 million tons in 2010, production has not kept pace with demand. There is considerable potential for extending and intensifying rice production in the five rice-growing ecosystems found in Nigeria (plateau, rained plains, irrigated plains, lowlands and mangrove), Bamba *et al.* (2010). Rice contributes a significant proportion of the food requirements of the population. In spite of the contribution of rice to the food requirements of the population, production capacity is far below the national requirements. In order to meet the increasing demand, Nigeria has to resort to importation of milled rice to bridge the gap between domestic demand and supply.

It therefore becomes imperative to empirically assess the trend in rice production, imports and consumption in Nigeria in the last 45 years under pre SAP period (1970-1985), SAP period (1986-1994) and post SAP period (1995 - 2014). No doubt, the policy reforms in existence prior to the introduction of SAP, during SAP and after the SAP period differed (Oyakhilomen and Emmanuel, 2012). The influence of these policies on rice production and imports in these periods in Nigeria therefore needs to be clearly understood in order to provide the right models for improvement in the system. It is against this background that the study sought to provide empirical comparative information on the trend in rice production, imports and consumption in Nigeria during the Pre-SAP (1970 -1985), SAP(1986-1994) and PostSAP(1995–2016). Specifically, the study sought to:

- analyze the trends in rice production, imports and consumption in Nigeria during

the Pre-SAP (1970 -1985), SAP (1986-1994) and Post SAP (1995 –2016) periods.

- estimate the compound growth rates of rice production, rice imports and rice consumption in Nigeria within the periods under study;
- compare the variations in the volume of rice production, imports and consumption in Nigeria across the three economic reform periods under study

The study also hypothesized that: there is no significant difference in the mean quantity of rice production, rice import and rice consumption across the three economic reform periods under study.

Materials and Methods

This study made use of secondary data which were principally elicited from the database of Statistical Bulletins and Annual Reports of the United States Department of Agriculture (USDA). The secondary data used for analysis was on arable food crop output in Nigeria extending from 1970 to 1985 (Pre – SAP period), 1986 to 1994 (SAP period) and 1995 to 2016 (Post – SAP period) and therefore, data on three sub – periods were utilized in this study. Trend analysis and Analysis of Variance (ANOVA) were employed in analyzing the data.

Data analyses

The exponential trend or log-linear trend model

The exponential trend or log-linear trend model (Onyenweaku, 2004) was used to analyze the trend in quantity of rice production, imports and consumption in Nigeria; and it is modeled as follows:

$$\ln R p_t = \beta_0 + \beta_1 t + \mu_t \dots \dots \dots (1)$$

$$\ln R i_t = \beta_0 + \beta_1 t + \mu_t \dots \dots \dots (2)$$

$$\ln R i c_t = \beta_0 + \beta_1 t + \mu_t \dots \dots \dots (3)$$

Where,

$\ln R p_t$ = quantity of domestic output of rice (measured in metric tons) at period t.

$\ln R i_t$ = quantity of rice imports (measured in metric tons) at period t.

$\ln R i c_t$ = quantity of rice consumption (measured in metric tons) at period t.

β_0 = the constant in the regression line.

β_1 = the trend coefficients.

t = trend variable measured in years.

μ_t = the error term.

The Instantaneous growth model and compound growth models

The instantaneous growth model and compound growth models were used to estimate the point-in-time and over-period rate of growth of rice production, imports and consumption in Nigeria within the periods under study.

The instantaneous (at a point in time) growth model (Sawant, 1983) is given as:

$$\text{Growth rate} = \beta_1 t \times 100 \dots \dots \dots (4)$$

Where,

β_1 = relative change in quantity of rice output, imports and consumption respectively (trend coefficient);

t = trend measured in years

The compound rate of growth was computed in line with Onyenweaku (2004), Gujarati and Porter (2009) as;

$$r = (e^\beta - 1) \times 100 \dots \dots \dots (5)$$

Where,

e = Euler's exponential constant (2.71828)
(Sawant, 1983).

β = estimated coefficient in equations (1),
(2) and (3) respectively.

Descriptive and inferential statistical tools

A one way ANOVA was used to test for differences among the mean values in rice production, imports and consumption within the periods under study.

The F- statistic is given as;

$$F_{cal} = \frac{BSS / (k-1)}{WSS / (n-k)} \dots\dots\dots (6)$$

Where:

- BSS = between groups sum of squares
- WSS = within groups sum of squares
- k = no of factors (groups)
- n = number of observations

It is worthy of note that the major groups under consideration in this study are:

Rice Production, Rice Import and Rice Consumption (3 groups)

Pre-SAP, SAP and Post SAP (3 groups)

Note also that $F_{tab} = F_{(k-1), (n-k)} \dots\dots\dots (7)$

Specifically, ANOVA tested the null hypothesis:

$$H_0 = \mu_1 = \mu_2 = \mu_3 \dots\dots\dots (8)$$

Where μ = group mean in each case and k = number of groups. If, however, the one-way ANOVA returns a statistically significant result, we accept the alternative hypothesis

(H_A), which is that there are at least two group means that are statistically significantly different from the main mean.

Results

Quantity of rice imported in Nigeria was ranged between 1- 6 MT between 1970 and 1975 and increased sharply from 1975 till 1978; dropped in 1979 and picked up again from 1980 and continued to increase till 1984 and 1985 when it declined. Rice consumption increased sharply from 1975 till 1978; dropped in 1979 and picked up again from 1980 and continued to increase till 1984 and 1985 when it declined. Also a phenomenal rise in rice imports was witnessed in 1977 as the quantity of rice imported in that year alone was (322, 000 metric tons) more than the combined quantity of rice imported during 1970 – 1976 period. Rice imports continued to increase until in 1979 when it declined. In the same vein, rice consumption increased by just 100 MT between 1970 and 1975; however the same quantity was consumed in just one year (1975-76). The increase in consumption thereafter almost doubled (500 -950 MT) from 1976-78 period.

The trend in quantity of rice consumed was almost stagnant between 1970 and 1974. On the other hand, the trend in quantity of rice output was almost stagnant between 1970 and 1979, rose sharply from 1979 till 1982 when it started declining and rose again in 1985 (Figure 1).

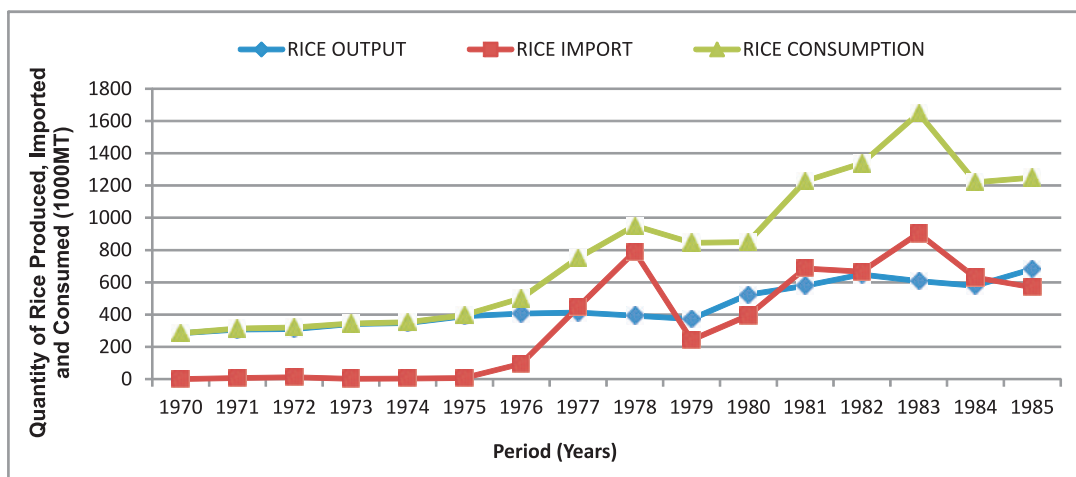


Figure 1: Trend in rice output, import and consumption in Nigeria between 1970 and 1985 (Pre-SAP period)

Rice output witnessed a steady increase from 1986 to 1989 when the highest quantity of rice output was recorded. It declined between 1989 and 1990 and witnessed the lowest output in 1990. Within the same period, rice import didn't witness any growth rather it declined and remained almost stagnant while rice consumption continued to rise but was highest in 1990 (Figure. 2). Within the same period (1986 – 1994), rice import didn't witness any growth rather it declined from 1987 and remained almost stagnant till 1994 (Figure 2) while rice consumption continued to rise from 1986 but was highest in 1990.

During post-SAP period, quantity of rice import was on steady rise from 1995 till 2001 when it became stagnant and declined between 2003 and 2004. Quantity of rice

import was highest in 2011. Consumption continued to rise and production rose faster than import between 1995 and 2000 but declined sharply in 2012. Also, there was a steady increase in rice consumption from 2000 to 5000 MT from 1995 to 2016, although the maximum consumption occurred in 2011 at 5600 MT followed by a yearly reduction of roughly 200 MT till 2016 although with some fluctuations. The same 2011 also marked the peak of rice production and importation for this post SAP period. Rice production fluctuated closely around 2000 MT for the first 10 years (1995-2005) of the post SAP-period following which there were steeper increases reductions of between 400- 700 MT between years till 2016.

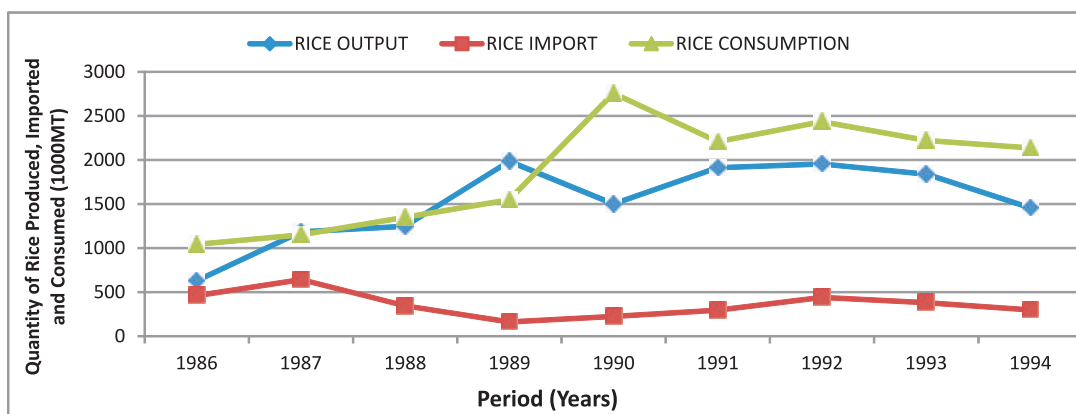


Figure 2: Trend in rice production, imports and consumption in Nigeria between 1986 and 1994 (SAP period)

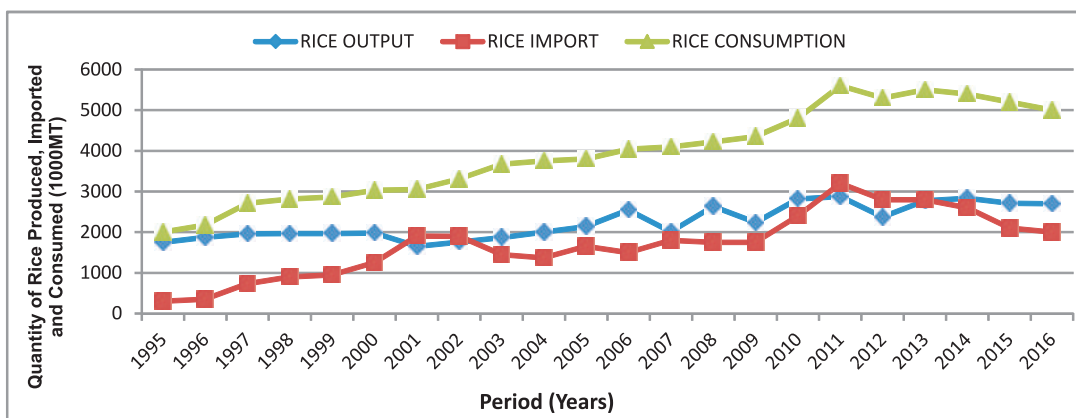


Figure 3: Trend in rice production, imports and consumption in Nigeria between 1995 and 2016 (post-SAP period)

Exponential Trend Equations for Quantity of rice Produced, Imported and Consumed in Nigeria for the Periods Under study

The quantity of rice production, quantity imported of rice and quantity of rice consumed in Nigeria exhibited various forms of growth during the three economic periods under study. During pre-SAP period, the coefficients of the time variable (β_1) (0.06, 0.47 and 0.12) were statistically significant at 1% and positively related to quantity of rice production, quantity imported and quantity consumed of rice

respectively (Table 1). Also, the coefficients of simple determination were high ($r^2=0.901$ for rice production; 0.768 for rice imports and 0.911 for rice consumption) and they were all significant ($p<0.01$). The F-ratio for each of the variables (rice production, rice import and rice consumption) is also statistically significant at 1% alpha level (Table 1).

During the SAP era, the coefficients of time trend variable (0.09 and 0.11) were positively signed and significant at 1% level for rice production and consumption respectively but

was negatively signed (-0.04) and insignificant for rice import. Also, the coefficients of simple determination were 0.473 for rice production; -0.061 for rice imports and 0.684 for rice consumption. The F-ratios for rice production (6.274) and rice consumption (15.158) were all significant at 5% and 1% alpha levels respectively, while that of rice import (0.457) was not significant (Table 1).

During the post SAP period, the coefficients of the time variable (0.02, 0.08 and 0.05) were all positively signed and statistically significant at 0.01 alpha level with respect to quantity of rice production, rice import and rice consumption respectively. Also, the coefficients of simple determination (r^2) were 0.727, 0.692 and 0.928 for rice production, import and consumption respectively and they were all significant ($p < 0.01$) (Table 1).

The estimated production growth rates (exponential compound growth rates) for pre

- SAP period, SAP period and post - SAP periods respectively were 5.96%, 9.96% and 2.43% respectively (Table 2). Also, the estimated import growth rates for pre - SAP period, SAP period and post - SAP periods respectively were 59.36%, -3.36% (negative growth) and 8.22% while the annual compound growth rates in rice consumption during pre-SAP, SAP and post SAP periods stood at 13.32%, 11.18% and 4.60% respectively (Table 2).

The one way Analysis of Variance (ANOVA) table (Table 3) shows that the computed or calculated F probabilities of 7.979, 28.202 and 44.853 for pre-SAP, SAP and post-SAP periods respectively are all significant at 1% significant level and as such are all greater than the F table value at ($p < 0.05$) adopted for the study. The degrees of freedom (DF) for pre-SAP, SAP and post-SAP economic reform periods under study are 47, 26 and 65 respectively.

Table 1: Estimated exponential trend equations for rice output, rice import and rice consumption in Nigeria for the periods under study

| | Dependent Variable | β_0 | β_1 | r | F-ratio |
|------------------------------------|--------------------|---------------------|--------------------|-------|------------|
| PRE - SAP (1970-1985) | Rice output | 5.64 (130.30)*** | 0.06 (11.74)*** | 0.908 | 137.797*** |
| | Rice imports | 0.85 (1.47) | 0.47 (7.11)*** | 0.783 | 50.590*** |
| | Rice consumption | 5.57 (63.31)*** | 0.12 (12.43) | 0.917 | 154.461*** |
| SAP (1986 - 1994) | Rice output | 5.43 (7.32)*** | 0.09 (2.51)*** | 0.473 | 6.274** |
| | Rice imports | 6.55 (5.99)*** | -0.04 (-0.68) | 0.061 | 0.457 |
| | Rice consumption | 5.36 (9.74)*** | 0.11 (3.90)*** | 0.684 | 15.158*** |
| POST - SAP (1995 - 2016) | Rice output | 6.85 (57.80)*** | 0.02 (7.29)*** | 0.727 | 53.202*** |
| | Rice imports | 4.49 (10.55)*** | 0.08 (6.70) | 0.692 | 44.859*** |
| | Rice consumption | 6.65 (66.09)*** | 0.05 (16.06)*** | 0.928 | 257.931*** |

Figures in parenthesis are t-values; ** and * imply statistical significance at 0.01 and 0.05 probability levels respectively.

Table 2: Instantaneous and compound growth rate for quantity of rice produced, quantity imported of and quantity of rice consumed for the periods under study

| Dependent Variables | Exponential compound Growth rates (%) |
|---------------------------------|--|
| PRE – SAP (1970-1985) | |
| Quantity of rice produced | 5.97 |
| Quantity of rice imported | 59.36 |
| Quantity of rice consumed | 13.20 |
| SAP(1986 – 1994) | |
| Quantity of rice produced | 9.64 |
| Quantity of rice imported | -3.63 |
| Quantity of rice consumed | 11.18 |
| POST - SAP (1995 – 2016) | |
| Quantity of rice produced | 2.43 |
| Quantity of rice imported | 8.22 |
| Quantity of rice consumed | 4.60 |

Source: Computed from time-series data, 1970-2016

Table 3: Summary of one way Analysis of Variance (ANOVA) of the mean quantity of rice production, imports and consumption in Nigeria within the three Economic Reform Periods (Pre-SAP, SAP, and Post-SAP)

| Sources of variation | Degree of freedom | Sum of square | Mean Square | F-cal | Sig. |
|------------------------------|--------------------------|----------------------|--------------------|--------------|-------------|
| PRE SAP (1970-1985) | | | | | |
| Between Groups | 2(k-1) | 1733196.792 | 866598.396 | 7.979 | 0.001 |
| Within Groups | 45(n-k) | 4887603.875 | 108613.419 | | |
| Total | 47(n-1) | 6620800.667 | | | |
| SAP(1986-1994) | | | | | |
| Between Groups | 2 (k-1) | 11260309.41 | 5630154.704 | 28.202 | 0.000 |
| Within Groups | 45 (n-k) | 4791198.222 | 199633.259 | | |
| Total | 47 (n-1) | 16051507.63 | | | |
| POST SAP (1995 -2016) | | | | | |
| Between Groups | 2 (k-1) | 59942075.03 | 29971037.53 | 44.853 | 0.000 |
| Within Groups | 45 (n-k) | 42096793.23 | 668203.067 | | |
| Total | 47 (n-1) | 102038868.3 | | | |

Group = Quantity of Rice Production, Imports and Consumption in Nigeria

k = number of variables (Between groups), n = Number of observations in each case (Within group)

Discussion

There was a phenomenal rise in rice imports in 1977 as the quantity of rice imported in that

year alone was more than the combined quantity of rice imported during 1970 – 1976 period. This could be as a result of liberal import policies within the period mostly

because of temporary shortages in 1977. The temporary shortages also accounted for the increase in the quantity of rice imported in Nigeria during the Pre-SAP period (1970 – 1984). This result is in line with that of Sadiq, (2014) and Salu *et al* (2016) who found significant growth of rice import prior to SAP period. The trend between 1970-1978 periods coincided with the result of the Second National Development Plan (1970-74) which spelt out a more defined approach towards food production as the main nexus of the plan because of the Nigerian civil war which created hardship due mainly to food shortages (Andohol, 2012). The tremendous rise in rice consumption within this period may be due to changes in consumer preferences as opined by Munonye, (2016). Domestic production (average compound growth rate of 6%) from the study was not able to meet the demand (average compound growth rate of 13%), leading to considerable imports at an average rate of 59% in the same period.

Importation in 1986 was 462 MT and in 1994, it was 300MT. There was a gradual reduction in rice importation in Nigeria between 1986 and 1994. The decline in rice import within the SAP period was due to some policy measures put in place to check rice importation. Rice import did not witness any growth within the SAP period. This period marked the introduction of Structural Adjustment Programme (SAP) in 1986 and the abolition of Commodity Boards to provide production incentives to farmers through increased producer prices. This period was also referred to as Rice Importation Ban Period. According Sadiq, (2014), rice importation was illegal during this period (SAP) period. The ban was anticipated to stimulate domestic production due to increase in price of rice. This price incentive

attracted producers into rice production and at the same time encouraged the already existing producers to increase production. Structural Adjustment Programme (SAP) was also to reinforce the ban and various trade policies were instituted (Sadiq, 2014). There was exchange deregulation and the value of Naira depreciated. The overvalued exchange rate had served as an implicit tax on rice producers as it made imported rice cheaper (USAID, 2009).

The boost in import within the post SAP period was mainly because the ban on rice imports was lifted in January 1995 as the local supplies, although showing improvement, couldn't meet the domestic demand for rice. The country adopted a more liberal trade policy towards rice after the quantitative restrictions (Daramola, 2005). The lifting of the ban resulted in heavy importation which was not affected by duty hikes by the Government. This policy attracted many rice importers as Nigeria consumes more of parboiled rice which is of relatively higher value compared to other West African countries. Consequently, Nigeria became a dumping ground for rice from various countries of the world (Daramola, 2005). Since the lifting of ban on rice imports, the government of Nigeria has resorted to the use of tariff measures. Price policies have been somewhat erratic. This was to discourage imports and to pave way for outright ban on rice importation by the end of 2019.

During the SAP era, the coefficients of multiple determinations were very low compared to Pre SAP and Post SAP periods though they were all significant. However, the positively signed and significant coefficient of time variable for rice production and consumption and negatively signed and insignificant coefficient of time variable for rice import

during this period implies that growth in rice production and rice consumption depended highly on time trend variable while it was not so with rice import within the same period. More so, during the post SAP period, the coefficient of the time variable was positive and statistically significant at with respect to quantity of rice production, quantity imported and quantity consumed of rice implying that growth in rice production, imports and consumption was highly time dependent in Nigeria during the post-SAP period.

The highest growth rate in rice production during SAP period was due to outright ban on rice import which boosted local production of rice. This finding agrees with that of Oyakhilomen and Emmanuel (2012) who reported significant growth rate in rice production in Nigeria during the SAP era. Rice importation was lowest during SAP era and highest during pre-SAP period.

It was also observed that the compound growth rate of rice production in Nigeria during the SAP era was the highest among the three periods and also the compounded rate of growth was higher than the instantaneous growth rate and this is attributed to the compounding effect. This agrees with findings of Oyakhilomen and Emmanuel (2012) who reported significant growth rate in rice production in Nigeria during the SAP era as against the pre – SAP and post – SAP eras. The implication of the growth rate of rice being higher in the SAP era as compared to the pre– SAP era and post–SAP era is that the policy reform of the SAP era was influenced by structural deregulation of the economy (Sadiq, 2014).

On the other hand, the annual compound growth rate of rice import during SAP era was the least among the three reform periods (decreasing compound growth rate). This

could be attributed to the introduction of SAP and the abolition of Commodity Boards to provide production incentives to farmers through increased producer prices in 1986 and also the complete ban placed on rice importation in 1985 (Onu, *et al.*, 2015).

Comparatively, the compound growth rate in rice production was highest during SAP period when compared to pre-SAP and Post SAP periods. This was due to government policies and programmes that boosted domestic rice production and total ban on rice import (Sadiq, 2014). On the other hand, compound growth rate in the quantity of rice import was highest during pre-SAP period as against SAP and post SAP era. This could be due to liberal trade policies that favoured food importation especially rice import (Sadiq, 2014). The relatively low compound growth rate in rice production during the post SAP era could be as a result of inconsistency and lack of continuity of various Government agricultural programmes in most cases (Okolo, 2004).

The self-insufficiency in rice production in Nigeria to cater for even domestic consumption gives rise to over reliance on imports with no earnings from exports. This is in spite of the country's potentials in terms of agriculture that if fully harnessed, will not only provide for local needs but competitive international markets. This will go a long way in increasing foreign earnings, which can be replicated, and to complement the country's economic growth and development.

However, there was significant difference among the mean quantity of rice production, imports and consumption in Nigeria across the three economic periods (Pre-SAP, SAP, and Post-SAP). This implies that quantity of rice production, quantity of rice imported and quantity of rice consumed within the periods under study were not the same statistically. In

other words, the mean quantity of rice consumption was highest among them followed by the mean quantity of rice output. The mean quantity of rice imported within the study periods was the least as could also be seen in the charts.

Conclusion and Recommendations

Rice production rate was lowest during post-SAP period but highest during SAP period while rice import was lowest during SAP era but highest during pre-SAP period. Rice consumption continued to increase giving rise to rice demand-supply gap scenario which has been an existing trend. Time trend variable was a significant factor in determining quantity of rice output, imports and consumption in Nigeria all through the periods under study.

This study also concludes that there would be continuous importation of rice to curb the demand-supply gap and this is detrimental to the Nigerian economy. This spurs the increase in rice imports in the face of the geometrically increasing Nigerian population whose demand for rice could only be met through rice import. The study therefore recommends that:

1. Stakeholders in rice subsector should raise domestic production as well as improve the quality of milled rice in Nigeria in a bid to increase its preference among rice consumers in Nigeria vis-à-vis imported rice;
2. policy actions to significantly reduce rice imports in the short-run should not only rely on reducing total imports, but should explore alternative measures such as trade agreements and perhaps restriction of rice imports to a level which will not lead to food insecurity, considering that rice is a food security crop in Nigeria;

3. Research should be intensified in order to significantly improve the relevant technologies across rice value chain in a way that the rate of growth will achieve the needed self-sufficiency in domestic rice production and thereby reduce the amount of money spent in rice imports in this country.
4. Deliberate attempts must also be made by government in terms of policy to improve its agricultural base and subsidies should be provided particularly in rice production not only as a substitute for its importation and domestic use, but export as well.

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