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Supply Response of Selected Agricultural Export Commodities in Nigeria

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ABSTRACT
This study investigates the supply response of seven (7) agricultural export commodities from Nigeria between 1970 and 2010. An econometric Error Correction Model (ECM) was employed to estimate export supply behaviors of the seven commodities chosen: cocoa, benniseed, rubber, palm-oil, ground nut, cotton seed, and soybeans. Results indicate that: the response of export supply to changes in relative price was positive and fairly significance for five (5) commodities except cocoa and soybeans, output growth and more credits to agricultural sector have positive and significance influence on the export supply of the commodities, change in road network positively and significantly affects export supply of three commodities. Exchange rate was significance for four commodities and was unexpectedly positive in most cases, rainfall was positive and significance to only perennial crops (cocoa, rubber and palm-oil), short-run export supplies responses range between 0.01 and 0.77 and were generally smaller than the long-run responses (0.22 to 28.09), Short-run price and non-price elasticities were less than unity (0.01 to 0.77 inelastic), Individual commodities shows different patterns of responses to price and non-price variables. These results point to three conclusions: First, the significance sensitivity of the commodities under consideration to output growth, credits to agricultural sector and improved road network suggest that price incentives alone are not sufficient to generate the desired export, attempt to increase the export supply of these commodities should focus more on the productivity of these commodities. Second, exchange rate appreciation may not hurt exports of these commodities much, if at all. Third, policies to stimulate commodity production and exports should attach significance consideration to the agro-climatic conditions as well as cropping patterns of the commodities.
Key word: Supply, Response, ECM, Agricultural export, Nigeria

1.0 Introduction

Prior to the 1970s, agricultural exports were Nigeria's main sources of foreign exchange earnings. During this period, Nigeria was a major exporter of cocoa, cotton, palm oil, groundnuts and rubber. Government revenues also depended heavily on taxes on non-oil exports. Thus, during the period; the current account and fiscal balances depended on agricultural export.

However, between 1970 and 1974, agricultural exports as a percentage of total exports declined from about 43 percent to slightly over 7 percent. From mid 1970s to date, the share of agricultural export as a percentage of total export is below 5 percent for most years since the introduction of Structural Adjustment Programme (Ebi, 2013). The major cause of this development was the oil price shocks of 1973 – 1974 and 1979, which resulted in large receipts of foreign exchange by Nigeria and the neglect of agriculture. The oil boom afflicted the Nigerian economy with the so-called "Dutch disease" effects (Ayodele, 1997; and Osuntogun, Edordu, and Orumah, 1997).

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 Programme (SAP) introduced in 1986. Under SAP, emphasis was on diversifying Nigeria's export base away from oil and increasing non oil foreign exchange earnings. To achieve the objectives of the programme, government put in place a number of policy reforms and incentives to encourage the production and export of non-oil tradables as well as broaden Nigeria's export market.
Given that the overall success of exports promotion strategy will depend among other things on what factors constrain export growth and on the responsiveness of producers to change in price and non-price variables, a better understanding of key variables affecting export commodities performance and the direction and magnitude of relevant elasticity is desirable (Love, 1982; Ghura and Grenness, 1994; and Lukonga, 1994).

This is particularly important considering the exhaustible nature of oil and the fact that over dependence on crude oil is associated with shocks and transmitted recessions. Where export supply responds negatively to prices, price changes cannot bring about an increase in export volume. With conducive policies, non-oil export production will increase and export earnings will be boosted. The study deals with seven commodities (cocoa, Benniseed, cotton, oil palm, rubber, soybeans and groundnut). The choice of these commodities is based on the ranking/contributions of the commodities to` total agricultural exports (FAO Trade Statistics, 2008).

In summary, the key problem is how to greatly and urgently increase the rate of growth of agricultural exports in general and that of selected commodities in particular.

The understanding of the responsiveness of these agricultural export commodities to change in price and non-price factors is indispensable in formulating a sound export policy package.

2.0 Review of Related Literature

Empirical works on the supply responses of agricultural export commodities have taken different approaches. There are studies that have used various models to explain the causality or the dynamic adjustment between the behavior of some exogenous and endogenous variables, and the agricultural export growth in an economy or in a group of countries. The literature is divided into two categories. The first comprises studies that have modeled export supply of agricultural commodities in Nigeria, and the second deals with works done outside Nigeria.

In Nigeria, we review five empirical studies on non-oil export commodities behavior: Oni (1969), Lunkonga (1994), Kwanashie, Gurba and Ajilima (1998), Antai (2006); and Mesike, Okoh and Inoni(2010).

Oni (1969) focused on the short run and long run supply response of palm produce to changes in output and input prices in Nigeria between 1949 – 1966 using the classical and Nerlovian model. The result shows that the average estimated values over the period of the study are 0.23 and 0.28 respectively for short-run and long-run price elasticities. Oni's work did not include non-price variable such as credit, transport and communication etc. Agricultural export response to policy

manifests itself through channels other than price (Kwanashie, Gurba and Ajilima, 1998; Gbertnkom and Khan, 2002; and Nichodemus, Bategeka and Banga, 2003). Moreover, Oni's work was undertaken long time ago when price and marketing process of these agriculture produce were highly controlled.

Lunkonga (1994) examined the factors underlying the past performance of Nigeria's non-oil exports. Ordinary least squares (OLS) estimation procedures were used to obtain estimates for three commodities. Cocoa, palm kernel and rubber between 1970 and 1990. Cocoa yielded statistically significant prices elasticities with expected sign, indicating that the commodity responds positively to changes in relative prices. Overally, the results provided evidence and lend support to the usefulness of pricing policy in eliciting export supply, denoted a weak relationship between agricultural output and export trends, supported the view that domestic market conditions strongly influenced export behavior and denoted poor performance with regard to lagged exports. This finding is supported by Munlak and Larson (1992), contrasts remarkably with the results of many other recent works on agricultural exports. Islam and Subramanian (1989) emphasized the relatively insignificant role of price compare with non-price factors in explaining export supply.

Kwanashie, Gurba and Ajilima (1998) estimated price and non-price supply response coefficients for nine individual crops, sub-sectoral aggregates and commodity exports using the Two-Stage Least Squares (TSLS) and Seemingly Unrelated Regression Method (SURM) as tools for evaluating the effects of sub-sectoral aggregates on Nigerian agriculture between 1970 and 1989. The estimates confirm two results in the supply response literature: Firstly, Short-run price elasticities of individual crops are smaller than the long-run elasticities and secondly, commodity sub-aggregates do not respond significantly to prices as individual crops. The results also show that the responses of food crops are sensitive to Nigeria's agro-climate and traditional cropping patterns of Nigerian farmers. Moreover, individual crops and sub-sectoral aggregates do not respond significantly to capital expenditures on agriculture.

Kwanashie work though published in 1998, it was for the period 1970 to 1989, about twenty years ago. Economic events have a way of changing economic models. Hence, it is pertinent to update a study of this kind in the face of changing economic phenomena.

Antai (2006) sought to ascertain the factors that influence the present non-oil export growth in Nigeria between 1970 and 2004. A Granger causality test was used to determine the direction of causation between non-oil exports and growth in Gross Domestic Product (GDP), while Ordinary Least Square (OLS) estimation technique was used in showing the effect of price and non-price variables on non-oil export aggregate and sectorally. The results show that there was

no bi-directional causality existing between exports and economic growth, non-price variables such as; foreign income, exchange rate, expenditure on agriculture and weather were the major determinants of export growth of the agricultural commodities considered.
Again, Mesike, Okoh and Inoni (2010) analyzed the supply response of rubber farmers to price and other factors in Nigeria using co-integration and vector error correction techniques. The analysis was carried out on secondary time series data collected from 1970 – 2008. The data where however tested for their time series characteristics using ADF tests. Preliminary analysis suggested that estimations based on their levels might be spurious as the results indicated that all variables in model were not stationary at their levels. Further results indicated that producers price and structural break significantly affected the supply of rubber. Response of rubber farmers to price were low with estimated elasticity of 0.373 in the short-run and 0.24 in the long-run due to emergence of other supply determinants indicating significant production adjustment.

At international level, many studies have investigated the performance of the export crops in Cameroon, Uganda, Ghana and Cote'd Ivoire, quantitative measurements have been undertaken on agricultural export performance (Tshibaka, 1998; Gbertnkom and Khan, 2002; Nicodemus, Bategeka and Banga, 2003, Fosu, 1992; and Trivedi and Akiyama, 1992). In most of these works the model proposed allows for the estimation of long-run responses function for exports based on linear regression form.

Tshibaka (1998) addresses the effects of external shocks and domestic sector and macroeconomic policies on the structure of price incentives of major agricultural export commodities and their repercussions on output and producers income. It concludes that during the period 1971-1993, Cameroon's export commodities faced a very unfavourable world market environment as their real world terms of trade declined at an average rate of 3.1% per year. The analysis has also shown that external factors have been the leading cause of the observed fall in the overall level of export earnings and real producer income in Cameroon.

Gbertnkom and Khan (2002), investigated the determinants of three agricultural exports from Cameroon between 1971/72 and 1995/1996. Export supply functions were specified and estimated for three export crops chosen: cocoa, coffee and banana. Quantitative estimates obtained from the (OLS) estimation procedure shows that: the responses of export supply of all the crops to relative price changes were positive, but fairly significant. Changes in the nature of the road network and more credit to crop exporters had positive and significant influence on the growth of the three crops. Equally, rainfall's influences on the growth of the three commodities was positive, but significant only for cocoa and coffee and that structural adjustment dummies shown a positive effect on the export supply of crops for policies implemented. These results led to the same conclusion and confirmation of Kwanashie, Gurba and Ajilima (1998) results in Nigeria.
In Uganda, Nichodemus, Bategeka and Banga (2003) studied the supply response of selected export commodities (maize, beans, cotton, tobacco, coffee and tea). They estimated supply elasticities of the commodities based on the supply function originating from Nerlove's model. The results revealed that lagged own price was positive and significant for maize, beans, coffee and tea and was negative and insignificant for cotton and tobacco. Exchange rate was positive and significant for all the commodities except coffee and tea which was positive and insignificant.

In Ghana, Fosu (1992) estimated the aggregate and individual agricultural export supply. He noted that real exchange rate (RER) of a domestic currency did not influence the economy's agricultural exports directly; instead, it influences agricultural exports through its effects on the incentive structure. In total, four agricultural export functions were estimated using the ordinary least square (OLS) method. First was an aggregate real agricultural export function followed by cocoa, coffee and sheanut export equations. At the five percent level, lagged export variable turnout to be the only significant variable in the aggregate model. The cocoa base capacity, cocoa to food price ratio and the trend term where statistically significant. The coffee to food price ratio and the foreign income were also significant. With respect to exchange rate, the inelasticity of agricultural export response to changes in this variable implies that large changes may be needed to stimulate increases in agricultural exports. In Cote d' Ivoire, Trivedi and Akiyama's (1992) findings in evaluating pricing policies for perennial crops vary across commodities. While coffee was highly sensitive to price factors, cocoa was less price sensitive.

Many studies found the income elasticity of demand to be low for agricultural exports. Islam and Subramanian (1989) stressed that for tropical traditional commodities, the income and price elasticities of demand are low and almost certainly less than unity: Ghura and Grennes (1994) however, found that primary exports are responsive to world real income. According to these authors, the impact of one percent increase in real world income

growth is to increase primary export demand by 1.6 percent, implying that a world recession has the potential to disrupt export growth, thus, lowering economic growth in sub-Saharan Africa. This view is supported by other works (Love, 1982; and Balasa, 1990).

It is pertinent to note the followings gaps in the reviewed literatures which this paper hope to fill.

i) All the reviewed empirical works done in Nigeria captured price variable in terms of export prices. In contrast, our work intends to employ the ratio of export prices to domestic prices of the selected commodities. This we hope would measure the behaviour of the exporter than mere export prices.
ii) None of the reviewed works in Nigeria captured the impact of transport and communication on the export supply of the selected commodities. Studies outside Nigeria identified that the farer exporters are located from an export hub (such as port), the less their exports (Venables, 2005; Mathee and Naude, 2007, etc).
iii) The reviewed literature in Nigeria relates acreage planted to supply. The appropriate measure would be volume of output produce since the level of output can easily change without changes in acreage (Nichodemus, Bategeka and Banga 2003).
iv) Methodologically, apart from Mesike, Okoh and Inoni (2010) who analyzed the supply response of rubber farmers to price and other factors in Nigerian using co-integration and Vector Error Correction techniques. In contrast, we intend to examine supply responses of export supply of cocoa, benniseed, rubber, cotton, palm produce, groundnut and soybean using co-integration and error correction techniques.
v) Above all, economic events have a way of changing economic models. Hence it is pertinent to continue to update a study of sensitivity of Nigerian agricultural export in the face of changing economic phenomena.

3.0 Data and research methodology

3.1 Data and Measurement

The research sought to explain how the export supplies of the selected commodities (cocoa, benniseed, cotton, rubber, oil palm, ground nut and soybean) response to prices and non-price factors. To achieve this aim, the Augmented Dickey –Fuller (ADF), Phillips-Perron (PP) tests, Error Correction Model (ECM) and Chow Break-point test are employed in analyzing the data collected.

The data employed in this study were obtained from secondary sources including the local and international agencies. The local agencies included Central Bank of Nigeria (CBN) Statistical Bulletin (CBN, 2008, 2009), National Bureau of Statistics (NBS various issues) and Federal Ministry of Agriculture production year book. The Food and Agricultural Organization (FAO – various issues) and the International Financial Statistics (IFS) served as the main international agencies. The empirical analysis covers the period 1970 to 2010 (40 observations).

Time series employed in the estimation of the models s include data on: Export Supply (Xs) measured in tons of the selected commodities, ratio of export prices to the domestic prices (RPs) of the selected commodities, world GDP growth rate or income growth rate (W) in US Dollar, the real effective exchange rate (ER), credit to agricultural sector (CRA) in Naira, crop output (Qs), amount of rainfall (RN), and government expenditure on transport and communication (EXTC).

3.2 Model Specification

Our model is built around the modern theory of external trade relating to international differences in price structures. The modification of the original specification is followed by the inclusion of non-price factors mentioned in previous studies as Lunkonga (1994) and Gbertnkom and Khan (2002).

Accordingly, we specify seven (7) long run models for this study. The seven (7) models capture the relationship between export supply of each of the select seven (7) agricultural export commodities and their prices and non-price factors between 1970 and 2010. A short-run analysis and a stability test will be carried out for each of the models between 1970 to 1986 and between 1987 and 2010. The long-run export supply models for the various crops are modeled thus:

3.2.1 The Cocoa model

The conventional way of specifying the export supply function based on Heckcher-Ohlin framework is in the form of a multiplicative or constant elasticity function of relative prices measured in a common currency and output, as follows (Gbertkom and Khan, 2002).

$XCC_t = A(RPC)^n (QCC)_t^{\varepsilon}$ ..... (1)

Where;

A = Constant (Autonomous export)

XCC_t = Export supply of cocoa in time t

RPC = $\frac{P_{fct}}{P_{dct}}$

P_{fct} = foreign price of cocoa in time t

P_{dct} = domestic price of cocoa in time t

QCC = Output of cocoa in time t

n = Price elasticity of supply for exports

ε = Output elasticity of supply of export commodity

Ratio of Export Price to Domestic Price (RPC) measures the behavior of exporters. It is expressed as a ratio of the export price and what is paid to farmers (the producer price). The price paid to producers represents a cost to exporters. If this cost increases in relation to the export price, it becomes less profitable to export, if it is the export price that increases more than the producer price, more will be put on the market. We expect a positive coefficient (Gbertnkom and Khan 2002). Exchange Rate (ER) measures international competitiveness of the products. There is a wider consensus that there exists a positive relationship between World GDP growth (W) and export growth since export of a country is an import of the rest of the world (Odusola and Akinlo 1995). Therefore world GDP growth rate is adopted in this study.

Agricultural input such as credit to agricultural sector (CRA) is understood to be an important variable explaining crop export supply (Gbetnkom and Khan, 2002). Studies also identified that, the farer exporters are located from an export hub (such as a port), the less their exports. Distance (domestic transport costs) matters (Venables, 2005; Hausman and Klinger, 2006; and Mathee and Naude, 2007). Thus, we captured transport costs via government expenditure on transport (EXTC) the more government spend on transportation, the cheaper the cost of transportation.

Agriculture in Nigeria is essentially rain fed (RN). The selected commodities export supply is expected to be positively influenced by rainfall. Although most of the literature relates the acreage planted to supply response particularly due to data problems, it is recognized that the

appropriate process would be to measure output in terms of crop weight or volume produce (QCC_t) rather than as a acreage under cultivation. This is because: (i) Farmers interests are not to adjust cultivated area to price fluctuations but to adjust the desired output level. (ii) level of agricultural output can easily change without changes in acreage (Nichodemus, Bategeka and Banga, 2003).

Equation 3.1 may thus be expanded to include real exchange rate, foreign income (Gross Domestic Product of the World), credit to agricultural sector, rainfall and expenditure on transport and communication. Accordingly, we specify that;

$XCC_t = f(RPC_t, ER_t, W_t, CRA_t, QCC_t, RN_t, EXTC_t)$.....(2a)

Where: f= functional form

XCC_t = export supply of cocoa in time t

RPC_t = ratio of export price to domestic price

ER_t = Real exchange rate

W_t = world GDP growth rate in time t

CRA_t = credit to agricultural sector

QCC_t = output of cocoa per hectre

RN_t, = lagged rainfall

$EXTC_t$ = Lagged government expenditure on transport and

Communication
Expressing equation 3.2a in log linear form, we have:

$LXCC_t = a_0 + a_1LRP_t + + a_2LER_t + a_3LW_t + a_4LCRA_t + a_5LQCC_t + a_6LRN_t + a_7LEXTC_t + U$…… (2b)

Where:

L = log form
t = lagged variable
a_0 = autonomous export of cocoa
$a_1, a_2 \ldots a_7$ = coefficients of economic relationships

Other variables apply as defined earlier
The apriori expectations are that
a_0, a_1, a_3, a_4…….. $a_7 > 0$; and $a_2 < 0$

From the foregoing discussion and as earlier mentioned, we employed the same approach and specify seven (7) long run supply equations for the individual commodities as follows;

$LXCC_t = a_0 + a_1LRPC_t + a_2LER_t + a_3LW_t + a_4LCRA_t + a_5LQCC_t + a_6LRN_t + a_7LEXTC_t + U$..…… (2b) for cocoa

$LXB_t = b_0 + b_1LRPB_t + b_2LER_t + b_3LW_t + b_4LCRA_t + b_5LQB_t + b_6LRN_t + b_7LEXTC + U$……..……(3b) for Benniseed

$LXR_t = c_0 + c_1LRPR_t + c_2LER_t + c_3LW_t + c_4LCRA_t + c_5LQR_t + c_6LRN_t + c_7LEXCT_t + U$…… (4b) for Rubber

$LXP_t = d_0 + d_1LRPP_t + d_2LER_t + d_3LW_t + d_4LCRA_t + d_5LQP_t + d_6LRN_t + d_7LEXTC_t + U$……..…….... (5b) for Oilpalm

$LXGN_t = e_0 + e_1LRPG_t + e_2LER_t + e_3LW_t + e_4LCRA_t + e_5LQGN_t + e_6LRN_t + e_7LEXTC_t + U$……(6b) for Ground nut

$LXCT_t = f_0 + f_1LRPT_t + f2LERt + f_3LW_t + f_4LCRA_t + f_5LQCT_t + f_6LRN_t + f_7LEXTC_t + U$…… …(7b) for Cotton seed

$LXSOY_t = g_0 + g_1LRPS_t + g2LERt + g_3LW_t + g_4LCRA_t + g_5LQSOY_t + g_6LRN_t + g_7LEXTC_t + U$……..…..(8b) Soybeans

4.0: DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

4.1Unit Root Test Results

Table1 reports the results of the augmented Dickey-Fuller (ADF) tests for order of integration of our variables.

Table 1: ADF Unit root test results

Variables	Level	First difference	Order of integration
XCC	-2.3745	-6.4285*	1(1)
XB	0.4982	-5.8442*	1(1)
XR	-1.3323	-3.9742*	1(1)
XP	-5.0129*	-	1(0)
XGN	-7.0905*	-	1(0)
XCT	-9.4127*	-	1(0)
XSOY	-0.4934	-5.1045*	1(1)
RPC	-2.1188	-5.5663*	1(1)
QCC	-2.0910	-5.0197*	1(1)
RPB	-2.8026***	-	1(0)
QB	2.4054	-4.7413*	1(1)
RPR	-1.6632	-4.9819*	1(1)
QR	-1.3145	-6.2168*	1(1)
RPP	-3.8143*	-	1(0)
QP	-1.1577	-5.1708*	1(1)
RPG	-1.7347	-5.0163*	1(1)
QGN	-0.8970	-4.3603*	1(1)
RPT	-0.4418	-9.4128*	1(1)
QCT	-2.3173	-6.6522*	1(1)
RPS	-2.7675***	-	1(0)
QSOY	0.4034	-5.3519*	1(1)
ER	0.647	-4.0211*	1(1)
CRA	0.4480	-4.1753*	1(1)
EXTC	0.5366	-7.6942*	1(1)
RN	-1.6449	-6.4485*	1(1)
W	-4.5596*	-	1(0)

Source: Extracted from Unit Root Results Provided by E-view Econometric software

Note: Mackinnon critical values for ADF at 1, 5 and 10% levels are - 3.6117, -2.9399 and -2.6080 respectively.

*, ** and *** means significant at 1, 5 and 10 respectively.

After comparing the ADF statistics in table 1 with the Mackinnon critical values provided by E-views econometric package, we came out with the following conclusions concerning the unit root tests. Most of the variables (19 out of 26) were not stationary in their levels, implying the non-rejection of the null hypothesis of non-stationarity. But they all became stationary in their first differences. This means that the variables are integrated of order 1(1) or they have only a single unit root. A number of variables (XP, XGN, XCT, RPP, RPS, RPB and W) are stationary in their levels. We cannot therefore specify the export supply response models in their levels without the risk of obtaining spurious regressions unless they are cointegrated. It is therefore necessary to carry out a cointegration test.

4.2 Cointegration test results

Given the unit-root properties of the variables, we proceeded to establish whether or not there is a long-run cointegrating relationship among the variables in the various commodity export supply models (equation 2b to 8b) by using the Johansen full information maximum likelihood method.

The Johansen cointegration tests revealed that the maximal Eigen value statistics show existence of 1 cointegration equation for cocoa model; and soybean model each, 2 cointegration equations for cotton model, 3 cointegration equations each for Benniseed and groundnut models, 4 cointegration equations for rubber and 5 cointegration equations for palm oil, all at 5 percent level of significance (see table 2 below).

Table 2: Cointegration test results

Commodity	Eigen value	0.05 critical value	Hypothesized no. of CE(S)
Cocoa	87.0543	52.3626	At most 1*
Soybeans	62.3947	52.3626	At most 1*
Cotton	61.876	52.3626	At most 2*
Benniseed	83.0733	52.3626	At most 3*
Groundnut	121.5777	52.3626	At most 3*
Rubber	115.0948	52.3626	At most 4*
Palm oil	91.9843	52.3636	At most 5*

Source: Extracted from cointegration results in Appendix C1-7. Provided by E-view Econometric software

* Denotes rejection of the hypothesis at 5% level.

The conclusion drawn from this result is that there exists a unique long-run relationship among the explanatory variables in our various commodity export models.

Hence, economic interpretation of the long-run export can be obtained by normalizing the estimates of the unconstrained cointegration equations.

4.3. Summary of determinants of the selected commodities

We summarized the result of the determinants in table 3. Lagged export is a determinant for only cocoa and soybeans, relative price is an important determinant for almost all the commodities except cocoa and soybeans. Output level is a significant determinant for all the commodities. The significance of output level for all commodities also lend support to the results obtained in our descriptive statistics on growth rate of the exports, outputs and prices of the selected commodities in chapter four of our study which shows that the output growth rate for all the commodities were far below their export and price growth rates. This implies that output growth constraints are the main reasons for low exports of the selected commodities. The significance and the effect of credits to agriculture on 6 commodities except cotton is further demonstration of production constraints as a major setback to commodity export growth in Nigeria. Exchange rate was significant for 4 crops cocoa, benniseed, palm oil and groundnut. Foreign income was only significant for rubber. Rainfall had impacts only on perennial crops in our study (cocoa, rubber and palm oil) while expenditure on transport and communication affects 4 commodities namely: cocoa, cotton, groundnut and soybeans.

Table 3: Summary of the results of export supply determinants of the selected commodities

Commodity	Determinants										
	Xs (-1)	RP	Q	ER	W	CRA	RN	EXTC	AdR^2	ECM (-1)	F-stat
Cocoa	√		√			√	√		0.62	-0.65	6.07
Benniseed		√	√	√		√			0.66	-0.44	11.64
Rubber		√	√	√		√	√		0.70	-0.33	1.36
Palm oil		√	√		√	√	√		0.53	-0.43	5.05
Groundnut		√	√	√		√		√	0.60	-0.86	3.76
Cotton		√	√	√				√	0.58	-0.08	2.67
Soybeans	√		√			√		√	0.52	-0.65	2.40

Source: Computed based on tables 5.3 to 5.9
Note: √ means determinant at 10% or less otherwise not a determinant
Xs(-1) = previous export supplies
RP = Relative prices
Q = Output level
ER = Real exchange rate
W = World GDP growth rate
CRA = Credits to agricultural sector
RN = Rainfall
XETC = Expenditure on transport and communication

4.4 Results of the short-run and long-run responsiveness of selected commodities to price and non-price variables

The coefficient of the estimates in the long-run co-integration equations and over parameterized/parsimonious equations are elasticities because we estimated log linear
forms of export responses. This makes it easy to directly obtain long-run and short-run elasticities (responses).
Table 4 shows the long-run and short-run elasicities for the seven selected commodities. As expected, the short-run elasicities are generally smaller than the long-run elasticities for all the seven commodities. Kwanashie et al (1998) obtained similar result for output responses of eight crops out of nine food crops studied. Empirical evidence from studies on Sub-Saharan African countries by Bond (1985) also suggest that the long-run prices elasicities are larger than those of short-run and are of the sizeable magnitude, Nichodemus et al (2003) also obtained similar results for four export crops in Uganda.
The result also indicates that export responses to output were greater than responses to price for most of the commodities in the long-run except Benniseed and cotton, as well as in the short-run with only exception being soybeans. Bond (1985) for example demonstrated that the supply elasticity with respect to prices in many sub-Saharan African countries is low partly due to inadequate supportive infrastructure and that the supply elasticity with respect to non-price factors is likely to be higher in countries with inadequate infrastructure facilities, imperfect markets, lack of credits etc.
The short-run responses to price and non-price factors were very inelastic in most cases. The short run responses ranges between 0.01 and 0.77 in all cases except palm oil export response to output (1.30) and rainfall (1.22).

Kwanashie et al (1998) obtained short-run elasiticities of between 0.13 and 0.78 for nine food crops in Nigeria. Nichodemus et al (2003) obtained similar results for four Uganda export commodities.

Table 4: Long-run and short-run supply elasticities of the selected commodities

Variables	Cocoa	Benniseed	Rubber	Palm oil	Ground nut	Cotton	Soy beans
Long-run elasticities							
LXs	1.00	1.00	1.00	1.00	1.00	1.00	1.00
LRPs	-0.55	2.30	0.00	-5.81	-1.94	-1.78	-0.46
LQs	0.99	1.43	19.94	-28.09	-3.75	-1.47	-1.83
LER	-1.17	-0.22	-5.34	0.46	0.93	-2.29	1.03
LCRA	-	-	-1.03	2.90	1.50	2.98	-0.63
LRN	-	-	1.03	4.70	-6.57	-1.04	0.68
Short-run elasticities							
LXs(-1)	-0.27	0.17	0.15	0.21	0.11	-0.24	0.29
LRPs(-1)	-0.06	0.30	-0.29	-0.25	0.08	0.30	-0.16
LQs(-1)	0.06	-0.75	0.77	1.30	0.49	0.32	-0.11
LER(-1)	0.02	0.20	0.30	0.50	0.35	0.52	0.18
LCRA(-1)	0.12	-0.09	0.14	0.07	0.49	0.38	0.20
LRN(-1)	0.23	0.42	0.42	1.22	-	-	-
LEXTC(-1)	0.01	-	-0.08	-0.31	0.29	0.43	0.02
ECM(-1)	-0.67	-1.32	-0.34	-1.43	-0.87	-0.08	-0.63

Source: The long-run elasticities are extracted from the various long-run cointegration equations in appendix C while short-run elasticities are extracted from the various overparametized and parsimonious equations in appendix B using e-view econometric software.

Note: Figures are the significant coefficients at 10% or less.

4.5 Results of the relative responses of the selected commodities to relevant determinants

As was expected, the individual commodities had different patterns of responses to price and other policy variables (see Table 5). For instance commodities like cocoa and soybeans show little or no significance response to price while groundnut was more responsive to price than other variables.

Table 5: Ranking of variables according to commodity responses

Rank	Cocoa	Benniseed	Rubber	Palm oil	Ground /nut	cotton	Soy beans
1st	LXCC(-1) (-0.27)	LQB (2.26)	LER (0.91)	RN(-1) (1.22)	LRPG (0.57)	LER(-1) (0.52)	LXSOY(-1) (0.29)
2nd	LRN(-1) (0.23)	LER (0.90)	LQR (0.78)	LQP(-1) (1.00)	LEXTC (0.56)	LEXTC (0.43)	LQSOY (0.23)
3rd	LQCC (0.18)	LRPB (0.61)	LRN(-1) (0.42)	LCRA(-1) (0.51)	LQGN(-1) (0.49)	LQCT(-1) (0.32)	LCRA (0.20)
4th	LCRA(-1) (0.12)	LCRA (0.42)	LRPR (0.37)	LRPP (0.27)	LCRA(-1) (0.48)	LRPT(-1) (-0.30)	LEXTC (0.12)
5th	-	-	LCRA(-1) (0.14)	W (0.08)	LCR(-1) (0.35)	-	-

Source: Extracted from the various commodity parsimonious results in Appendix B obtained from e-view econometric software.

Note: Figures in parenthesis are the significant coefficient at 10% or less. The variables are as earlier defined.

These findings were, to some extent, expected. This is because the characteristics of each commodity such as their gestation period are different, the climatic conditions, domestic demand for the commodities and spatial distribution are also different. These factors influence responses of individual commodities to various price and non-price incentives. It is not accidental that cocoa, rubber and palm oil responded more to rainfall compare to no significant responses to groundnut, cotton and soybeans to rainfall. The amount of rainfall requirement for cocoa, rubber and palm oil is far more than those of groundnut, cotton, soybeans and Benniseed. Again, Benniseed, groundnut and cotton in most cases had a high short-run response than cocoa, rubber and palm oil. Lag structure for benniseed, cotton and groundnut is much smaller than that of cocoa or palm oil because Benniseed, cotton and groundnut requires a relatively short-time between planting and harvesting (shorter

gestation period). This results confirmed that trade-offs in responsiveness exist among commodities. Kwanashie et al (1998) obtained similar results for output responses of nine food crops in Nigeria.

5. Conclusion

These results point to three conclusions: First, the significance sensitivity of the commodities under consideration to output growth, credits to agricultural sector and improved road network suggest that price incentives alone are not sufficient to generate the desired export, attempt to increase the export supply of these commodities should focus more on the productivity of these commodities. Second, exchange rate appreciation may not hurt exports of these commodities much, if at all. Third, policies to stimulate commodity production and exports should attached significance consideration to the agro-climatic conditions as well as cropping patterns of the commodities.

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