



Growth Rates and Determinants of Rubber Export in Nigeria

Nse-Nelson, F. A., I.C. Onyebinama and K.C. Obike

*Department of Agricultural Economics, Michael Okpara University of Agriculture Umudike,
P.M.B.7267, Umuahia, Abia State, Nigeria. floxynse@gmail.com. 08035236753*

Abstract

The study analysed growth rates and determinants of rubber export in Nigeria. Time series data used for the study were collected from Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS). The data were analysed using exponential trend model, quadratic trend model, ordinary least square regression model and z-test. Findings from the study showed that time trend variable was a major factor in determining rubber export in the study period. The growth trend of rubber export in Nigeria per annum within the period under study (instantaneous rates of growth) was 4.15% and the rate of growth of rubber export in Nigeria (compound rates of growth) was 4.23%. Results showed that there was stagnation in the growth rates of rubber export. Results further showed that there was a significant difference in the mean output quantity of rubber and exports within the period under review. From the regression model, it was observed that rubber export was positively influenced by output quantity of rubber, world price of rubber and producer price while it was negatively influenced by domestic utilization and nominal exchange rate. The study recommended the need to reassess the rubber export policy in Nigeria and to compliment it with such policies as farm support policies, output price incentives and non-price incentive policies.

Keywords: Growth rates, Determinants, Rubber export, Nigeria

Introduction

Exports play a dynamic role in the growth and development process of a nation's economy (Mesike *et al.*, 2008). In Nigeria, agricultural exports have played a prominent role in economic development by providing the needed foreign exchange, the current account and

fiscal balances of the country depended on agricultural export. However, between 1970 and 1974, agricultural exports as a percentage of total exports declined from about 43 percent to about 7 percent. The major cause of this development was the oil price shocks of 1973 to 1979, which resulted in large receipts of foreign exchange by Nigeria and the

neglect of agriculture (Nkang *et al.*, 2006). By 1986, the situation had become a crisis, dramatizing the ineffectiveness of the prevailing external sector policy of import substitution industrialization (ISI). The failure of this policy regime to cope with the negative oil price shock was the reason for its substitution with an outward looking external policy under Structural Adjustment Program (SAP) introduced in 1986. Under SAP, emphasis was on diversifying Nigeria's export base away from oil and increasing non-oil foreign exchange earnings (Yusuf and Yusuf, 2007). To achieve the objectives of the program, government put in place a number of policy reforms and incentives to encourage the production and export of non-oil tradable as well as broaden Nigeria's export market.

Among the agricultural commodity exports, rubber is one of the most dominant crops in the export basket of Nigeria (Nwachukwu *et al.*, 2014). In Nigeria, rubber is currently grown in Edo, Delta, Ondo, Ogun, Abia, Anambra, Akwa-Ibom, Cross River, Rivers, Ebonyi and Bayelsa States where the amount of rainfall is about 1800 mm to 2000 mm per annum. In terms of price, the FOB (Free on board) prices of rubber range from USD2,5003,000/MT depending on quality and time of year (Umar *et al.*, 2011). It has also been observed that those unfavorable domestic terms of trade for agricultural exports, loss of market power and declining output

are the principal contributors to the dismal performance of traditional exports, and those factors reflect in the interaction of inappropriate domestic pricing policies and external shocks. However, the current programme on natural rubber which is tagged 'Presidential Initiative on Natural Rubber Production and Utilization' which started in 2005 is seen as a good step to regenerate the interest of farmers on natural rubber production in the country when adequate machineries are put in place and maintained. Therefore, this research work intends to find out the impact made so far on Nigerian economy by the value realized from the rubber exports from (1986-2016).

It is hoped that the outcome of this study will form a basis for formulating appropriate sub – sectoral policies and dependable platform for taking informed decisions and act as a reference to further studies. As such, wider interest will be stimulated in this study area and attention drawn to the need for redefining, revitalizing and re-diversifying Nigeria's economic prosperity. On the basis of the foregoing, the study aimed to analyze the trend in growth rate of rubber export from; investigate whether there is stagnation, acceleration or deceleration in rubber export; compare the mean variation in output quantity and export of rubber in Nigeria and estimate the determinants of rubber export in Nigerian economy within the reference period.

Materials and Methods

Study Area

This study was carried out in Nigeria. Nigeria is the most populous African country south of the Sahara (FOS, 1992). It is a geo-political and sovereign entity that is composed of 36 states and the Federal Capital Territory (FCT-Abuja). Nigeria is situated along the coast of West Africa between Latitudes 4° and 14°N and Longitudes 3° and 15°E. It shares a common boundary with Niger on the West, Cameroun Republic on the East, and Gulf of Guinea on the south. Nigeria occupies a land area of 98.3 million hectares, of which only about 34.2 million hectares are

actually being cultivated and less than one percent of the arable land is irrigated (NBS,2008).

Data Collection and Model Specification

The study made use of secondary data, mostly time series. Data for the study were collected from Central Bank of Nigeria annual report and statement of account and National Bureau of Statistics (NBS). The data used for the study covered 1986 to 2016. Objective one which analysed trend in growth rate of rubber export was achieved with trend analysis. The exponential trend was employed in line with Onyenweaku (2004) as;

$$\ln EQ_t = \beta_0 + \beta_1 t + e_t \dots\dots\dots (1)$$

Where,

ln = natural logarithm

EQ_t = Export quantity of rubber (tonnes) in time t.

β₀ = the constant in the regression line.

β₁ = the trend coefficient.

t = trend measured in years.

e_{it} = the error term.

For objective 2, which investigated whether there is stagnation, acceleration or deceleration in the

export of rubber, log quadratic trend equation was used. This was fitted as;

$$\ln EQ_t = \beta_0 + \beta_1 t + \beta_2 t^2 + e_t \dots\dots\dots (2)$$

Where,

β_2 = estimated parameter while all other terms are as defined in equation 1.

A positive significant value of β_2 indicates acceleration while a negative significant value of β_2 entails a deceleration. Stagnation in the growth process is explained by a non- significant value of β_2 . In line with (Onyenweaku and Okoye, 2005), the compound growth rate equation was given as;

$$(3) \quad r = (e^{\beta_1} - 1) \times 100 \dots\dots\dots$$

Where,

e = Euler’s exponential constant (2.71828).

β_1 = estimated coefficient in equation 1.

The time it will take to double the rate of growth in rubber export was estimated in line with Onu (2018) as:

$$DR_t = 69/r \dots\dots\dots (4)$$

Where

DR_t = doubling time

r = compound rate of growth computed in equation 3.

To achieve objective 3 which compared output quantity and export of rubber, tables, means and percentages were employed. Thereafter, a paired sample z-test was employed to test for differences between the mean output quantity and mean export quantity within the period under study. The z- statistic is given as;

$$Z_{cal} = \frac{\underline{X}_i - \underline{X}_j}{\sqrt{\frac{S^2 \underline{X}_i}{n_i} + \frac{S^2 \underline{X}_j}{n_j}}} \dots\dots\dots (5)$$

Where,

\underline{X}_i = Mean output quantity of rubber in time t.;

\underline{X}_j = Mean export quantity of rubber in time t.;

$S^2 \underline{X}_i$ = Variance for output quantity of rubber in time t.;

$S^2\underline{X}_j$ = Variance for export quantity of rubber in time t.;

n_i = Number (years) for rubber output quantity;

n_j = Number (years) of rubber export quantity.

To realize objective 4, which looked at the determinants of rubber export, regression model was estimated as shown in equation 6. The model was specified in its implicit form as;

$$REXP_t = f(ORUB_t, DRUB_t, NER_t, PII_t, WRUB_t, PRUB_t, OPN_t)..... (6).$$

Where,

REXP_t = Rubber export (000'tonnes) in time t,

ORUB_t = Output quantity of rubber (000'tonnes) in time t,

DRUB_t = Domestic utilization of rubber (000'tonnes) in time t,

NER_t = Nominal exchange rate (N/\$) in time t,

PII_t = Political instability index in time t,

WRUB_t = World price of rubber (N/tonne) in time t,

PRUB_t = Producer price of rubber (N/tonne) in time t

OPN_t = Degree of openness of the economy to other economies

On *a priori* ground, it was expected that the coefficient estimates for ORUB_t,

NPS_t, WPRUB_t, PPRUB_t, OPN_t > 0 and DRUB_t, NER_t, < 0.

The estimate of rubber export function and its effect on the economy were based on the assumption that the underlying data process is stationary. This assumption was verified by conducting a unit root test on the time series variables. The use of OLS with non-stationary variables may result in spurious regressions,

thus, the need for the unit root test. Augmented Dickey-Fuller (ADF) test was adopted for this study. The use ADF test is formed by its popularity, recommendation and use by various authors. The choice of the lead equation was based on the magnitude of the coefficients, conformity of the variables with *a priori* expectation, explanatory

power of the model (R^2), significance of the regression parameters and the F - statistic.

Results and Discussion

Trend in growth rate of the export quantity of rubber

The result of the trend in growth rate for the export quantity of rubber in the period under review is presented in Table 1.

Table 1. Estimated trend equations for rubber export (1986-2016)

Parameters	Coefficient	Std. Error	t-Statistic	Prob.
Constant (B_0)	10.39714	0.218293	47.62923***	0.0000
Time (B_1)	0.041457	0.012927	3.207095***	0.0033
R^2	0.268652			
\hat{R}^2	0.242532			
F-Ratio	10.28546***			

*** = significant at 1%

Source: Author’s computation.

The trend results in Table 1 showed that the estimated coefficient of the time variable was positive and statistically significant at 1% with respect to rubber export. This implies that time trend variable was a major factor in determining quantity of rubber export and thus, quantity of rubber increased in this period. Hence, implementation of liberalization policies like the

abolishment of the commodity boards and devaluation of naira may have favoured rubber exports despite the increase in domestic utilization of this cash crop. Table 1 showed further that the coefficient of multiple determination is low ($R^2=0.268652$). This implies that growth in rubber export is highly time dependent.

Table 2: Instantaneous and compound growth rate for rubber export (1986 – 2016)

Variables	Parameter (β_1)	Exponential Instantaneous Growth rates (%)	Exponential compound Growth rates (%)
Rubber export quantity	0.041457***	4.15	4.23

*** = significant at 1%

Source: Author’s computation.

The growth rates of 4.15% for rubber export implies that over the period of 1986 – 2016, the exportation of rubber in Nigeria increased at instantaneous (at a point in time) rate of growth. Compound growth rate (over period of time) was estimated from the instantaneous rates of growth. Therefore, the growth trend of rubber export in Nigeria per annum within the period under study (instantaneous rates of growth) was 4.15% and the rate of growth of rubber export in Nigeria over the study period under study (compound rates of growth) was 4.23%. This implies that the growth rate of rubber export in Nigeria is very low. This finding is in line with Mesike *et al.*, (2008), who averred that export of cash crops like palm oil, groundnut, rubber and etcetera has suffered a reduction in recent years due to numerous identifiable factors. FAO (2009) identified some of these factors as inconsistent production

pattern, increase in domestic utilization of these crops, low yield due to the use of unimproved seedlings and poor pricing system for the commodities in world market due to the low quantity of these products comparable to that of other major exporting countries like China, Indonesia, and Argentina. The low instantaneous and compound growth rates of rubber export imply that there would be continuous poor foreign earning from rubber and this is detrimental to the Nigerian economy. As noted by Nwachukwu *et al.*, (2014), the poor revenue from rubber exportation represents a significant amount of lost earnings for the country in terms of jobs and income.

The calculated period of time required for the exponential growth rates in quantity exported of rubber to double in size is presented in Table 3.

Table 3: Doubling time for the compound growth rate in years of quantity of rubber export

Variables	Doubling time (years) for Instantaneous growth rate in rubber export	Doubling time (years) for compound growth rate in rubber export
Quantity exported of rubber	16.6	16.3

Source: Author’s computation.

The result shows that it takes 16.6 years to double the rate of growth in rubber export. This suggests that research must be intensified in order

to improve rubber exportation, improving on rubber production technologies significantly in a way that the rate of growth will achieve

the needed self- sufficiency in domestic rubber production for exportation and thereby increase the quantity of rubber exported from this country so as to enhance the performance of Nigeria economy.

Investigating acceleration, deceleration or stagnation in rubber export

The result of the quadratic equation in time variables fitted for rubber export is shown in Table 4.

Table 4: Estimated quadratic equations in time variables for quantity of exported rubber

Parameters	Coefficient	Std. Error	t-Statistic	Prob.
Constant (B ₀)	10.564	0.317	33.315	0.000
Time (B ₁)	0.005	0.050	0.111	0.912
Squared Time (B ₂)	0.001	0.001	0.732	0.470
R ²	0.282			
\hat{R}^2	0.229			
F-Ratio	5.325 **			

***, and ** = significant at 1% and 5% respectively.

Source: Author’s computation.

The non-significant positive value of the coefficient of time variable for rubber export showed stagnation in the growth rate of this variable, thus, indicating that rubber export in Nigeria exhibited sameness in growth within the period under review, This tends to confirm the earlier finding of this study that rubber exportation need to be stepped up through the implementation of output scheme policies that will help boast the

growth of domestic rubber production to enhance the quantity of rubber for export.

Comparison of the mean output quantity of rubber and rubber export in Nigeria.

The z-test result of the difference in the mean output quantity of rubber and rubber export is presented in Table 5.

Table 5: Test of significant of the difference in the mean quantity of rubber production and export

Samples	Mean	Standard Deviation	Std. Error Mean	Df	z-statistic
Output quantity of rubber	125733.8	25678.9	4688.3		
Rubber export	50158.6	23780.1	4341.6		
Paired difference	75575.3	34600.4	6317.1	30	11.964***

*** represent 1% significance level. Source: Author’s computation.

The mean output quantity of rubber and rubber export vary within the period under study. The mean quantity of rubber was 125733.8 metric tonnes and rubber export was 50158.6 metric tonnes. There was a significant difference ($t = 11.964^{***}$) in the two means. This indicates that the mean quantity of rubber was more than the quantity

exported of rubber within the study period.

Determinants of rubber export in Nigeria

The multiple regression result of the determinants of rubber export in Nigeria within the reference period is presented in Table 6.

Table 6: Regression result for the determinants of rubber export in Nigeria (1986 -2016)

Variables	Linear	Exponential	Double-log	Semi-log ++
Output quantity	1.000 (2.32E+14)***	1.81E-05 (7.977)***	1.071 (3.317)***	68091.43 (6.336)***
Domestic utiliza- -tion	-1.000 (-2.92E+14)***	-1.82E-05 (-10.089)***	-0.674 (-4.667)***	-42198.41 (-8.778)***
Nominal Exchange Rate	5.75E-12 (1.343)	-0.002 (-1.001)	0.547 (2.324)**	26091.33 (3.330)***
Political Instability Index	2.05E-11 (1.075)	-0.006 (-0.559)	0.698 (0.567)	35383.74 (0.864)
World Price	9.01E-16 (0.024)	5.91E-06 (0.293)	0.137 (1.151)	7996.503 (2.021)*
Producer Price _t	5.77E-15 (1.012)	2.92E-06 (0.971)	0.228 (1.894)*	8184.085 (2.040)*
Degree of Openness	4.38E-10 (0.680)	-0.194 (-0.571)	-0.036 (-0.599)	-826.055 (-0.418)
Constant	-2.57E-11 (-0.397)	0.0378 (1.107)	0.005 (0.106)	-336.151 (-0.210)
R ²	1.000	0.876	0.644	0.856
\hat{R}^2	1.000	0.830	0.513	0.802
F-statistics	1.66E+28***	19.130***	4.910***	16.080***
DW-statistic	2.504637	2.469	2.041	1.966

***, ** and * represent 1%, 5% and 10% significance levels respectively. Figures in brackets are t- values and ++ means lead equation.

Source: Author's computation.

Based on the magnitude of the coefficient of multiple determinations (R^2), the signs of the regression coefficients as they conform to *a priori* expectations and number of significant variables, the semi-log model was chosen as the lead model. The model showed that the explanatory variables included in the model explained about 85.6% of the observed variations in the quantity of rubber export in Nigeria within the period under study. The Durbin Watson statistic was used to test for the existence of serial autocorrelation and it showed that there was no positive first order serial autocorrelation at 1% that is, $DW (1.966) > Du (1.85)$. The F-statistics was significant and confirms the goodness of fit of the model.

Output quantity, domestic utilization, nominal exchange rate, world price and producer price of rubber were significant determinants of export quantity of rubber within the period under study. Output quantity, world price and producer price were positively related to rubber export while domestic utilization and nominal exchange rate were inversely related to rubber export. The positive relationship between the output quantity and rubber export suggests that rubber export increases as output quantity of rubber increases. This conforms to *a priori* expectation. The rubber export would naturally increase as domestic production of rubber

increased especially when the domestic output of rubber is in surplus to domestic utilization of rubber. This will lead to a marked increase in quantity of rubber exports. In other words, an increase in output quantity of rubber brings about increase in rubber export and vice versa. This corroborates with Onu, 2018 who stipulated that increase in output quantity of rice increases the export of rice.

Domestic utilization of rubber was negatively related to rubber export and this indicates that rubber export decreases as domestic utilization of rubber increases and vice versa. An Increase in domestic utilization of the rubber could mean that the domestic market for rubber is large. A large domestic market for rubber implies that rubber producers will sell more rubber to local consumers. The appropriate sign on rubber production is positive; it implies that an increase in production of rubber will stimulate an increase in rubber export. There was an inverse relationship between nominal exchange rate and rubber export. This suggests that rubber export decreases as nominal exchange rate increased. This finding conforms to that of Onyebinama *et al.*, (2005) and Grafoute and Yao Shen (2013), who recorded that nominal exchange rate negatively affect exports supply of major export crops.

There was a direct relationship between rubber export and world

price of rubber. an indication that rubber export increases as world price of rubber increased. An increase in the world price of rubber means that rubber exporters will earn higher revenue from their export activities. Therefore, in order for the exporters to take advantage of the increase in world price for rubber, they will increase the relative price of rubber to induce rubber farmers to produce and sale more quantities of rubber. As a result, quantity of rubber export will increase with increase in world price for the commodity. This finding

conforms to that of Gbetnkoum and Khan (2002) who observed that world price positively affects export supply of all the crops investigated. The coefficient of producer price of rubber was significant and has a positive sign. This indicates that rubber export increases as producer price of rubber increases. Positive relationship between producer price and rubber export conforms to *a priori* expectation. This finding is in agreement with Omonona *et al.*, (2007), who opined that an increase in producer price of cash crops will lead to increase in their exports.

CONCLUSION

Given that the export quantity of rubber significantly stagnated in growth in the period under study, the study advocate that there is need to reassess the policy and to compliment it with such policies as farm support policies, output price incentives and non-price incentive policies. Emphasis of these policies should be on the attainment of the objective of accelerating the growth rate in rubber output and hence export quantity. Research must be intensified in order to improve rubber production significantly in a way that the rate of growth will

achieve the needed self- sufficiency in domestic rubber production and thereby increase rubber exports in the country. Policies aimed at enhancing rubber exports in Nigeria should consider those significant factors that determined rubber exports in Nigeria. This condition offers opportunity for youths empowered in rubber production to increase rubber export. This will not only offer sustainable means of livelihood for the teaming youth population but will help to achieve self-sufficiency in rubber production in Nigeria which will boost the economy at large.

References

- Central Bank of Nigeria CBN (2016): Annual Report and Statement of Account.
- Food and Agriculture Organization (FAO) (2009). Food and Agriculture Organization (FAO) Statistical Database (1986 – 2016).

- Gbetnkom, D. and Khan, S.A (2002). Determinant of agricultural exports: The case of Cameroun. African Economic Research Consortium. AERC Research paper. Nairobi, Kenya. No. 120. Pp 1 - 46.
- Grafoute, A. and Yao Shen (2013). The Determinants of Agricultural Export: Cocoa and Rubber in Cote d'Ivoire. International Journal of Economics and Finance. 5 (1):228-233.
- Mesike, C.S., Giroh, D.Y. and Owie, O.E.D. (2008). Analyzing the Effect of Trade Liberalization Policy on Nigerian Rubber Industry. Journal of Agriculture & Social Sciences. 4(2):132-134.
- Nkang, N.M.; Abang, S.O., Akpan, O.E. and Ofem, K.J. (2006). Co-integration and Error-Correction Modelling of Agricultural Export Trade in Nigeria; The Case of Cocoa. Journal of Agriculture and Social Sciences. 2(4):249 – 255.
- Nwachukwu, I. N., Onyenweaku, C. E., Nwaru, J. C., Mbanasor, J. A. and Daramola, A. (2014). Competitiveness in the export demand for Nigerian rubber. Journal of Agricultural Sciences. (1):1-11.
- Omonona, B. T, Oni, O. A. and Akpan, E. (2007). The determinants of demand for Nigeria's Agricultural Export Commodities. Medwell Journal of Social Science. 4(2): 247 – 251.
- Onu, D.O. (2018). Empirical analysis of rice production, import and consumption in Nigeria (1970 – 2016): Comparative assessment of three economic reform periods. Unpublished M.sc thesis in the Department of Agricultural Economics, Michael Okpara University of Agriculture Umudike, Abia State, Nigeria.
- Onyebinama, U.A.U., Chidebelu, S.A.N.D. and Nwagbo, E.C. (2005). Effects of Devaluation on Food Imports in Nigeria. Proceedings of the 19th Annual Conference of the Farm Management Association of Nigeria (FAMAN) 63 - 67.
- Onyebinama, U.A.U., Chidebelu S.A.N.D. and Nwagbo, E.C. (2007). Effect of Exchange Rate Adjustment on the Output of Nigerian Agriculture. Nigeria Agricultural Journal (38):82-91.
- Onyenweaku, C.E., (2004). Stagnation, Acceleration and Deceleration in Agricultural Production in Nigeria, 1970-2000. Journal of Agriculture and Food Science 2(2): 131-140.
- Onyenweaku, C. E. and Okoye, B. C. (2005). Trends in cassava output, area and productivity in Nigeria, 1960/61 – 2003/04. Proceedings of the 39th Conference of the Agricultural Society of Nigeria, Benin. Pp 19 – 21.
- Umar, H.Y., Giroh, D.Y., Agbonkpolor, N.B., and Mesike, C.S. (2011). An Overview of World Natural Rubber Production and Consumption: An Implication for Economic Empowerment and Poverty Alleviation in Nigeria. Journal of Human Ecology. 33(1): 53-59.
- Yusuf, S.A. and Yusuf, W.A. (2007). Determinants of Selected Agricultural Export Crops in Nigeria: An Ecm Approach. African Association of Agricultural Economics Conference 469-472.