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STAGNATION, ACCELERATION AND DECELERATION IN AGRICULTURAL PRODUCTION IN NIGERIA, 1970-2000

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ABSTRACT

This study investigated the hypothesis of stagnation/acceleration/deceleration in agricultural production in Nigeria for the period 1970-2000 by fitting exponential trend equations to the output data of the country's 23 major agricultural commodities and computing compound annual growth rates of agricultural production. The computed compound growth rates of agricultural production were very low and non significant in most cases. However, statistical significant acceleration in output growth was confirmed for 21 out of 23 agricultural commodities studied; stagnation (absence of significant acceleration or deceleration in the growth process) was confirmed for only 2 of the agricultural commodities while no statistical deceleration in growth was confirmed for any of the commodities.

INTRODUCTION

According to Omuruyi (1987), the oil boom of the 1970s is associated with the following fundamental changes in the Nigerian economy: (i) heavy dependence of the economy on crude oil exports as the main source of foreign exchange earnings and government revenue, (ii) erosion of the competitiveness of the agricultural sector in the international market due to overvalued exchange rates, inadequate pricing policies, rural urban migration and general neglect coupled with low productivity in the country's agriculture which led to heavy dependence on imported food and agro allied industrial materials, (iii) government policies encouraged import oriented production and consumption pattern with little incentives for non oil exports, and (iv) government became the prime mover of the economy through huge investments of oil revenue in social, physical and economic infrastructure.

However, with the collapse of the world oil market in the early 1980s, a serious economic crisis erupted in Nigeria. There were sharp declines in oil exports and prices, which resulted in drastic reductions in the country's foreign exchange reserves, and earnings as well as in government revenue. Government deficits widened exacerbated by escalating foreign debts thereby plunging the country into economic depression, rising prices and unemployment (Omuruyi, 1987).

Economic deregulation in Nigeria began with the introduction of the Structural Adjustment Programme (SAP) in 1986, aimed at (i) restructuring and diversifying the productive base of the economy in order to reduce dependence on the oil sector and on imports. (ii) reducing the dominance of unproductive investments in the public sector, (iii) improving

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the sectors efficiency and intensifying the growth potentials of the private sector. The main policy instruments for SAP included adoption of a realistic exchange rate policy coupled with liberalization of the external trade and payments system and the adoption of appropriate pricing policies in all sectors with greater reliance on market forces and reduction of complex administrative controls (Ojo *et al*, 1993).

A major effect of deregulation in Nigeria has been the boost to non-oil exports as a result of the alteration of relative prices through exchange rate adjustments, which have made Nigeria's exports competitive in the international market. The outputs of agricultural export commodities especially coca, cotton, rubber, groundnut, palm produce, ginger, and coffee have been stimulated. For cocoa, palm produce and rubber, abandoned trees and plantations have been rehabilitated. There have also been substantial increases in food crop output since deregulation particularly cassava, yam, maize, sorghum, millet, rice, cowpea and vegetables.

This study is designed to investigate the hypothesis of stagnation or acceleration or deceleration in agricultural production in Nigeria from 1970 to 200 using trend analysis.

II. THE METHODOLOGY

2.1 The Data

This study covered 23 Nigeria's major agricultural commodities made up of 13 food crops – maize, millet, sorghum, rice, beans, cassava, potato, yam, cocoyam, plantain, vegetables, melon and wheat, 9 cash crops –groundnut, soybeans, cotton, palm kernel, palm oil, cocoa, coffee, rubber and benniseed; and one industrial crop – sugar cane. The data on annual outputs of agricultural commodities were obtained from various issues statistical Bulletin of the Central Bank of Nigeria for the period 1970-2000.

2.2. Methods of Analysis

Annual compound growth rates of agricultural production were computed by fitting exponential equations in time to the output data as follows:

$$Q = ae^{bt} \quad \text{---------- (1)}$$

which when linearized in logarithms becomes

$$\text{Log } Q = a + bt \quad \text{---------- (2)}$$

where Q = crop output in metric tones, t = time trend (variable)
while a and b are the regression parameters to be estimated.

The annual compound growth rate ® in crop output is given as

$$r = (e^b - 1) \times \frac{100}{1} \quad \text{---------- (3)}$$

where e = Eulers exponential constraint (2,71828)

In order to confirm the existence of statistically significant acceleration or deceleration or stagnation in agricultural production in Nigeria, a quadratic equation in time variable was fitted to the output data of each agricultural commodity for the same period (1970-2000) as follows:

$$\text{Log } Q = a + bt + ct^2 \quad \text{---------- (4)}$$

In the above specification, the linear and quadratic time terms given the secular path in the dependent variable (Q). The quadratic time term (4^2) allows for the possibility of deceleration or acceleration or stagnation in crop production during the period under study, (Sawant, 1981; Onyenweaku, 1993). Significant positive values of the coefficients of t^2 confirm significant acceleration in growth; significant negative values of t^2 are confirmation of significant declarative in growth while non-significance of the coefficients of t^2 implies stagnation or absence of either acceleration or deceleration in the growth process.

III RESULTS AND DISCUSSION

Estimated Production Trends

Table 1 shows the estimated output trend equations for the 23 commodities for the period 970-2000 with t-ratios in parentheses. Among the food crops, the coefficient of the time trend is positive and significant for rice, cassava, potato, plantain and melon while it is positive but non significant for maize, millet, sorghum, beans, yam, cocoyam, vegetables and wheat. With regard to the cash crops, the coefficient of the time trend is positive and significant for only soybeans, and palm oil while the coefficient is positive but non significant for groundnut, cotton, palm kernel, cocoa, coffee, rubber and benniseed. As for the industrial crop- sugarcane, the coefficient of the time trend is positive but non significant. These results indicate significant increases/growth in the outputs of rice, cassava, potato, plantain, melon, soybeans and palm oil in Nigeria between 1970 and 2000 while the other crops experienced no significant growths in output during the same period.

3.2 Growth Rates of Crop Production

Table 2 shows the computed annual compound growth rates in the outputs of the 23 commodities for the period 1970-2000. These growth rates are generally low but positive in all cases. These results differ from those of the same author for the period 1960/61–1981/88 with regard to 11 annual crops in Nigeria. In that study only 3 crops – millet, rice and melon showed positive growth rates while the other crops such as guinea corn, groundnut, beans, maize, yam, cassava and cocoyam experienced negative growth rates.

Among the food crops, the computed annual compound growth rates in crop production range from 0.08% for yam to 1.17% for rice. For the cash crops, the annual compound growth rates range from 0.08% for groundnut to 1.85% for coffee. The only industrial crop (sugar cane) studied has the least compound rate of growth in output of 0.03% per annum.

3.3 Confirmation of Stagnation or Acceleration or Deceleration in Output Growth.

Table 3 shows the estimated quadratic equations in time variables for the 23 commodities from 1970-2000 with t-ratios in parentheses. The non-significance of the coefficients of the quadratic term t^2 in the equations for cotton, and sugar cane is a confirmation of stagnation (absence of either acceleration or deceleration) in the output of cotton and sugar cane from 1970 to 2000. For the remaining 23 commodities, the positive and significance of the quadratic term t^2 is a confirmation of significant acceleration in output growth for such commodities as maize, millet, sorghum, rice, beans, cassava, potato, yam, cocoyam, plantain, vegetables, melon, wheat, groundnut, soybeans, palm kernel, palm oil, cocoa, coffee, rubber and benniseed. Significant deceleration in output growth was not confirmed for any of the Commodities.

These results are improvements over the author's earlier work on the country's annual crops (Onyenweaku, 1993) where acceleration in output growth was confirmed for melon, sorghum, maize, yam and cocoyam, significant deceleration in output growth was confirmed for groundnut, cotton, and cassava, while stagnation in output growth was confirmed for millet, cowpea and rice for the period 1960/61 to 1987/88.

SUMMARY AND CONCLUSION

This study has tested the hypothesis of stagnation/acceleration/deceleration in the growth of agricultural production in Nigeria from 1970 to 2000 using trend analysis. The results of this study have confirmed significant acceleration in output growth for 21 out of the 23 agricultural commodities studied, stagnation in output growth in only two commodities and no significant deceleration in output growth in any commodity. The declining trends in the outputs of most of these commodities observed since the early 1970s have been stemmed by deregulation of the economy. However, the very low and non significant annual compound growth rates of agricultural production obtained in this study seriously undermine the ability of the agricultural sector to perform its traditional role of meeting domestic food requirements, raw materials for industries, and of earning of enough foreign exchange through agricultural exports.

Policies to stimulate agricultural growth in the country will include creating favourable macroeconomic environment involving market liberalization, greater investments to improve the well-being and productivity of farmers through education, health and nutrition interventions, improving farmers access to production inputs, (land, credit, fertilizer, agricultural extension services), development of rural infrastructure, improvement in research, technology development and transfer, strengthening of national agricultural research and extension systems, development of efficient and effective agricultural input and output markets, effective organization of small scale farmers in the country, increased support for women, and the sustainability of the environment.

Table 1: Estimated Exponential Equations in Time Variable for the outputs of Nigeria's major Agricultural Commodities, 1970-2000(Log Q= a + bt)

	Commodity	Estimated Parameters a	b	r^2	
(A)	**FOOD CROPS**				
1.	Maize	3.156	0.0073		.063
			(1.399)		
2.	Millet	3.527	0.0020		.044
			(1.112)		
3.	Sorghum	3.591	0.0031		.094
			(1.670)		
4.	Rice	2.621	0.0116		.112
			(1.845)*		
5	Beans	2.906	0.0019		.018
			(0.708)		
6.	Cassava	3.619	0.0085		.041
			(1.471)*		
7.	Potato	1.575	0.0049		.148
			(2.169)**		
8.	Yam	4.019	0.0008		.001
			(0.140)		
9.	Cocoyam	2.725	0.0011		.003
			(0.283)		
10.	Plantain	3.042	0.0020		.125
			(1.964)*		
11.	Vegetable	3.107	0.0037		.087
			(1.607)		
12.	Melon	2.066	0.0060		.150
			2.194)		
13.	Wheat	1.605	0.0058		.029
			(0.901		

(B)	**C A S H C R O P S**			
14.	Groundnut	2.964	0.0008	.003
			(0.925)	
15.	Soyabeans	1.919	0.0060	.115
			(1.872)*	
16.	Cotton	2.167	0.0038	.028
			(0.890)	
17.	Palm Kernel	2.583	0.0033	0.055
			(1.254)	
18.	Palm oil	2.753	0.0020	.125
			(1.960)*	
19.	Cocoa	2.304	0.0012	.019
			(0.716)	
20.	Coffee	1.003	0.0188	.096
			(1.692)	
21.	Rubber	1.939	0.0056	.086
			(1.596)	
22.	Benniseed	1.480	0.0053	.096
			(1.691)	
(C)	**I N D U S T R I A L C R O P**			
23.	Sugar cane	2.878	0.0003	.017
			(0.395)	

Figures in parentheses are t- ratios
*** Significant at 10%**
**** Significant at 5%**

Table 3. Estimates of Quadratic in Time Variable Fitted to Outputs of Nigeria' Major Agricultural Commodities, 1970 – 2000.

		ESTIMATED PARAMETERS		
S/N	**COMMODITY**	**A**	**b**	**c**
1.	Maize	2.877	-0.0019	0.0015
			*(-0.679)	(8.751)***
2.	Millet	3.441	-0.0009	0.0005
			(-0.730)	(6.438)***
3.	Sorghum	3.491	-0.0002	0.00005
			(-0.142	(8.358)
4.	Rice	2.310	0.0014	0.0017
			(0.324)	(6.659)***
5.	Beans	2.765	-0.0028	0.0008
			(-.877)*	(8.546)***
6	Cassava	3.276	-0.0004	0.0084
			(-0.540)	(5.934)***
7.	Potato	1.436	0.0004	0.0007
			(0.704)	(10.346)***
8.	Yam	3.908	-0.0029	0.0006
			(-0.504)	91.941)*
9.	Cocoyam	2.599	-0.0030	0.0007
			(-0.820)	(3.052)***
10.	Plantain	2.981	0.0006	0.0003
			(0.002)	(16.830)***
11.	Vegetable	2.976	-0.0006	0.0007
			-0.641)	(11.858)
12.	Melon	1.939	0.0019	0.0007
			(0.921)	(8.341)***

Table 2: Compound Annual Growth Rates of Agricultural Production in Nigeria, 1970-2000.

S/N	Commodity	Growth Rate (%)
1.	Maize	0.73
2.	Millet	0.20
3.	Sorghum	0.31
4.	Rice	1.17*
5.	Beans	0.19
6.	Cassava	0.85*
7.	Potato	0.49**
8.	Yam	0.08
9.	Cocoyam	0.11
10.	Plantain	0.20*
11.	Vegetables	0.37
12.	Melon	0.60*
13.	Wheat	0.58
14.	Groundnut	0.08
15.	Soya beans	0.64*
16.	Cotton	0.38
17.	Palm kernel	0.33
18.	Palm Oil	0.20*
19.	Cocoa	0.12
20.	Coffee	1.85
21.	Rubber	0.56
22.	Benniseed	0.53
23.	Sugar cane	0.03

*** Significant at 10%**
**** Significant at 5%**

13.	Wheat	1.424	-0.0002	0.0010
			(1.121)	(2.741)**
14.	Groundnut	2.857	-0.0027	0.0006
			(-1.112)	(4.122)***
15.	Soybean	1.742	0.0002	0.0010
			(0.1410)	(9.259)***
16.	Cotton	2.109	0.0012	0.0003
			(0.416)	(1.132)
17.	Palm kernel	2.475	-0.0002	0.0006
			(-0.096	(4.362)***
18.	Palm oil	2.698	0.0002	0.0003
			90.364	(8.369)***
19.	Cocoa	2.251	-0,0055	0.0003
			(-0.329)	(2.950)***
20.	Coffee	0.428	-0.0006	0.0031
			(-0.097)	(8.283)***
21.	Rubber	1.755	-0.0005	0.0010
			(-0.232)	(8.031)***
22.	Benniseed	1.386	0.0022	0.0005
			(0.730)	(2.812)***
23.	Sugar cane	2.883	0.0005	-0.00003
			(0.558)	(-0.533)

Note: Figures in Parentheses are t-ratios.

* Significant at 10 at 10%
** Significant at 5%
*** Significant at 1%

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