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Determinants of Agricultural Export Earnings in Nigeria, 1980-2011

Adama, Joseph Ibrahim
Lecturer, Department of Economics, Land Mark University, Omu-Ara, Kwara State, Nigeria
Ohwofasa, Bright Onoriode
Lecturer, Department of Social Sciences (Economic Unit),
School of General Studies, Delta State Polytechnic, Otefe-Oghara, Nigeria

Abstract:
The study focuses on the determinants of agricultural export earnings in Nigeria for the period 1980-2011. The explanatory variables were identified to include world income, exchange rate, degree of openness and rainfall (a proxy for weather). The study tested for stationarity, co-integration and employed VAR model and found that current agricultural export earnings in Nigeria are positively and significantly responsive to its lag 1, World income (lag 1 and 2), openness (lag 2) and exchange rate (lag 1). On the other hand, the impact of agricultural export earnings (lag 2), openness (lag 1), exchange rate (lag 2) and annual rainfall (lag 1 and 2) is negative. The results of variance decomposition and impulse response function reveal that world income and exchange rate is key variables that explain changes in agricultural export earnings. The paper recommended that there is need for value addition to agricultural products being exported and that conservation and rehabilitation programmes for agricultural products should be organized in areas where degradative processes are about to set in and farmers encouraged through appropriate pricing mechanisms.

Keywords: *Agricultural export earnings, world income, exchange rate, degree of openness, VAR model*

1. Introduction

The Nigerian economy is dominated by oil and gas export which contribute about 90 percent of the country's foreign exchange while the non oil sector which include agriculture, solid mineral, semi-manufacturing and manufacturing contribute the balance of 10 percent. 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. Ekpo and Egwakhide (1994) asserted that agricultural export commodities contributed well over 75 percent of total annual merchandise exports in the 1960s. For instance, Nigeria was the largest exporter of palm-oil and palm-kernel; ranked second in cocoa and occupied a third position in groundnut Abolagba, Onyekwere, Agbonkpolor and Umar (2010). Nigeria's export earnings from major agricultural crops contribute significantly to the gross domestic product (GDP) over the years. In 2005 for instance an output of about 1,640.4; 28,521.8 and 2,479. 2 tons were obtained from potato, yam and cocoyam respectively, while a total output of 111,780.7 tons were obtained from staple foods (Abolagba, et al., 2010). Similarly, a total of 456.4 tons of staple foods were exported with a value of ₦38,588.1 million in earning (CBN, 2005). The accrued earnings from agricultural export in Nigeria have brought numerous benefits to Nigeria and the continent at large (Nwibo, 2012). The government revenue depended heavily on agricultural export taxes while both the current account and fiscal balances depended to some extent on agriculture before the discovery of oil (Folawewo and Olakojo, 2010).

However, since the oil-boom era of the 1970s, the contributions of agriculture to foreign earnings have remained abysmally low, representing less than 1 percent between 2000 and 2004 (CBN, 2005). For instance between 1970 and 1974, agricultural exports as a percentage of total exports declined from about 43 percent to slightly over 7 percent and further declined to below 5 percent for most of the 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 and consequently a neglect of agriculture sector. 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 (Ebi and Ape, 2014).

Although, agriculture is still the leading earner of foreign exchange from non-petroleum exports, the reduction in agricultural activities has caused a high level reduction in local food production, making Nigeria one of the leading countries in importation of food to supplement local production, which leads to growing importation and falling export earnings (Nwachukwu, Ehumadu, Mayeha,

Nwaru, 2008). The trends of importation of food has grown increasingly over the years with the food import bill attaining a height of about ₦76,818.9 million in 1996 and ₦173,002.2 million in 2005 (CBN, 2005). At present Nigeria has lost its role as one of the world's leading exporters of agricultural commodities. In addition, the country is currently suffering from declining as well as fluctuating income from her heavily dependence on oil exports. With the present free fall of oil price at the world market, it has become necessary for the country to reconsider its agricultural commodity export position. Thus, the objective of this study is to examine the determinants of agricultural export earnings in order to ensure sustained growth in sector. It is in the realization of this objective that the study is undertaken. As such, the paper is structured into five subsections. Following the introduction, section 2 reviews related literature, section three unveils the model while section four discusses the results. Section five concludes the paper and made policy recommendation.

2. Review of Related Literature

The literature is saddled with diverse views by economists on what constitute the determinants of agricultural export earnings. Thus in Ethiopia, Ramli (2011) assessed the instability of the Malaysian palm oil export earnings by employing the generalized autoregressive conditional heteroskedasticity (GARCH). The result of the study revealed that prices of palm oil and soya bean were the main sources of Malaysian export earnings instability. Fluctuations in export earnings can be a concern to many analysts and can be caused by many relevant factors. In Nigeria, fluctuations in rubber and cocoa export earnings have raised concerns about the country's future growth potentials and self-sustainability. This is why Abolagba, et al., (2010) had attempted to establish the major determinants of rubber and cocoa exports. Employing the Ordinary Least Squares (OLS), the findings show that rubber export is significant and positively influenced by domestic rubber production and producer price while exchange rate, domestic consumption and interest rate appearing negatively significant. An increase in production and producer price will stimulate export and encourage maintenance of rubber farms and thus increased output. The negative sign of exchange rate implies that lower exchange rate led to increased exports. In the case of domestic consumption, its reduction will lead to an increase in export supply and vice versa. For cocoa, the relevant factors are cocoa output, domestic consumption and rainfall. Yusuf and Edom (2007) analyzed the factors influencing exports of timber in Nigeria with the aid of ECM. The study spanned 33 years (1970-2003) for round wood and sawn wood. Their study found significant relationship for timber woods as indicated by the significant of ECM terms. The result suggests that the short run dynamic effect of the changes in export quantities of round wood is determined by one year lagged export quantity of round wood, domestic output consumption ratio of round wood while that of sawn wood is determined by lagged values of the official exchange rate, domestic consumption-output and world export-output ratio of sawn wood.

Bakare (2011) examined the relationship between oil export and the agricultural export performance in Nigeria. The study employed a co-integration and ECM via Ordinary Least technique on a time series data for the period 1990-2010. The results revealed that the data were co-integrated and found a significant but negative relationship between oil export and the agricultural export performance in Nigeria. According to the study, there is the need for the government to diversify the oil sector and encourage agriculture through incentives to farmers, mechanization and positive policy measures. The study further recommended for the government to consolidate and maintain export incentives comprising a duty draw-back scheme, explicit export bonuses, currency retention scheme and other direct fiscal incentives, such as the exemption of export transactions from stamp duties.

Mesike, Giroh, and Owie (2008) analyzed the effect of trade liberalization policy on Nigerian rubber industry by using secondary data from 1960–2004 and primary data from 120 farmers. The results of their descriptive statistics and multiple regressions revealed that output and producers price exerted positive effects on export supply, that is a rise in output and producer's price would cause exporters to export more natural rubber. However, domestic consumption quantity and annual rainfall were disincentives to rubber exporters. The results also shown that rubber producers also experienced a multiplicity of problems, which centered on inputs used in rubber production and aged rubber trees.

Nkang, Abang, Akpan, and Offem (2006) estimated cocoa export supply in Nigeria from 1970 - 2003 in the context of co-integration and error correction modeling approach. The data employed for the study included export supply of cocoa measured in tons, the ratio of the producer price to the domestic price index, the ratio of the export price to the domestic price index, average annual rainfall in millimeters, trade-weighted income of major Nigerian trading partners, trend variable to capture technological changes in production and export processes, dummy variable for liberalization of both domestic and export marketing activities, Their founding revealed that the error correction mechanism (ECM) shows that any disequilibria away from the long-run steady state equilibrium of cocoa exports is corrected within one year. Specifically, the speed at which cocoa export supply adjusts to changes in real producer price, trading partners' income and lagged cocoa export supply in an effort to achieve long-run static equilibrium is 78.75 percent. In the short-run, real cocoa producer price has significant but negative effect on cocoa export supply. However, in the long-run, the effect of real producer price on cocoa export supply is significant, positive and inelastic. Foreign income indicates a negative but non-significant effect on export supply in both the short and long-run. These results, among others show that there may be a promise for increased cocoa exports in the long-run, when it would have been possible for harvested hectares to be expanded and/or existing low-yielding and aged trees replaced. Overall, increased domestic production and increase in domestic industrial utilization will increase income and price elasticity of its manufactured exports compared with primary products.

Folawewo and Olakojo (2010) examined the determinants of agricultural exports in oil exporting economy. The study employed ordinary least square with parsimonious error correction model on data set from 1970-2007 and the results revealed that world prices for Nigeria major agricultural commodities, world income and a one year lag of agricultural output were the determinants of agricultural exports in Nigeria.

Ukoha (2007) established quantitative relationships among the relative price volatility of agricultural commodities, inflation and agricultural policies in Nigeria with his data, covering the period 1970–2003. The study's results show that the effect of inflation on relative price variability among agricultural commodities in Nigeria is non-neutral. Inflation has a significant positive impact on relative price variability in both the long run and the short run. The findings suggested the need for policies that will buffer the agricultural sector from the effects of inflation in the short run, and in addition the crops subsector from the long-run effect of inflation. Similarly, policies that reduce the rate of inflation will minimize relative price variability among agricultural commodities and consequently reduce inefficiency, distortions and misallocation of resources in agriculture that might be caused by inflation. As a result of no data points in the study period that show negative inflation, the data could not provide evidence for the effect of deflation on relative price variability.

The study further revealed that policies like the Green Revolution and structural adjustment programmes and post-SAP policies increased relative price variability among cash crops in the long run, but influenced food crop prices only in the short run. In addition to this, the Operation Feed the Nation project (OFN) had a significant positive short-run effect on food prices. Thus the agricultural policies under SAP, post-SAP and Green Revolution caused price changes that led to efficient reallocation of resources among cash crops in the long run and food crops in the short run. The policies should be considered in planning for the agricultural sector.

On the other hand, the price control policy brought about a reduction in relative price variability among cash crops and consequently led to a misallocation of resources in the sector. Cash crop prices should be allowed to be determined by market forces of demand and supply, and no attempts should be made to fix prices administratively, the study argued.

Ebi and Ape (2014) investigated the supply response of seven agricultural export commodities from Nigeria between 1970 and 2010. They seven commodities were cocoa, benniseed, rubber, palm-oil, ground nut, cotton seed, and soybeans. Employing error correction model, they found that the response of agricultural export supply to changes in relative price was positive and fairly significance for five commodities except cocoa and soybeans. In addition they also found that output growth and more credits to agricultural sector have positive and significance impact on the export supply of the commodities, change in road network positively and significantly affects export supply of three commodities. Exchange rate was positive and significance for four commodities, rainfall was positive and significance to only perennial crops (cocoa, rubber and palm-oil). Similarly, 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) while short-run price and non-price elasticities were less than unity (0.01 to 0.77 inelastic).

3. Model Specification

A vector autoregressive (VAR) model is adopted for the study to enable us assess the response of each of the determinants on agricultural export earnings in Nigeria. In a VAR approach the number of variables is eventually the number of equations in the model. Thus, the model is specified as follows:

$$AEX = f(WI, DO, EXR, ATR) \quad \ldots\ldots(1)$$

where:

AGEX = average World income of agricultural export earnings

WI = World income

DO = Degree of openness (i.e. export + import/GDP)

EXR = exchange rate

ATR= annual rainfall in millimeters (a proxy for weather)

The VAR form of equation (1) becomes:

$$\Delta AEX_t = \sum_{i=1}^{n} a_{1t}\Delta AEX_{t-1} + \sum_{i=1}^{n} b_{1t}\Delta WI_{t-1} + \sum_{i=1}^{n} c_{1t}\Delta DO_{t-1} + \sum_{i=1}^{n} d_{1t}\Delta EXR_{t-1} + \sum_{i=1}^{n} e_{1t}\Delta ATR_{t-1} + e_{1t} \quad \ldots\ldots(2)$$

$$\Delta WI_t = \sum_{i=1}^{n} a_{21t}\Delta AEX_{t-1} + \sum_{i=1}^{n} b_{2t}\Delta WI_{t-1} + \sum_{i=1}^{n} c_{2t}\Delta DO_{t-1} + \sum_{i=1}^{n} d_{2t}\Delta EXR_{t-1} + \sum_{i=1}^{n} e_{2t}\Delta ATR_{t-1} + e_{2t} \quad \ldots\ldots(3)$$

$$\Delta DO_t = \sum_{i=1}^{n} a_{3t}\Delta AEX_{t-1} + \sum_{i=1}^{n} b_{3t}\Delta WI_{t-1} + \sum_{i=1}^{n} c_{3t}\Delta DO_{t-1} + \sum_{i=1}^{n} d_{3t}\Delta EXR_{t-1} + \sum_{i=1}^{n} e_{3t}\Delta ATR_{t-1} + e_{3t} \quad \ldots\ldots(4)$$

$$\Delta EXR_t = \sum_{i=1}^{n} a_{41t}\Delta AEX_{t-1} + \sum_{i=1}^{n} b_{4t}\Delta WI_{t-1} + \sum_{i=1}^{n} c_{4t}\Delta DO_{t-1} + \sum_{i=1}^{n} d_{4t}\Delta EXR_{t-1} + \sum_{i=1}^{n} e_{4t}\Delta ATR_{t-1} + e_{4t} \quad \ldots\ldots(5)$$

$$\Delta ATR_t = \sum_{i=1}^{n} a_{5t}\Delta AEX_{t-1} + \sum_{i=1}^{n} b_{5t}\Delta WI_{t-1} + \sum_{i=1}^{n} c_{5t}\Delta DO_{t-1} + \sum_{i=1}^{n} d_{5t}\Delta EXR_{t-1} + \sum_{i=1}^{n} e_{5t}\Delta ATR_{t-1} + e_{5t} \quad \ldots\ldots(6)$$

Equation 2-6 indicates that there are five variables in the model and a positive relationship is expected between agricultural export earnings and the four explanatory variables.

3.1. Unit Root Test

To avoid spurious regression, the Augmented Dickey Fuller (ADF) test was used to test for the stochastic properties of the series. The ADF test is specified thus:

$$\Delta Y_t = C_i + \omega Y_{t-1} + C_{2t} + \sum_{t=1}^{p} \delta_i \Delta Y_{t-1} + \varepsilon_t \quad \text{.....(.7)}$$

yt = relevant time series; Δ = an operator for first difference; t = a linear trend; εt= error term. The null hypothesis of the existence of a unit root is Ho: ω=0. Failure to reject the null hypothesis leads to conducting the test on further differences of the series. Further differencing is conducted until stationarity is reached and the null hypothesis is rejected. Akaike Information Criteria (AIC) and the Schwarz criterion (SC) were employed to determine the lag length.

3.2. Co-integration

Co-integration regressions measure the long-term relationship between the variables whose existence demonstrates no inherent tendency to drift apart. Johasen and Juselius (1990) two test statistics are employed and they include the trace test and the maximum eigenvalue test which are used to test the hypothesized existence of r co-integrating vectors. The trace test statistic tests the null hypothesis that the number of distinct co-integrating vectors is less than or equal to r against a general alternative while the maximum eigenvalue statistic tests the null hypothesis that the number of co-integrating vectors is r against the alternative of r+1 co-integrating vectors. The trace statistic for the null hypothesis is computed as:

$$LRtr(K) = -\Gamma \sum_{i=r+1}^{h} \log(1-\mu i) \quad \text{.....(.8}a\text{)}$$

Where: LR_{tr} = trace statistics; K =co-integration relations; μi =ith eigen value. Similarly, the Maximum Eigen value static is computed as follows:

$$\Gamma_{\max}(r, r+1) = -\tau \log(1-\lambda_r + 1) \quad \text{.....(.8}b\text{)}$$

4. Data and Discussion

4.1. Description of Basic Statistics of Agricultural Export Price

Table 1 gives the description of variables used in the estimation in this section. The variables include agricultural export earnings (AEX), World income (WI), degree of openness (DO), exchange rate (EXR) and annual rainfall (ATR). The table reveals that agricultural export earnings averaged ₦3797.1 million and varies from ₦56.0 to ₦10,347.7 million with a standard deviation of ₦3315.6 million. Similarly, averaged world income stood at $30,066.3 billion. It ranges from $12,950.0 to $48, 550.0 billion with a standard deviation of $11, 647.0 billion. It can also been seen from the table that openness of economy ranges from -0.08 to 0.26 percent with a mean of 0.12 percent and a standard deviation of 0.09 percent. Exchange rates with a mean of ₦57.5 and a standard deviation of ₦59.80 also varies from a minimum of ₦0.55 to a maximum of ₦153.9. Finally, annual rainfall has a mean of 664.13 millimeter and ranges from 193.0 to 1282.0 millimeters with a standard deviation of 59.80 millimeters. Table 1 also shows that the series are positively skewed around their mean except DO with negative value.

Statistic	**Variable**				
	AEX	WI	DO	EXR	ATR
Mean	3797.106	30066.25	0.123844	57.45844	664.1250
Median	3384.850	28690.00	0.130300	21.8900	409.0000
Maximum	10347.70	48550.00	0.263000	153.9000	1282.200
Minimum	56.00000	12950.00	-0.077900	0.550000	193.0000
Std. Dev.	3515.585	11647.24	0.092949	59.80241	458.6026
Skewness	0.328848	0.190898	-0.307724	0.444205	0.596535
Kurtosis	1.618752	1.794917	2.315608	1.381000	1.438559
Jarque-Bera	3.120545	2.130659	1.129558	4.547242	5.148683
Probability	0.210079	0.344614	0.568486	0.102939	0.076204
Sum	121507.4	962120.0	3.963000	1838.670	21252.00
Sum Sq. Dev.	3.83E+08	4.21E+09	0.267826	110866.2	6519808.
Observations	32	32	32	32	32

Table 1: Basic Statistic of Agricultural Export Price and it Determinants

Kurtosis for all the variables exhibits flatness or platykurtic since their values are less than 3. The Jarque-Bera shows that the variables are normally distributed.

4.2. Unit Root Test

Three of the variables are in logarithmic terms and they include agricultural AEX, WI and ATR while EXR and DO are in levels. Consequently, table 2 below presents the result of stationarity test and it was discovered that at level none of the variables were stationary.

	ADF (Trend and Intercept)			Phillips-Perron (Trend & Intercept		
Variable	Level	1st Diff	2nd Diff	Level	1st Diff	2nd Diff
LAEX	-1.0422	-4.5311**	-6.6656**	-1.0302	-5.7775**	-10.2778**
LWI	-1.8473	-4.4366**	-5.9221**	-1.3072	-3.5793*	-6.6307**
EXR	-2.0874	-3.5846*	-5.7761**	-2.0946	-5.2333**	-11.2450**
DO	-3.2509	-7.4179**	-8.2664**	-3.2254	-6.7141**	-10.7814**
LATR	-1.5142	-3.5906*	-6.9191**	-2.0161	-6.5368**	-15.4869**
Critical Value						
1%	-4.2949	-4.3082	-4.3226	-4.2826	-4.2949	-4.3082
5%	-3.5670	-3.5731	-3.5796	-3.5614	-3.5670	-3.5731
10%	-3.2169	-3.2203	-3.2239	-3.2138	-3.2169	-3.2203

Table 2: Unit Root Test Result

*(**) stationary at 5 and 1 percent level respectively

However, at integration of order 1 they became stationary and even more at order 2. Since all the variables were stationary in atleast I(1), the Johasen co-integration test result is presented below.

4.3. Co-integration Result on Agricultural Export Earnings

The result in table 3 reveals that there is no co-integration between agricultural export earnings and the four explanatory variables as both the trace and the max-engen statistics are less than the critical levels. This made VAR test inevitable.

Null Hypothesis	Alternative Hypothesis	Statistical Value	5 percent critical value	1 percent critical value	Eigen value
Trace Statistics					
r = 0	r ≥ 0	78.1	87.3	96.6	0.85
r ≥ 1	r ≥ 1	65.8	66.0	70.1	0.68
Max-Eigen Statistics					
r = 0	r = 1	44.3	47.5	52.4	0.85
r ≤ 1	r = 2	30.4	31.5	36.7	0.68

Table 3: Co-integration Result of Agricultural Export Earnings

4.4. VAR Estimates of Agricultural Export Earnings

In interpreting the results, it should be recalled that VAR allows each variable to be a function of its own past values as well as the past values of the other variables in the system. Thus, all the variables appearing on the columns of table 4 are the current values of the endogenous variables while the rows contain lagged values of the endogenous variables. Each of the endogenous variables was made a dependent variable, thus the results are the same since all equations have identical regressors. Since all the information in VAR are utilized this makes the interpretation cumbersome. For ease of understanding however, our interest is narrowed to the coefficients with asterisk (*) which is being regarded as significantly responsive while the rest coefficients are either negatively responsive or have a ,positive relationship. Our interest in this result is the second column, which has agricultural export earnings as endogenous variable and its own lags and the lags of other variables.

	LAEX	LWI	DO	EXR	ATR
LAEX(-1)	0.69* (2.8)	0.03* (2.0)	-0.02 (-0.6)	-5.90 (-0.8)	-0.03 (-0.2)
LAEX(-2)	-0.07 (-0.3)	-0.01 (-0.7)	0.01 (0.2)	8.45 (1.3)	0.02 (0.1)
LWI(-1)	0.94 (0.3)	1.27* (6.5)	0.63* (1.8)	26.88 (0.3)	0.27 (0.2)
LWI(-2)	0.56 (0.2)	-0.43* (-2.3)	-0.12 (-0.4)	34.88 (0.4)	-0.85 (-0.5)
DO(-1)	-1.26 (-0.9)	-0.09 (-0.9)	0.27 (1.5)	-113.96* (-2.7)	0.65 (0.7)
DO(-2)	2.00 (0.9)	0.08 (0.6)	-0.83* (-3.2)	-59.74 (-1.0)	0.06 (0.0)
EXR(-1)	0.00 (0.4)	0.00 (1.3)	-0.00* (-1.8)	0.53* (2.0)	0.00 (0.4)
EXR(-2)	-0.00 (-0.1)	-0.00* (-1.8)	-0.00 (-0.8)	0.09 (0.4)	0.04 (2.0)
ATR(-1)	-0.36 (-0.9)	-0.01 (-0.3)	0.09* (1.9)	13.38 (1.2)	0.33 (1.4)
ATR(-2)	-0.21 (-0.6)	0.05* (2.3)	0.03 (0.7)	-5.90 (-0.6)	-0.06 (-0.6)
Constant	-9.10 (-0.7)	1.26 (1.4)	-5.51* (-3.3)	-649.26 (-1.7)	-0.06 (-0.3)
R^2	0.95	0.99	0.73	0.97	0.90
F-stat	38.9	481.6	5.0	63.1	17.0
AIC	1.5	-3.9	-2.7	8.2	4.0
SC	2.0	-3.4	-2.1	8.7	0.5

Table 4: VAR Parameter Estimates t-statistics in ()

The results therefore show that all the five equations have good fit with R^2 of between 0.73 and 0.99. Thus, the fit to all the equations is very good while the F-statistic is also very robust with exception of openness of the economy with a value of 5.0 which is also significant at convention level. Looking at the overall level of significant of the variables, only about a quarter of the lagged variables in the model were significant.

These notwithstanding the results revealed that current agricultural export earnings in Nigeria are positively and significantly responsive to its one year lag, World income (lag 1 and 2), openness (lag 2) and exchange rate (lag 1). On the other hand, the impact of agricultural export earnings (lag 2), openness (lag 1), exchange rate (lag 2) and annual rainfall (lag 1 and 2) is negative on current export earnings of agricultural products. Ramli (2011) in Malaysia, Folawewo and Olakojo (2010) in Nigeria and Abolagbe, et al. (2010) also in Nigeria have earlier reached similar findings. Columns 3 to 6 can similarly be interpreted.

4.5. Forecast Error Variance Decomposition (FEVD)

By definition, the variance decomposition shows the proportion of forecast error variance for each variable that is attributable to its own innovation and to innovation in the other endogenous variables. In order words, FEVD examines the percentages of innovation each variable is contributing to the other variables in the VAR system. When calculated by the structural shocks as in the present case, the FEVD provides information on the importance of various structural shocks explaining the forecast error variability of agricultural export price and its determinants.

Table 5 presents the FEVD of the five endogenous variables. "Own shocks" constitute the predominant source of variation in agricultural export earnings errors. The variation ranges from 72.3 per cent to 96.0 percent over the ten-year horizon. Although, our interest is the shock in agricultural export earnings occasioned by own shocks and that of its determinants, only panel 1-3 of table 5 is interpreted with concentration based on the 10^{th} period horizon.

Thus in period 10 of the first panel, agricultural export earnings explain 72.4 percent of own shocks while that attributed to World income is 15.4 percent, about 2.9 percent for openness, 4.5 percent for exchange rate while annual rain fall explained about 4.9 percent shock in agricultural export earnings. In period two, the variation in World income ranges from 37.7 to 72.6 percent. Thus, while own shock constitutes about 38 percent, the shock in World income attributed to agricultural export earnings is 47.5 percent, openness 2.7 percent, exchange rate 11.2 percent and 0.9 percent traced to rainfall.

Variance Decomposition of LAEX						
Period	S.E	LAEX	LWI	DO	EXR	ATR
2	0.5454	95.9532	0.1915	1.8184	0.0300	2.0069
6	0.7424	79.3112	9.1809	1.1050	3.7700	6.0533
8	0.8334	74.9278	12.9233	2.5467	4.2495	5.3527
10	0.9003	72.3875	15.4042	2.8592	4.4568	4.8922
Variance Decomposition of LWI						
Period	S.E	LAEX	LWI	DO	EXR	ATR
2	0.0529	23.3626	72.6343	1.2832	2.6290	0.0909
6	0.1034	43.4933	43.3272	1.9873	9.9572	1.2155
8	0.1163	45.9216	39.6612	2.7597	10.6215	1.0410
10	0.1253	47.4537	37.7084	2.7313	11.1971	0.9044
Variance Decomposition of DO						
Period	S.E	LAEX	LWI	DO	EXR	ATR
2	0.0640	3.1016	9.5884	75.4008	2.7071	9.2022
6	0.0816	9.6151	10.5752	62.3441	7.5157	9.9499
8	0.0840	9.7285	10.3213	62.1088	8.0170	9.8244
10	0.0849	9.5964	10.1465	61.2434	9.2845	9.7292
Variance Decomposition of EXCR						
Period	S.E	LAEX	LWI	DO	EXR	ATR
2	17.7935	11.0323	0.0975	16.4617	69.8532	2.5553
6	25.8691	5.7569	0.5245	27.9961	62.8440	2.8785
8	27.7758	6.2945	0.6457	30.1281	58.3100	4.8785
10	28.8213	8.8648	1.7878	29.0739	55.0600	5.2134
Variance Decomposition of LATR						
Period	S.E	LAEX	LWI	DO	EXR	ATR
2	0.2875	0.3905	0.6037	1.0958	37.4807	60.4294
6	0.4385	4.5108	1.6784	15.3301	50.5067	27.9738
8	0.4700	4.9579	2.0075	17.8086	50.3005	24.9255
10	0.4915	4.6366	1.8581	20.4542	48.5570	24.4940

Table 5: Variance Decomposition Result

Finally in panel 3, exchange rate explains much of the shocks in openness and contributes 55 percent in the 10^{th} period. Openness own shock is 29.1 percent, agricultural export earnings is 8.9 percent, world income is 1.7 percent and 5.2 percent for rainfall. Panel 4 and 5 are interpreted along the same line of reasoning.

4.6. Impulse Response Function

Fig 1 below x-rays the sensitivity of agricultural export earnings to shocks occasioned by world income, openness of the economy and exchange rate. It is observed that most of the innovations are due to the variables' own shock while the forecast horizon considered is 2011-2020, the target years for vision 20:2020.

The shocks induced by world income causes stability in agricultural export earnings between 2011 and 2012 and from 2013 further increase in world income is likely to produce ripple effect. This is likely to continue beyond 2020.

The response of agricultural export earning to one standard deviation in openness of the economy was initially negative between 2011 and 2013 and is expected to be slightly positive in 2014, stable in 2015-16. It will oscillate in 2017 which will continue up to 2020 and beyond.

Finally, the innovation occasioned by exchange rate causes agricultural export earnings to remain stable between 2011 and 2012 and from 2013 the response was negative and it is expected to remain negative up till 2020 and beyond.

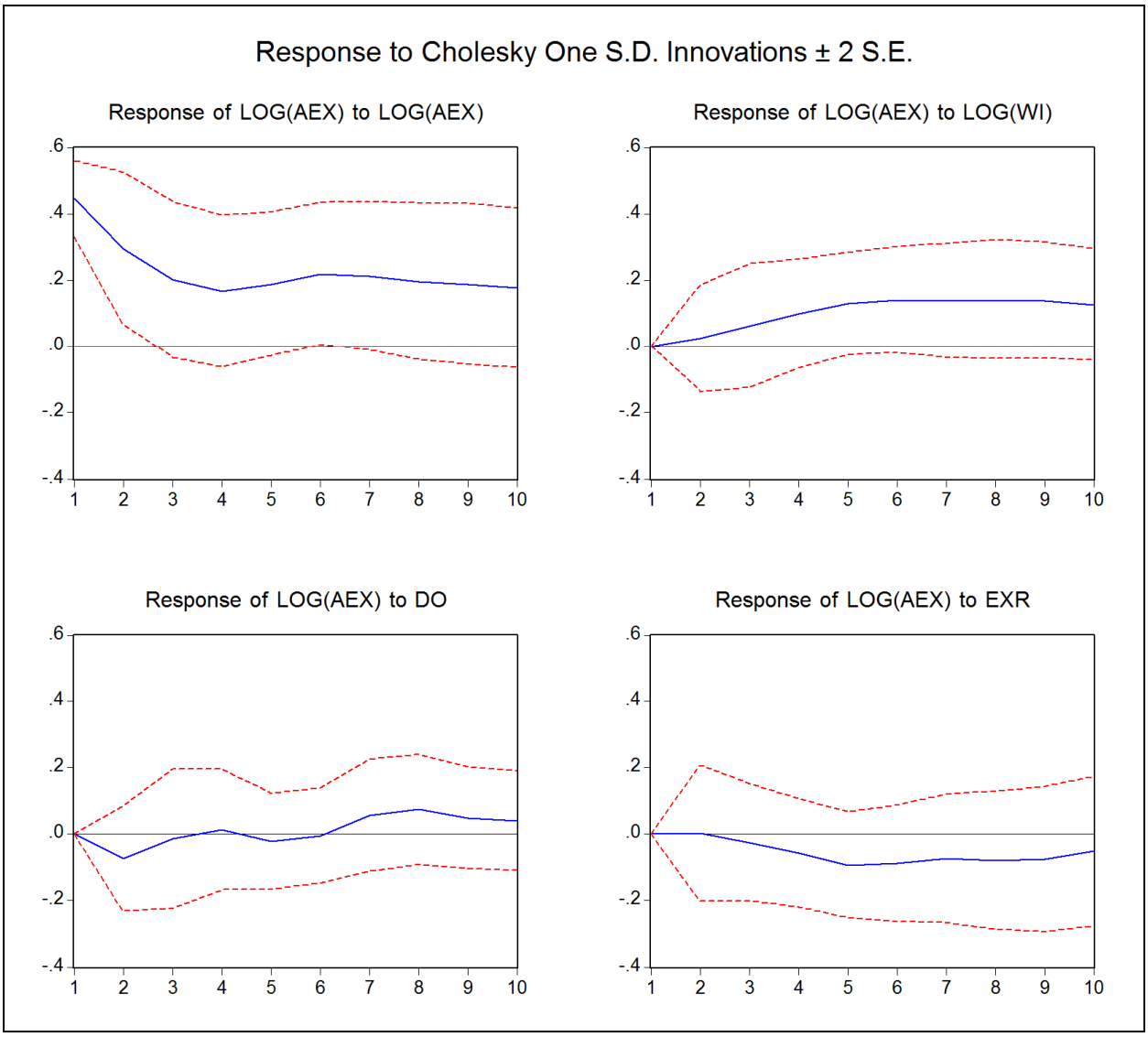

Figure 1: The sensitivity of agricultural Export Price to shocks in World GDP per Capita, Openness of the Economy and Exchange Rate (2011 -2020)

5. Concluding Remarks

Export earning is a source of economic stability in most economies as it helps to secure foreign exchange. However, exports from developing countries consist mainly of primary commodities including agriculture products whose earnings are mostly unstable. This study identified the determinants of agricultural export earnings in Nigeria and it was discovered that while both lags of world income has the potential to positively induce agricultural export earnings, the impact of rainfall (a proxy for weather) is deleterious. The implication is that an increase in world income has tended to boast earnings from the sector while lack of good agricultural policy to control for drought and flood has negatively affected export earnings from the sector. For instance, there are no irrigation system except the ones provided by individual which in most cases are grossly inadequate.

It was also discovered that while openness may negatively affect agricultural export earnings in the short run, in the long run the relationship is likely to be negative. It must be emphasized here that the country has few major trading partners which include the U.S, Britain, France, Italy, Canada, Japan such that any adverse economic conditions in these countries has ripple effect on agricultural export earnings. Also, while exchange rate exact positive impact on the agricultural export earnings in the short run, negative relationship was observed in the long run. An increase in the exchange rate means a fall in the value of the naira and this create demand for agricultural exports and thus increased earnings and vice versa. The variance decomposition reveals that world income and exchange rate is two key variables that explain changes in agricultural export earnings. This was supported by the sensitivity test where agricultural export earnings responded positively to world income and negatively to exchange for the entire horizon. The major conclusion we can draw from the study therefore is that world income, exchange rate and openness are key to sustainable agricultural export growth in Nigeria especially at this period of crude oil price volatility. It therefore recommended that there is need for value addition to agricultural products being exported. This will attract more earnings than raw products as it will also stimulate local consumption. Conservation and rehabilitation programmes for agricultural products should be organized in areas where degradative

processes are about to set in and farmers encouraged through appropriate pricing mechanisms. The Nigerian government should ensure that there is only a small margin between the producer prices and world price of agricultural products so that the farmers can benefit substantially from international trade. Finally, the external sector should be broadened through trade liberalization and tariff reduction to enable Nigeria's exports including agricultural commodities penetrates wider markets at the international level.

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