Journal of Agricultural Economics, Extension and Rural Development: ISSN-2360-798X Vol. 1(12): pp 218-223, December, 2014.

Full Length Research Paper

Empirical growth rate analysis of rice production in Nigeria and its implication on food security: Comparative assessment of three economic reforms phases in Nigeria.

Sadiq, Mohammed Sanusi

Research Scholar Department of Agricultural Economics, S.K Rajasthan Agricultural University, Bikaner, India

Author's Email: sadiqsanusi30@gmail.com

Accepted 22nd December, 2014

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, Structural Adjustment Program period and post – Structural Adjustment Programme period. Secondary data on rice production in Nigeria during the Pre – Structural Adjustment Programme period (1970 to 1985), Structural Adjustment period (1986 to 1994) and post - Structural Adjustment Programme period (1995 to 2013) were employed in this study. A growth rate model was used to estimate the growth rates in the three sub – periods. The results of the analysis showed that the instantaneous growth rates of maize production are 5.8%:7.8%; 9.2%:11.6% and 2.4 %:1.1% and the compound rates of growth of maize production are 106%:108%; 110%:112% and 102%:101% for the pre – Structural Adjustment Programme, Structural Adjustment Programme and post – Structural Adjustment Programme periods respectively. Rice production during post-SAP periods experienced relatively lower instability compared to other two periods. However, statistically significant deceleration was confirmed during the SAP period. Economically the declining trend in the growth of rice production in the Structural Adjustment Programme period implies that the policy reforms in the period was not effective in ensuring increased growth of rice production over that of other periods in Nigeria. Therefore, SAP programme was strictly 'economy killing by deep neck cutting'. Despite the myriads of problems associated with the programme in Nigeria, there is need for continuous in-depth analysis of the past reform programmes with a view to draw lessons for future reforms.

Keywords: Growth, rice, refoms, food security, Nigeria

INTRODUCTION

Agriculture is the cultivation of land, raising and rearing of animals for the purpose of production of food for man, animals and industries. It involves and comprises of crop production, livestock and forestry, fishery, processing and marketing of those agricultural production (Mabuza et al., 2008). During the 1960s, the growth of the Nigerian economy was derived mainly from the agricultural sector. However, in more recent years, there has been a marked deterioration in the performance of Nigeria's agriculture. The contribution of agriculture to the GDP which stood at an average of 56% in 1960 – 1964 declined to 47% in 1965, 1969 and more rapidly to 32% in 1996 – 1998 (Goni et al., 2007). The agricultural sector's changing share of GDP is partly a reflection of the relative productivity of the sector. 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). However, in terms of area of land under food crop production in the country, rice ranks sixth (after sorghum, millet, cowpea, cassava and yam) (Imolehin and Wada, 2000; Akinbola, 2002). The average annual rates of growth in rice production in Nigeria have declined in recent years (Goni and Amaza,

2006). The Federal Ministry of Agriculture (2012) estimated that the annual supply of food crops (including rice) would have to increase at an average annual rate of 5.9% to meet food demand, and reduced food importation significantly. Studies have shown that aggregate rice production in Nigeria has been growing at about 2.5% per annum in recent years (Goni et al., 2007). But the annual rate of population growth has been high (about 3%) (CBN, 2010). The reality is that Nigeria has not been able to attain self-sufficiency in rice production despite increasing hectares put into production annually (CBN, 2012). The Federal Ministry of Agriculture (2012) estimated that the annual supply of food crops (including rice) would have to increase at an average annual rate of 5.9% to meet food demand, and reduced food importation significantly. The development of agriculture in Nigeria has been slow inspite of the various agricultural policies. In fact, the government recognized the unhealthy condition of Nigerian agricultural sector since 1970, and has formulated and introduced a number of programmes and strategies aimed at remedying 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 believe that the weaknesses of 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 objectives of the programme included reconstructing and diversifying the productive base of the economy, by reducing the dependence on oil and imports, laying a basis for sustaining noninflationary growth, making substantial progress towards fiscal and balance of payment viability, improving efficiency of the private sector's contribution to economic growth, through liberalized trade and privatization of public sector enterprises, devaluing the naira and reducing government deficits and these translated into specific policy measures in the agricultural sector such as abolition of commodity boards, privatization and commercialization of agricultural and agro-industrial enterprises (Mesike et al., 2008), the removal of all government subsidies on food and other agricultural products, promotion of the production and export of non-traditional agricultural products, import restrictive measures on food and other locally produced agriculturally based raw materials, increase of the budgetary allocation to the system of agricultural development projects as a major instrument for agricultural development(Kajisa et al., 1997). 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. Inspite 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, its roles as a major source of foreign exchange earner. The policy reforms in existence prior to the introduction of SAP and after the SAP period differs and therefore, the growth in agricultural production is expected to vary in the Pre – SAP, SAP and Post – SAP periods in Nigeria. In view of the foregoing, this study was designed to provide an empirical comparative information on the growth rates of Rice production in Nigeria in the Pre – SAP, SAP and Post–SAP periods which would be relevant for future policy formulation, implementation and evaluation in Nigeria.

CONCEPTUAL FRAMEWORK

The model employed in this study for the estimation of growth trend in crop output in Nigeria is the growth rate model adopted from (Gujarati and Porter, 2007). This model is a semi log model whose regressand is in logarithm form and the regressor is time variable which can take values from one, two, three to infinity. For descriptive purposes, the growth rate model is called a log – lin model and the slope coefficient of the model measures the constant proportional or relative change in the regressand for a given absolute change in the value of the regressor. This model has been used by Khalid and Burhan (2006).

METHODOLOGY

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 Agricultural (USDA) and also journal articles. 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 2013(Post – SAP period) and therefore, data on three sub – periods were utilized in this study. Both descriptive statistics (co-efficient of variability) and inferential statistical tools (growth rate model; quadratic time trend model) were used to analyse the data.

Model specification

The compound growth rate formula is adopted for developing the model and is expressed as:

$Y_t = Y_0 (1+ r)^t$ ……... (1)

Where:

Y = Output of Rice ('000 tonnes)

Y = Initial Value of Rice Output ('000 tonnes)

r = Compound rate of growth of Rice output over time

t = Time trend (1970 to 1985, 1986 to 1994 and 1995 to 2007)

Taking the natural logarithm of equation (1), equation (2) was derived as:

$\ln Y = \ln Y_0 (1 + r)^t$ …… (2)

Where:

$b_0 = \ln Y_0$

$b_1 = \ln (1+ r)$

Equation (2) is rewritten as:

$\ln Y_t = b_0 + b_1 t$ …….. (3)

Adding disturbance term to equation (3), the explicit form of the model employed was derived as:

$\ln Y_t = b_0 + b_1 t + U$ …… (4)

Where:

Y_t = Output of Rice ('000 tonnes)

b = constant term

b = Coefficient of time variable

u = Random term

After the estimation of equation (1), the compound rate of growth was computed as follows:

$r = (e^{b1} - 1)$ ……... (5)

Where:

r = compound rate of growth

b_1= estimated coefficient from equation …..(1)

The coefficient of variability (CV) which measure instability is a normalized measure of dispersion and is the ratio of standard deviation (σ) to the mean (μ):

Algebraically, $CV = \frac{\sigma}{\mu}$ ……..... (6)

Following Marchenko (2009), a quadratic equation in time variable was fitted to the data to confirm the existence of acceleration, deceleration or stagnation during the same period and it was given as follows:

$\text{Log } Y = \beta_0 + \beta_i t + ct^2$ …… (7)

Where c is the regression coefficient used to depict acceleration, deceleration or stagnation. In the equation 5 above, the linear and quadratic time terms gives the circular path in the dependent variable (Y). The quadratic time term (t^2) allows for the possibility of acceleration, deceleration or stagnation during the period. Significant positive values of the coefficient of t^2 indicates acceleration in growth; significant negative values of t^2 indicates deceleration in growth; while non-significance of the coefficients indicates stagnation in the growth process.

RESULTS AND DISCUSSION

Growth trends of rice production

The result in table 1 shows that time variable was significant in influencing production, area and yield of rice all at 1 percent in the pre – SAP, SAP and post – SAP periods respectively. In the estimated growth rate model, the slope coefficients for pre – SAP, SAP and post – SAP periods respectively measures relative changes in production of rice for a given change in the value of time trend. By multiplying the relative changes in rice variables for pre – SAP period, SAP period and post – SAP periods respectively by hundred, we obtained the percentage change or the growth rate for an absolute change in time. The estimated production growth rates for pre – SAP period, SAP period and post – SAP periods respectively, implies that over the period, the production of rice in Nigeria increased at the rate of 5.8%, 9.2% and 2.4 % per annum. The estimated area growth rates for pre – SAP period, SAP period and post – SAP periods respectively, implies that over the period, the area under rice in Nigeria increased at the rate of 7.8%, 12% and 1.1% per annum. However the growth rate worked out are an instantaneous (at a point in time) rate of growth and not the compound (over period of time) rate of growth.

Compound growth rates (r) were estimated from the instantaneous rates of growth, in that production revealed 106%, 108% and 120 %; area 108%, 112%, 101%, respectively, are the rate of growth of rice in terms of production and area in Nigeria over the periods 1970 – 1985, 1986 – 1994 and 1995 – 2007 (compound rates of growth). Therefore, the rate of growth of rice in terms of production and area in Nigeria per annum during the pre – SAP period, SAP period and post – SAP periods (instantaneous rates of growth) are of 5.8%: 7.8%; 9.2%:11.6%; and 2.4%: 1.1%, and the rate of growth of rice in terms of production and area in Nigeria over the periods 1970 – 1985, 1986 – 1994 and 1995 – 2007 (compound rates of growth) are 106%:108%;

Table 1: Estimated trend and growth analysis of Rice production in Nigeria

Statistical tools	Production	Area	Productivity
PRE-SAP PERIOD			
Regression coefficient (β_1)	0.058	0.078	-0.056
R^2	0.91	0.94	0.57
Growth rate (%)	5.8***	7.8***	-5.6***
Compound growth rate (%)	106***	108***	94.5***
SAP PERIOD			
Regression coefficient (β_1)	0.092	0.116	2.24E-18
R^2	0.47	0.74	0.000
Growth rate (%)	9.2***	11.6***	2.24E-20^{ns}
Compound growth rate (%)	109.7***	112.3***	100^{ns}
POST-SAP PERIOD			
Regression coefficient (β_1)	0.024	0.011	0.016
R^2	0.66	0.33	0.07
Growth rate (%)	2.4***	1.1***	1.6***
Compound growth rate (%)	102.4***	101***	101.6***

Source: Computed from time-series data, 1970-2014
Note: ***, *** and * implies statistically significant at 0.01, 0.05 and 0.10 probability levels respectively.
Ns: not statistically significant

Table 2: Instability analysis of Rice production in Nigeria

Statistical tools	Production	Area	Productivity
PRE-SAP PERIOD			
Arithmetic mean ('000 tonnes)	448.81	427.12	1.56
Standard deviation	131.96	166.95	0.51
Coefficient of variability (%)	29	39	33
SAP PERIOD			
Arithmetic mean ('000 tonnes)	1523	1322.2	1.78
Standard deviation	452.91	419.83	0.44
Coefficient of variability (%)	30	32	25
POST-SAP PERIOD			
Arithmetic mean ('000 tonnes)	2186.05	2215.2	1.6
Standard deviation	386.14	240.59	0.50
Coefficient of variability (%)	18	12	31

Source: Authors computation from time-series data, 1970-2014

120%:112%; and 102%:101%, respectively. It was observed that the compounded growth rate of rice production and area in Nigeria during the SAP era was higher than during the pre –SAP and post – SAP eras 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 maize 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 stemmed by structural deregulation of the economy.

Instability analysis of rice production

Results in table 2 indicated that there has been fluctuations in production, area and productivity of rice production in Nigeria during the pre-SAP, SAP and post-SAP period. The variability in terms of production and area during the pre-SAP and SAP period where relatively higher when compared to post-SAP period. This suggests that the production of rice experienced relatively higher instability during the periods before post-SAP.

Acceleration, deceleration and stagnation in rice production

To investigate for the existence of acceleration or deceleration or stagnation in growth of rice production, the quadratic equation in the time trend variable were fitted according to the equation. Results in Tables 3 shows the estimated quadratic equation in time trend variable for production, area and productivity of rice during the pre-SAP, SAP and post-SAP period. The

Table 3: Estimates of Quadratic equation in time trend variable for the period 1970-2014

Statistical tools	Production	Area	Productivity
	PRE-SAP PERIOD		
Constant (β_0)	280.42	242.09	2.24
Time trend (β_1)	8.52	1.063	-0.078
Time trend squared (β_2)	1.026***	1.904***	0.00***
R^2	0.90	0.96	0.57
F-ratio	59.05***	148.87***	8.44***
Status	Accelerative	Accelerative	Accelerative
	SAP PERIOD		
Constant (β_0)	133.67	278.71	0.67
Time trend (β_1)	567.47	341.22	0.61
Time trend squared (β_2)	-45.73***	-20.92***	-0.061***
R^2	0.84	0.84	0.73
F-ratio	15.35***	15.38***	8.00***
Status	Decelarative	Decelerative	Decelerative
	POST-SAP PERIOD		
Constant (β_0)	1.785E3	1.733E3	2.19
Time trend (β_1)	10.67	87.63	-0.20
Time trend squared (β_2)	2.01***	-3.05***	0.011***
R^2	0.68	0.49	0.49
F-ratio	18.29***	8.02***	8.16***
Status	Accelerative	Decelerative	Accelerative

Source: Computed from time-series data, 1970-2014
Note: ***, *** and * implies statistically significant at 0.01, 0.05 and 0.10 probability levels respectively.
Ns: not statistically significant

quadratic term t^2 allows for the possibility of acceleration, deceleration and stagnation in the growth process. Results in Table 3 shows that the values of the coefficients of t^2 variable for pre-SAP are 1.026, 1.904 and -0.078 for production, area and productivity, all being significant at 0.001 probability level. The significance of the coefficients of the t^2 variable is a confirmation of significant accelerative growth in production, area, and significant decelerative growth in for yield. Furthermore, the results in table 3 reveals the coefficients of t^2 variable for SAP are -45.73, -20.92 and -0.061 for production, area and productivity, all being significant at 0.001 probability level. The significance of the coefficients of the t^2 variable is a confirmation of significant decelerative growth in production, area and productivity. Lastly, the result in table 3 shows the coefficients of t^2 variable for post- SAP are 2.01, -3.05 and 0.011 for production, area and productivity, all being significant at 0.001 probability level. The significance of the coefficients of the t^2 variable is a confirmation of significant accelerative growth in production, productivity, and significant decelerative growth in area. Stagnation was not observed neither for production nor area nay productivity of rice in Nigeria during the three reform phases. This result contradicts earlier findings of Onyenweaku (2004) where stagnation in output was confirmed for rice in pre-SAP period, and conforms to the findings of Tanko *et al*. (2010) where significant decelerative in production, area and productivity was observed for rice in SAP period. The economic policies towards rice sub- sector during pre-SAP and post-SAP period respectively, are healthy and favourable, except for area in post-SAP which is unfavourable. This may be attributable to the agrarian focused economy during pre-SAP period and observed intervention policies by the government geared at improving the rice production in the country one of which was drastic reduction in importation and massive support of domestic production of rice. The declining trend observed in rice during the SAP period was stemmed by the structural deregulation of the economy.

SUMMARY, CONCLUSION AND RECOMMENDATION

The instantaneous growth rates and compound growth rates of maize production in the pre – SAP, SAP and post – SAP periods in Nigeria were estimated using a growth rate model. The estimated functions in time trend variable pointed to positive trends. There were also marked fluctuations in rice production, but relatively lower during post-SAP period. Furthermore, rice production during the SAP period experienced significant deceleration in growth been stemmed by the structural deregulation of the economy. The implication of the growth rate of maize being higher in the SAP era as compared to the pre – SAP era and post – SAP era with the notion that the policy reform of the SAP era was

favourable in ensuring increased rice production in Nigeria as cited by Oyakhilomen and Emmanuel (2012) is misleading and therefore, from in –depth economic point of view the notion that SAP was a complete failure and ruse is factual. By economic implication despite the policy measures in the SAP period, the agricultural sector did not register significant overall growth. This study disagrees with NCEMA (2003) who noted that in spite of the mixed performance of Structural Adjustment Programme in the country, it is important to stress the continued relevance of its basic tenets to our social and economic situation now and in the future and therefore, agrees with NCEMA calls for an in-depth analysis of the past reform programmes with a view to drawing lessons for future reforms.

REFERENCE

Akinbola GE (2002). Poverty Reduction through the Crop Subsector in Nigeria: A Regionaz Perspective. *Poverty Reduction and the Nigeria Agricultural Sector.* El- Shaddai Global Ventures Ltd, pp. 39-52

Central Bank of Nigeria, 2010. Domestic Production, Consumption and Prices. *Central Bank of Nigeria Statistical Bulletin*, Volume 18.

Central bank of Nigeria (CBN) (2012). *Statistical Bulletin*, Vol. 2 (2)

Child MN, 2008. The effect of a depressed economy on agricultural sector. Journal of African Studies, 3 (2): 152-167.

Federal Ministry of Agriculture (2012). Analysis of Technical Efficiency in Food Crop Production in Gombe State, Nigeria. *Journal of Applied Economic Letters.* 9: 51-54

Goni M, Amaza PS (2006). Determinants of Household Food Security in the Lake Chad Area of Bomo State, Nigeria. J. Res. Agric. 3(4):Pp. 29-34

Goni M, Mohammed S, Baba BA (2007). Analysis of Resource-Use Efficiency in Rice Production in the Lake Chad Area of Borno State, Nigeria. *Journal of Sustainable Development in Agriculture and Environment*, Vol. 3:31-37

Gujarati DN, Porter CD (2009). *Basic Econometrics (5th Edition)*. McGraw-Hill, New York.

Imolehin, E. D. and Wada, A. C. (2000). Meeting Rice Production and Consumption Demand of Nigeria with Improved Technologies, *International Rice Commission Newsletters*: Vol. 49 FAO Rome

Mabuza ML, Taeb M, Endo M (2008). Impact of food aid on small wolder. Agricultural development in Swaziland. Afri. J. Agric., 8 (2):151-169.

Marchenko Y (2009). Multiple-imputation Analysis Using Stata's mi Command. *Presentation given to the 2009 UK Stata Users Group Meeting,* London, UK, on September 10., 2009. StataCorp.

Onyenweaku CE (2004). Stagnation, Acceleration and Deceleration in Agricultural Production in Nigeria, 1970-2000. J. Agric. Food Sci., 2(2):131-140

Oyakhilomen, O, Emmanuel YD (2012). Empirical Assessment of the Growth Rate of Maize Production in The Pre – SAP, SAP and Post – SAP Periods In Nigeria. Russian J. Agric. Socio-Econ Sciences, 5(5): Pp. 23-27.

Tanko L, Jirgi AJ, Igwe KC (2010). Trend Analysis of Area, Production and Productivity of Rice in Nigeria. In: Nmadu, J.N and Baba, K.M. (eds). Commercial Agriculture, Banking Reform and Economic Downturn: Setting a New Agenda for Agriculture Development in Nigeria. *Proceedings of 11th Annual National conference of National Association of Agricultural Economists.* Federal University of Technology, Minna, Nigeria. Pp 43-48.

Usman A (2005). Trade Regime and Food Security in Developing Countries: Evidence from Nigeria. J. Econs. Finan. Stud., 2(1):116-133.

Usman A, Abdulgafar TI (2010). Agricultural trade liberalization and food security in Nigeria. J. Econ.s Int. Finan., 2(12): pp. 299-307