TREND ANALYSIS OF CASSAVA PRICE AND GROWTH RATE IN NIGERIA

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ABSTRACT
The research work was on trend analysis of cassava output and price. The period covered was 1966-2009 (43 years) and data were collected on output hectare (area) and price of cassava within the time period from FAO statistical data base. The objectives were to estimate and analyze the trend of cassava price, estimate the growth rate of cassava, confirm acceleration, deceleration and stagnation of price of cassava in Nigeria. The results showed that there was gradual fluctuation in production; area planted increased with minimal fluctuations indicating that farmers are still faced with problem of pest and diseases, desertification, use of local implements, lack of mechanization in production process. Price of cassava accelerated with time and grew at 16.61% per annum confirming significant increase during the years under review and t^2 was positive but not significant. This implies that cassava price stagnated with time. The R^2 value was 0.9632 indicating that 96.32% of the variation in cassava price was explained by the estimated values. The F-ratio was also highly significant at 1% level of probability implying a regression of best fit. The results call for policies aimed at placing a type of stabilization fund through the requisite agencies to ensure that prices of the commodities do not fall below acceptable level because it discourages production. There is need to encourage private sector investment on the industries to expand existing market on the price offer for cassava and encourage large scale production.

Keywords: Cassava, price, growth rate, acceleration, deceleration, stagnation

INTRODUCTION
Agriculture is one of the most important sectors of the Nigerian Economy. This is because it contributes more than 30% of the total annual GDP, employs about 70% of the labour force and accounts for 70% of the non oil export & perhaps most importantly, provides 80% of the food needs of the country (Adegboye 2004). Major crops grown in Nigeria include: Rice, beans, cashew nuts, oil palm, rubber, maize, cassava etc of all these crops cassava (*Manihot esculata*) is one of the most important staple food and cash crop in several tropical Africa countries especially Nigeria where it plays a principal role in the food economy (Agwu and Anyaeche, 2007). Nigeria is the world's largest producer of cassava with about 47,274,320mt and average yield of 13.027 tones/ht. the south-east zone is leading in cassava production accounting for over 37% of the national production (NAERLS and NFRA 2009) cassava has become very popular crop in Nigeria and is fast replacing yam and other traditional staples in the country as it contributes about 15% of the daily dietary energy intake of most Nigerians and supplies about 70% of the total calories intake of about 60 million people in Nigeria (Ezulike *et al*, 2006).

The food and agriculture organization (FAO) estimated that over 600 million people on cassava as staple food in Africa, Asia, and Latin America. In Nigeria, cassava is primarily produced for its roots. This is because its roots are quite high in carbohydrates about 60 to 70% for Nigerian cultivars and a world average of about 39%. Traditionally, cassava tuberous root are particularly starch in human diets and are processed by various methods into numerous products utilized in diverse ways depending on local customs and preferences. The crop is very poor in protein content about 2.7 to 3.2% for Nigerian cultivars.

In Nigeria, the land area put under cassava production is projected to increase at 1.3% million from 2.9m hectare in 1993-1995 to 3.3 million hectare in 2005. Cassava production grew by 7.4 percent, in response to the drive to increase cassava exports & the domestic consumption especially with the federal government's directive to flour millers in the country to include at a least 10.0 percent of cassava flour as input in the production of composite bread and other confectionaries. These achievements were facilitated by the increased use of improved cassava cuttings and processing facilities across the country (CBN 2007 Annual Report and Statement of Account).

METHODOLOGY

Study Area

The study area is Nigeria with landmass area of 923,766sqkm. She has a population of about 150milllion and is divided into 36 states with its capital in Abuja. Nigeria is situated in the West Africa region and his between longitude $7^0$29'E and latitude $9^0$4'N. it boarders to the north by the republic of Niger and Chad it shares boundaries to the west to republic of Benin, while the republic of Cameroun shares the Eastern boarders. Right down to the shores of the Atlantic ocean which forms the southern limit of Nigeria territory. Land is in abundance in Nigeria for agriculture industrial and commercial activities. The largest national population of African content the population is made up about 374 pure ethnic stocks.

Sampling Procedure

Data on output, land area (hectare), price of cassava were elicited from secondary source from FAO statistics.

Method of Data Collection

Secondary data were used for this study. The data were generated from Food and Agriculture Organization for different variables over the years ie 1966-2009.

Method of Data Analysis

Compound price of cassava was computed by fitting Exponential equation in time to these data as follows:

$Q=a_ebt$ ---------- (1)

Which when linearized in logarithms becomes

Log Q=a+bt ---------- (2)

Where Q is price of cassava in naira (₦)

t = is the time trend variable.

While A and B are the regression parameters to be estimated.

To estimate the growth rate of cassava, data were analyzed using the annual compound as growth rate for cassava price as follows:

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

Where e is Euler's exponential constant (2.71828)

In order to confirm acceleration, deceleration and stagnation of price of cassava in Nigeria the quadratic functions for the period under study i.e. 1966-2009 was employed. This is stated as:

$Y= a + b + ct^2$ ---------- (4)

In the above specification

Where y = price

t =time.

a and b = the unknown parameters to be estimated.

t^2 = allows for the possibility of acceleration declaration or stagnation in growth of cassava in Nigeria.

The major concern with the time series is that if non-stationary of data series persists then it may lead to spurious relationship. To avoid this problem, it is necessary to use the co-integration methodology.

The error correction model is based on stationary data and includes the lagged residuals of the long run equation which is also when the varieties have co-integrating relationship. Some of the data series home a long-run equilibrium relationship we formulate on error correction representation (ECM) to capture the short-run dynamics (Engel and Granger, 1987) one can estimate and ECM using the residual from the long-run equation. Most of the time series variables are non-stationary. To check for the unit root in the variable there are many alternatives. However the most recommended methods are the Augmented Dickey-Fuller (ADF) test and the Philips-pennon (P.P) test.

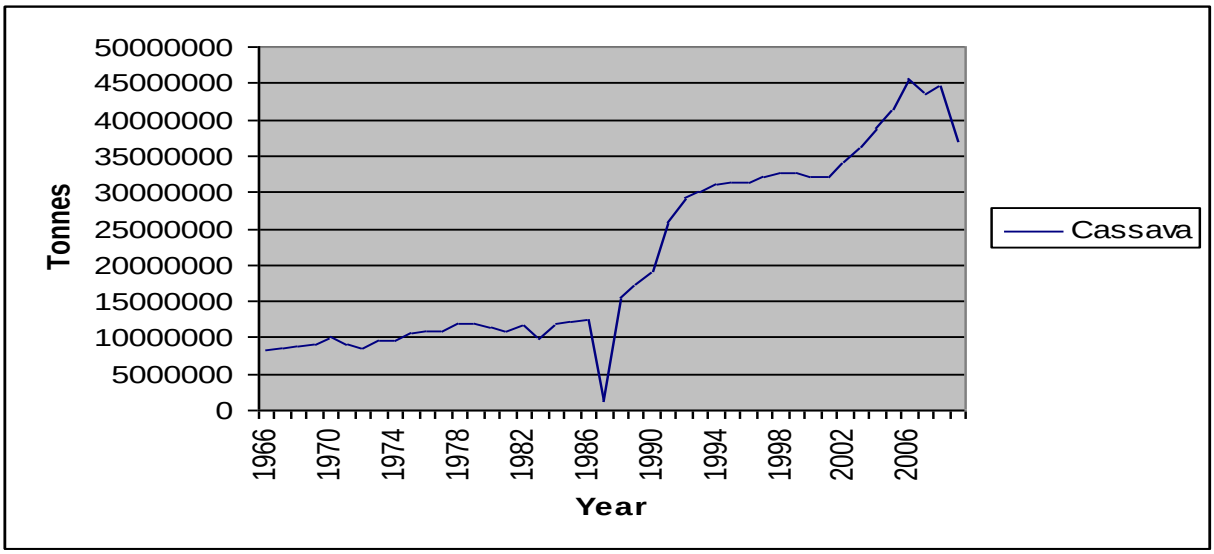
RESULTS AND DISCUSSION

Trend in the Supply of Cassava in Nigeria 1966-2009

Production of Cassava in Nigeria 1966-2009

Figure 1 presents the production (tones) of cassava in Nigeria from 1966-2009. The figure shows that from 1966 to 1986 there were gradual fluctuations in production from 8.382million tones (mmt) to 12.388mmt. In 1987, there was a sharp decline to 1.387mmt and another sharp increase to 15.430mmt in 1988. This increase continued steeping to 1004 then flattered until 2001. There was also a sharp increase to 41056mmt in 2005 to 44.50mmt in 2008 and a decrease to 36.704mmt in 2007.

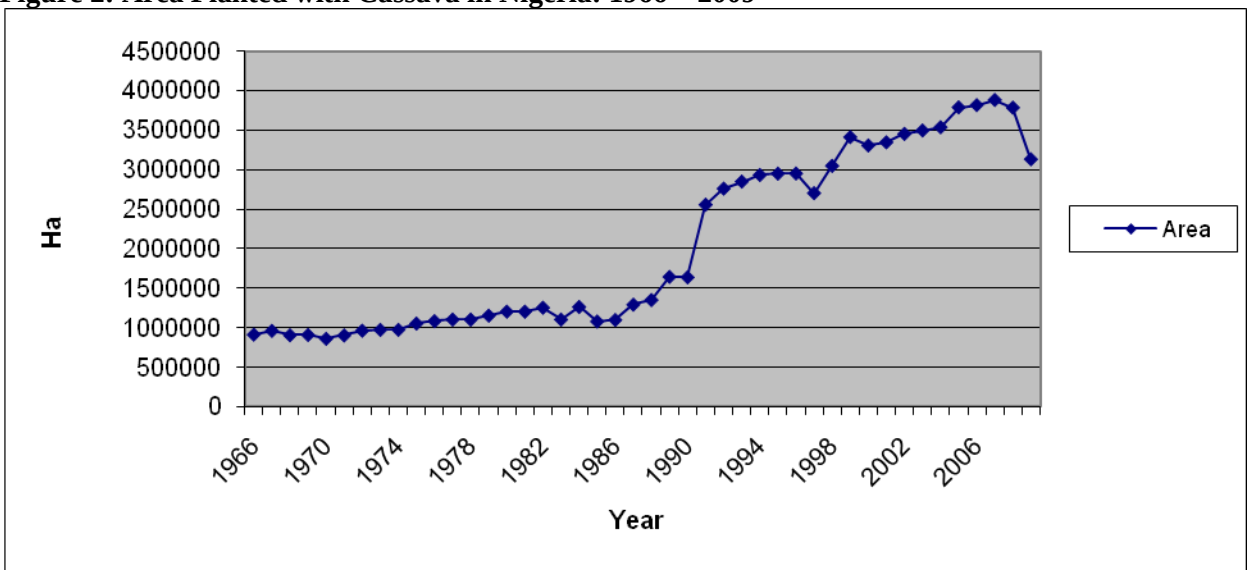
Fig 1: Trend in production of cassava in Nigeria: 1966-2009



Area Planted with Cassava in Nigeria: 1966-2009

Figure 2 presents the area (ha) planted with cassava in Nigeria from 1966 to 2009. The figure shows that area planted with cassava increased gradually from 910,000ha in 1966 with minimal fluctuation to 15.4m ha in 1988 and 17.4m ha in 1987. There was a sharp increase to 30.18m ha in 1993. This trend increased to 32.0m ha in 2001 and 34.1m ha in 2002 with fluctuations to 37.78m ha in 2008 with or sudden decrease to 31.2m ha in 2009.

Figure 2: Area Planted with Cassava in Nigeria: 1966 – 2009



Productivity of Cassava in Nigeria: 1966-2009

The data in fig. 3 shows the productivity of cassava in Nigeria from 1966-2000. The fig. shows that productivity exhibited gradual fluctuations from 1966 (9.27t/ha) to 11.31t/ha in 1988. There was also a sharp decline to 1.08t/ha in1986 and their rising sharply again to 11.46t/ha in 1988, from 1988 to 1998, there were gradual fluctuations from 11.46t/ha to 10.75t/ha respectively. The fluctuations continued to 2009 (11.77t/ha).

Price of Cassava in Nigeria: 1966-2008

The data in fig. 4 shows the price trend analysis of cassava in Nigeria from 1966 to 2008. The price/ tone of cassava in Nigeria increased gradually from double digit (₦31/t) in 1966 to ₦92/t in 1975 to triple digit to (₦100/t) in 1976 and 1977. This quadripuled (₦1,450) in 1988 to ₦6, 610 in 1995. There was a sharp increase (₦10, 370/t) in 1996 to ₦21, 160/t in 2007. This further increased to ₦ 22, 437.4/t in 2008.

Fig 3: Productivity of Cassava in Nigeria: 1966-2009.

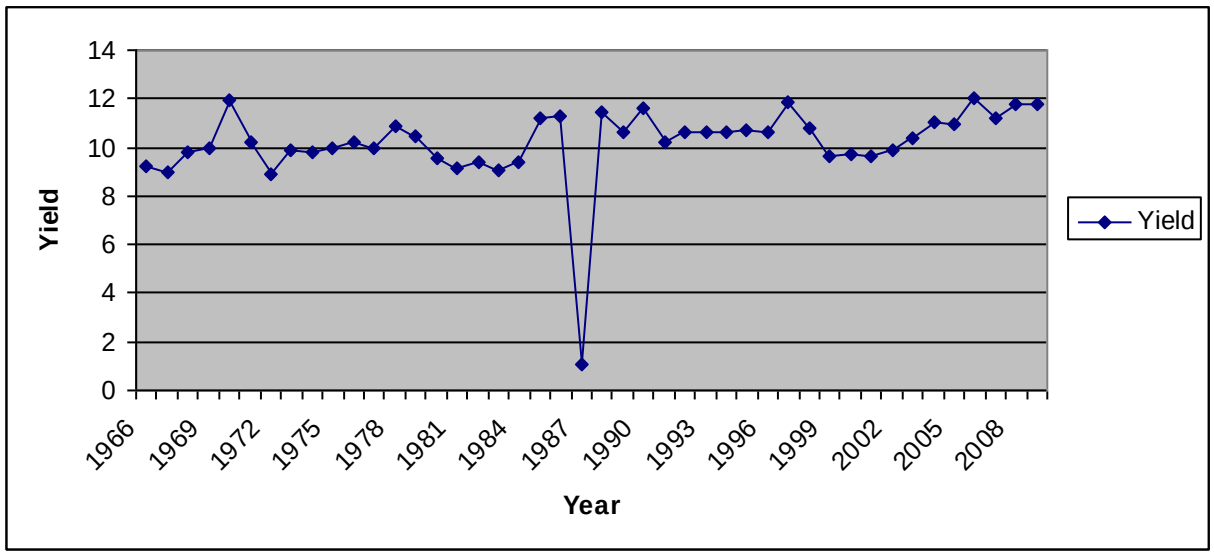
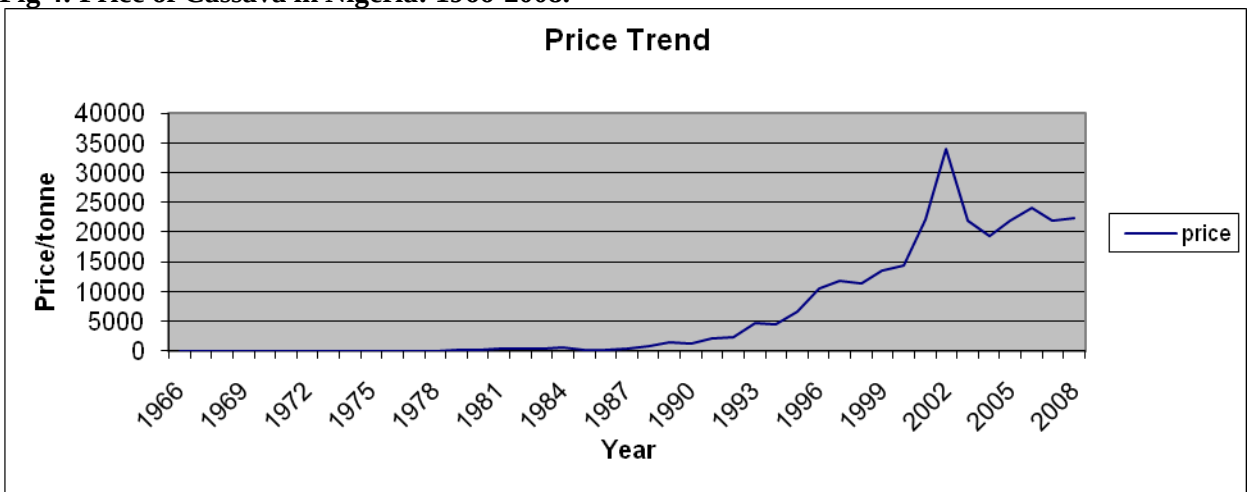


Fig 4: Price of Cassava in Nigeria: 1966-2008.



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Growth Rate of Cassava Price in Nigeria

Diagnostic Evaluation

To obtain reliable estimates for price, the study tested if there is an equilibrium relationship of the variables i.e. whether they exhibit similar statistical properties using the Engle and Granger (1987) co-integration tests by testing the Dickey-Fuller (DF) statistics. In lined with co-integrating methodology (Mickey *et al*, 1999), the data in table 1 shows the ADF test statistics for unit root of the variable. According to the results, the null hypothesis for the existence of unit root cannot be rejected for the years in their level form. In other words, the ADF test statistics together with the details in number of logs indicate non-stationarity property and the possibility of a long-run equilibrium relationship in their difference form.

Table 1: Unit Root Tests for price variable

Variable	ADF	1% critical value	5% critical value	10% critical value
In p_t	-0.694	-3.641	-2.955	-2.611

The implications of non-stationarity or random-walk behavior in the variable highlight the possibility of a stochastic trend feature. These open a vista of policy possibilities, e.g. the long run growth may result from the real supply or technology shocks rather than demand or the monetary (Issler and Valid, 2001). In addition, shocks due to changes in government expenditure can generate random fluctuations (Aiyagiri *et al*, 1992; Baxter and King, 1993).

Error Correction Model and Short-Run Dynamics

Since price variable have a long-run equilibrium relationship, the study formulated an error correction representation (ECM) to capture the short-run dynamics. The residuals from the equilibrium co-integrating regression were used as an error correction regression (lagged one period). The data in table 2 show the unit root test of price variable lagged one because it is a yearly data.

Table 2: Unit Root Test of Price Variable (log1)

Variable	ADF	1% critical value	5% critical value	10% critical value
In p_t	-5.033	-3.648	-2.958	-2.612

After lagging, the test statistic (ADF) was greater than the critical values at 1%, 5% and 10%. This then generated a new set of data that is non-stationary which can then be subjected to trend analysis.

Growth in Price of Cassava in Nigeria: 1966-2008

The result in table 3 shows the estimated log linear function in time variable for cassava price from 1966-2008. The coefficient for the trend variable of cassava price was positive and highly significant at 1% level of probability. This implies that cassava price grew with time.

Table 3: Estimated Function for Cassava Price in Nigeria: 1966-2008

Variable	Estimated coefficients				Growth
	Constant (b_0)	Time (b_1)	R^2	F-value	
Cassava	-0.5067	0.1537	0.9634	1071.90^{xxx}	16.6141^{xxx}
	(-4.27^{xxx})	(32.74^{xxx})			

The R^2 value of 0.9632 indicates 96.32% variability in price explained by time. The F value uses highly significant at 1% level of probability implying a regression of best fit. The result in table 3 also shows the computed growth rates in price of cassava from 1966-2008. The growth rate increased at a compound growth rate of 16.61% per annum confirming significant increase within the years under review.

Confirmation of Acceleration, Deceleration and Stagnation of Cassava Price in Nigeria

In order to confirm the existence of acceleration, deceleration or stagnation of cassava price in Nigeria, the result of the quadratic equation in time varieties is shown in table 4

Table 4: Quadratic Equation Time variable for cassava price: 1966-2008

Variable	Estimated coefficients				
	B_0	t^1	t^2	R^2	F-value
Cassava	2.6956	0.1859	0.00006	0.8634	526.16^{xxx}
	(11.82^{xxx})	(7.78^{xxx})	(0.16)		

The result shows that t^2 was positive but not significant. This implies that cassava price stagnated with time.

CONCLUSION

The study examined the econometric trend analysis of cassava output and price in Nigeria from the output; it was found that there were gradual fluctuations in production from 1987-2009. The study further revealed that area planted with cassava in Nigeria from 1966-2009 increased gradually with minimal fluctuations. This may be due to the fact that farmers are still faced with the problem of pest and diseases, cattle under nomad's control, availability of land, desertification and environmental degradation. Price of cassava accelerated with time under the period of study and also t^2 was positive but not significant, this means that cassava price stagnated with time. These may be due to inadequate pricing for tubers and processing centers among others and bulk of production is consumed in form of human food in different forms. Choosing the estimated log linear function in the variable for cassava price from cassava price was positive and highly significant at 1% level of probability. This implies that R^2 indicating a 96.32% variable in price explained 1% level of probability implying a regression of best fit. The price of cassava growth rate increased at a compound growth rate of 16.61% per annum confirming significant increase with time and stagnated with time under the years reviewed. This may be due to adequate pricing, use of local implements, cost of living labour, non availability of fund to increase production.

Therefore the study recommended the following:

1. There is need for government to put in place a type of stabilization fund through the requisite agencies to ensure that prices of the commodity do not fall below acceptable level. It must be noted that poor pricing regime discourage production and sale of cassava products.

2. There is also the need to encourage private sector investment in the establishment of cassava processing plant to produce such internationally sought product like cassava chips and pellets for animal feed, flour, starch, ethanol, glue etc. The presence of these industries will expand the existing cassava market improve in the price other for cassava roots and hence encourage large scale production.

3. The Nigerian environment is very conducive for cassava cultivation, therefore in order to enhance the production to meet the food and industrial requirement of the roots, there could be increased production through land use intensification, whereby land that was not previously included in the total land area under rotation for cultivation is brought into cassava cultivation. Increase in production could be achieved under the condition of land use intensification.

4. Provision of infrastructure such as rural road maintenance, electricity supply, water, information centers to be internet linked (to monitor the market trend in terms of type of product required, quality and price etc.)

5. Mechanization of production processes through putting in place a rural agricultural mechanization facility to provide such machinery as tractors, bulldozer, harrowing, and ploughing machine etc. to be hired at affordable price rate to the farmers which will reduce the tedium associated with farm work.

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