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EXCHANGE RATE DEREGULATION AND AGRICULTURAL EXPORT PERFORMANCE IN NIGERIA:EVIDENCE FROM VECTOR ERROR CORRECTION MODELLING

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ABSTRACT

This study examined response of real agricultural exports to exchange rate deregulation policy in Nigeria. Examinations of statistical properties of the relevant variables showed they are generally I(1) series, and exhibits multiple co-integrating relations. Thus, the study examined the agricultural export response within the framework of Vector Error Correction Modelling (VECM). The study found that the anticipated inverse relationship exists between real agricultural export and exchange rate as postulated in trade theories. However, while the response is elastic in the short-run, it is smaller and inelastic in the long run. Meanwhile, any exogenously induced changes/ shock to the long-run relations is corrected within one year. Thus, income gains an elastic short-run export supply response to changes in the exchange rate tend to be eroded quickly as real agricultural export returns to its in-elastic long-run equilibrium relations with the exchange rate in about a year. Meanwhile, long-run agricultural export quantity supply is world price inelastic and falls with increase in real GDP in the world, depicting an inferior good. The study thus recommends that Nigeria should strive to promote a stronger Naira, a stable domestic prices and an enhanced quality of agricultural export commodities.

Key words: Exchange Rate Deregulation, Agricultural Export Performance, Vector Error Correction Modelling, Nigeria

INTRODUCTION

One of the main challenges in the management of Nigeria's economy today is how to significantly diversify and expand the nation's export sector, which for over three decades now, is dominated by the oil sector. Crude oil export accounts for 90-95% of Nigeria's foreign exchange earnings and around 80% of government revenues (Malchau, 2002). As a result, government

revenues and Nigeria's economy fortunes has been very unstable, following the instability that have characterised the world's oil market since the early 1980s (Bogunjoko, 1997 and Aigbokan, 2001). Beside this, the growth in Nigeria's oil revenue over the years, can hardly be said to have impacted too positively on the lives of an average Nigerian who today is poorer, of shorter lifespan, and generally lives under worse socio-economic conditions than he was about three decades ago (Federal Office of Statistics (FOS), 1996 and 1999; and World Bank, 2002).

Prior to the advent of the oil-boom of the 1970s and early 1980s, Nigeria's economy was relatively more diversified. Then, agriculture led non-oil sector accounted for over 80% of the GDP, between 60% and 80% of export earnings, while the regional and later state governments in those days derived a sizable proportion of their income from taxes charged on agricultural incomes and exports (Aigbokan, 2001; World Bank, 2002). The situation however changed since the 1970s, following sharp increases in oil revenue and an attendant neglect of the non-oil sector in pursuit of cheap oil money. As a result, the share of non-oil export, declined sharply from an average of about 57% in 1965-69 to 6.7% in 1975-79 and 3.4% in 1980-85 (Aigbokan, 2001). In term of its value, Nigeria's non-oil export declined, even in nominal terms, from about N670 million in 1979 to as low as N203.2 million in 1982 (Central Bank of Nigeria (CBN), 2004).

To stem this trend, governments have undertaken a wide range of policy reforms, including the Structural Adjustment Programme (SAP) adopted in 1986, with a major objective of diversifying the nation's economy and enhancing the non-oil export. One prominent and consistent feature of these reforms has been the adoption of a relatively more liberalised trade and exchange rate regime, which has led to sharp declines in the value of the domestic currency (Naira). The main trust of government's trade liberalisation policies, which started in the early days of SAP with the abolition of import / export licensing and exchange control, was the liberalisation of export and pricing mechanisms, which is expected to lead a convergence of producer and export prices (Olomola, 1998). This was expected to lead to higher farm income, thus stimulating increased domestic production. Similarly, a movement away from fixed to flexible exchange rate regimes allowing significant depreciation of Naira was aimed at enhancing export by making Nigerian goods cheaper.

Research Problem

Despite the plethora of trade policy reforms adopted since 1986, available statistics shows that agriculture led non-oil export continues to account for a declining proportion of the nations foreign exchange earnings; which as at year 2002 remained below five percent (World Bank, 2004). This probably led CBN (2003) to conclude that non-oil sector response to trade and exchange rate reforms in Nigeria since 1986 has been largely unsatisfactory; and points at the urgent need to identify exactly what went wrong with the trade policy reform and why.

Meanwhile, while several economists and policy analysts (e.g. Egwaikhide, 1993; Phillip,1996; Ajobo, et al.,1996; Olomola, et al., Nwosu and Okunmadewa, 1998;

Adubi and Okunmadewa, 1999; and Aigbokan, 2001) to mention a view had focused considerable research attention on Nigeria's non-oil trade behaviours, a prominent feature of these studies has been a lack of consensus on the suitability of trade and exchange rate deregulation in the Nigerian case. For example, while Obadan (1994) reported that agricultural export responded positively to government's trade policy reforms, Olomola (1998) and many others reported that the response was not appropriate. Aigbokan (2001), for example, noted that while trade deregulation in SAP and post SAP periods boosted producer prices, which in turn led to increases in values of non-oil exports, the gain was more as a result of the price effects (i.e., nominal increases) than any real changes in value of non-oil exports.

Given the conflicting evidences emanating from studies of Nigeria's non-oil export behaviours, it is imperative that more research efforts are required to explain the source of the conflict, and provide relevant information for the much desired policy review. One quite reasonable approach to resolution of such conflicts is to examine the validity of assumptions underlying the various analyses. A close examination of available literature on Nigeria's non-oil export behaviour reveals that virtually all constructed econometric behavioural models involving relevant trade variables, which were commonly estimated by the least square technique or some variants of this. As pointed out by Arize, et al. (2000), however, a major presumption with such analyses is that the series are stationary: meaning that they maintain constant means, variances and autocovariances over time. Meanwhile, Nelson and Plosser (1982) and many other recent studies have shown that most economic time series are not stationary, while Granger and Newbold (1974) had noted that application of least square regression to equations containing non-stationary series results in spurious regression: a case in which coefficient estimates from such model may appear to be of correct signs and magnitudes, while deeper investigations often reveal flaws. The import of this is that standard inference procedures do not apply to regression models that contain non-stationary series.

The search for appropriate techniques for modelling economic relations involving non-stationary series led to the emergence of Error Correction Modelling (ECM) techniques of Engle and Granger (1987), which permits incorporation of both the long-run and short-run dynamics of a group of non-stationary series into econometric models. For example, application of ECM would allow estimation of both the short-run and long-run elasticities of trade response, and the speed with which export for example would return to its long-run equilibrium after such short-run disturbances as Naira devaluation. Thus, ECM has drawn renewed interest to the modelling of non-stationary series, with some recent application in Nigeria non-oil trade sector including Egwaikhide (1993) and Tijani, et al. (1999).

A major requirement for ECM, however, is the test for cointegration, which seeks to verify whether or not a linear combination of the non-stationary series is stationary, and can thus describe long run or equilibrium relationships (Engle and Granger, 1987; Tambi, 1999). The problem however, has been that multiple co-integrating relations often emerges in tests for cointe-

gration. This brings the identification problems of simultaneous equation modelling into ECM such that the estimates may not be unique nor be directly interpretable, unless some identifying restrictions are imposed (Boswijk and Doornik, 2002). This problem has however been solved by more recent methodologies developed notably by Johansen (1991, 1995a, b), Johansen and Juselius (1990, 1992, 1994), Boswijk (2000), Doornik (1995), Elliot (2000), Hansen (2002), and Pesaran and Shin (2002), leading to what is now known as Vector Error Correction Modelling (VECM). An added advantage of VECM over the traditional ECM used by Egwaikhide (1993) and Tijani, et al. (1999) is that it permits examination of simultaneous relations that often exists among trade related macro-economic variables.

Objectives of the study

The main objective of this study is to analyse, within cointegration and VECM framework, agricultural export supply response to trade reforms in Nigeria between 1970 and 2002.

The specific objectives are to:

(i) describe the statistical properties of the time series of Nigeria's agricultural export and its determinants;

(ii) estimate both the short-run and long-run elasticities of agricultural export supply response to changes in export prices, exchange rate and real income; and

(iii) explain the rather poor response of agricultural export supply to the sharp devaluation / depreciation of Naira in recent times.

METHODOLOGY

The study data and sources

This study was based on time series secondary data obtained from three main sources – FAOSTAT data, CBN Statistical Bulletin and statistical database of the United Nations Statistics Division. The data includes export quantities and unit value indices extracted for the entire period (1970 – 2002) from FAOSTAT data (2004), index of average world price of Nigeria's agricultural export commodities and the nominal effective exchange rate indices extracted from CBN (2004); and World's GDP in 1990 constant US$ extracted from the online statistical database of United Nations Statistics Division.

Model Specification

Theoretically, export quantity supplied by, or demanded from, a country (Q^E) is determined principally by the country's export price (P^E) relative to the world's average prices of similar commodities emanating from other competing countries (P^W), and the level of real income in the importing countries (Y^W). That is, $Q^E = f(P^E / P^W, Y^W)$, where all prices have been expressed in common currency. If the prices are expressed in different national currencies, the relative price term, $P = P^E / P^W$, would become $P=P^D x\ E / P^W$, where E is the exchange rate between the national currencies, while P^D and P^W are the export unit price in domestic currency and the world prices say in US$ respectively.

Thus, following the usual approaches in literatures (Arize *et al.*, 2000), and using the split format of the relative prices, the long-run equilibrium export supply function adopted in this study is specified in double logarithmic form as follows:

$$\ln Q^{E}{}_{t} = \beta_0 + \beta_1 \ln P^{D}{}_{t} + \beta^2 \ln E_t + \beta_3 \ln P^{W}{}_{t} + \beta_4 \ln Y^{W}{}_{t} + u_t \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Where:

$\ln Q^{E}{}_{t}$ = the logarithm of desired volume of Nigeria's agricultural export supply in year t measured by the export quantity index with the average of 1989-91 as base value;

$\ln P^{D}{}_{t}$ = the logarithm of Nigeria's agricultural export unit value index (EUVI) in average of 1989-91 constant prices in Naira.

$P^{D}{}_{t}$ was reconstructed from EUVI reported by FAO in constant US$ (EUVI$), as P^{D}=EUVI$*E/100;

$\ln E_t$ = the logarithm of the nominal effective exchange rate indices for Nigeria in US$ per Naira with the average of 1989-91 as base value, reworked from those reported by CBN which had 1985 as the base year;

$\ln P^{W}{}_{t}$ = the logarithm of the average world price indices of Nigeria's major agricultural export commodities in constant 1990 US$ with average of 1989-91 as base value. This was also recomputed from world price reported by CBN, which were expressed in Naira terms, as $\ln P^{W}{}_{t} = \ln P^{WD}{}_{t} - \ln E_t$.

$\ln Y^{W}{}_{t}$ = the logarithm of the index of world's GDP with the average of 1989-91 as the base value, which were derived from real world GDP in 1990 US$ reported by UN-Statistical Divisions.

B_js = are the coefficient of the j^{th} variable in the model, while u_t is the stochastic residual term.

The coefficients β_1, β_3 and β_4 can be interpreted, in a similar version to Arize *et al.* (2000), as the own-price, cross-price and income elasticity of demand for Nigeria's agricultural exports respectively under the assumption that the volume of exports demanded in period t is equal to the actual level of exports in period t, while β_2 gives the elasticity of export supply response to devaluation / depreciation of Naira. A priori, the expectation is that $\beta_1 < 0$ and $\beta_2 < 0$, since an increase in export price and stronger value of Naira are expected to discourage Nigeria's exports. Conversely, it is expected that $\beta_3 > 0$ and $\beta_4 > 0$, since higher world prices and increase in economic activities in the rest of the world are expected to encourage increased Nigeria's exports.

The statistical model and estimation procedure

While estimation of the theoretical model specified in (1) would appear straight forward, the recent developments in time series modelling as they relates to the need to examine the stationarity of the individual series and presence of cointegrating relations between them, point to the need to exercise some caution. Thus, the study first examined the statistical properties of the time series by conducting (a) Augmented Dickey Fuller (ADF) unit root tests for stationarity of the individual series, and (b) Johansen (1992, 1995b) likelihood ratio tests for the number of cointegrating relations among the series. Against evidences from these tests, the economic model was re-specified and estimated as a VECM.

ADF Tests

Whistler, White, Wong and Bates (2001) observe that for a time series Y_t, two forms of ADF test exists. These are based on t-test of significance of the coefficient associated with the lagged value of the series (Y_{t-1}) in any of the following two forms of ADF regression equations:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \qquad 2$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 t + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \qquad 3$$

where ε_t for t = 1, ….,N is assumed to be Gaussian white noise. Equation (2) is with constant, no trend while equation (3) is with both constant and trend. The number of lagged term p is chosen to ensure the errors are uncorrelated. If, $\alpha_1 = 0$, the time series is non-stationary so that standard asymptotic analysis cannot be used to obtain the distribution of the test statistics (Whistler *et al.*, 2001). In this study, the two forms of ADF tests were carried out, using the unit root test procedure in EViews 3.1.

Having ascertained that all the series in the economic model are non-stationary in their level, but stationary in their first difference, it became obvious that least square technique would not be appropriate for the estimation of the economic model. Thus, bearing in mind the need to accommodate the interdependence of relationships between most economic variables, the economic model was re-conceptualised as a vector autoregressive system (4), allowing for the possibility of cointegration among the endogenous variables.

$$\Delta y_t = Bx_t + \sum_{i=1}^{4} \Gamma_i \Delta y_{t-1} + \Pi y_{t-1} + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \; 4$$

where

x is vector of deterministic variables, constant (C) and/or trend;

y is vector of I(1) endogenous variables – lnQ, $\ln P^D$, lnE, $\ln P^W$ and $\ln Y^W$.

B, Γ and Π are matrices of coefficients to be estimated, while

e is vector of stochastic residuals.

Terms in B give the influence of the associated deterministic variables, while Γ represent short-term elasticities of response. And, where evidence of r<5 cointegrating relations exists, by Granger causality theorem, $\Pi = \alpha\beta'$; in which case β is the cointegrating vector (containing the long-run elasticities), while elements of α are the adjustment parameters in the

vector error correction model.

Cointegration Test

The next stage in the modelling technique was to test for cointegration among the endogenous variables in the VAR system. This was implemented using the Johansen (1992, 1995b) system based techniques in EViews. The test utilises a trace statistic based likelihood-ratio (LR) test for the number of cointegrating vectors in the system. In implementing the Johansen technique however, two main issues had to be addressed. The first is the choice of the optimal lag length in the VAR system. Noting that the lag length ought to be set long enough to ensure that the residuals are white noise (EViews, 1998), and considering limitations imposed by the data, this study stuck to the use of two lags in the VAR.

A second issue that had to be addressed was whether deterministic variables such as a constant and/or trend should enter into the long-run cointegrating space or the short-run model. Arize *et al.* (2000) noted that there are, in general, three possible ways of incorporating these deterministic components into an analysis: (1) If there are no linear trends in the levels of the data, the most restrictive specification would be to allow a constant in the cointegration space only simply in order to account for the units of measurement of the variables. (2) Where linear trends are present in the levels of the data, a less restrictive option would be to permit a constant in both the cointegration space and the short-run model. And (3), if quadratic deterministic trends are absent in the levels of the variables (which is not usually a possible long-run outcome), the least restrictive specification would be to force the trend term to lie in the cointegration space so that any long-run linear growth is captured by a linear deterministic trend in levels.

EViews provides facilities for conducting, and comparing, cointegration tests based on five scenarios that accommodates above suggestions. These may be listed, from the most restrictive to the least restrictive options, as follows:

Option A: Assumes no deterministic trend in the data, and allows no intercept nor trend in the cointegrating equation (CE) or test VAR;

Option B: Also assumes no deterministic trend in the data, and allows intercept (no trend) in the CE and no intercept in the VAR;

Option C: Allows for linear deterministic trend in the data, with intercept (no trend) in the CE and test VAR;

Option D: Allows for linear deterministic trend in the data, with intercept and trend in the CE but no trend in the VAR;

Option E: Allows for quadratic deterministic trend in the data, with intercept and trend in the CE and linear trend in the VAR.

Because significant trends were found in most series in the model (Table 1), this study's option is limited to only C and D. The final choice between options C and D was based on application of the so-called

Pantula principle (Johansen, 1992), which permits joint test of the rank order of the long-run matrix and the presence of deterministic components. This involved estimation of all the possible specifications, and conducting Johansen's likelihood-ratio tests for the rank order of the long-run matrix sequentially from the most restrictive to the least restrictive specification. The first time the null hypothesis is not rejected indicates both the rank order of the long-run matrix and the appropriate specification for the deterministic components (Arize *et al.*, 2000).

The final stage of the analyses, haven established that more than one cointegrating vector existed in the data, was to estimate the restricted VAR in (4) using the VECM facility in E-view.

RESULTS AND DISCUSSION

Results of Unit Root Tests

Table 1 summarises results of Augmented Dickey-Fuller (ADF) unit root tests on the levels and first difference of the economic series in the study. Two main evidences emerged from these tests. First, all the variables, except the index of world GDP (lnY^W), had t-values that was lower than the critical value for rejection of unit root at $p<0.05$, when examined at their levels using both the ADF regression with and without trend terms. At their first difference however, the entire variables had t-coefficients greater than the critical values. This shows that the series are generally I(1) series, and could not be appropriately included at their levels in least square regressions. Thus, the appropriate modelling technique for Nigeria's agricultural export supply response would be to specify a VAR system as in (4), and where evidence of cointegration exists, the relations should be estimated by VECM.

Table 1: Results of Augmented Dickey-Fuller Unit root tests

Variable	Tests on levels of series		Tests on first difference of series	
	t-value on ADF regression without trend	t-value on ADF regression with trend	t-value on ADF regression without trend	t-value on ADF regression with trend
LnQ	-2.28	-1.78	-4.48**	-5.00**
lnPD	0.79	-1.54[t]	-4.85**	-5.12**
LnE	-1.29	-1.64[t]	-3.61*	-4.43**
lnPW	-2.40	-2.57	-4.00**	-4.06*
lnYW	-1.49	-3.47*[t]	-4.23**	-4.42**

Critical values reported by e-views at $p<0.01$ ($p<0.05$) was -3.67 (-2.96) for ADF regressions without trend, and -4.29 (-3.57) for ADF regressions with trend terms.
* and ** indicates rejection of unit root hypothesis at $p<0.05$ and $p<0.01$ respectively.
[t] indicates that the trend term was significant ($p<0.10$) in ADF regression in levels of the series.

The second important evidence from the unit root tests relates to the presence of significant ($p<0.10$) trends in the levels of three out of the five series in the model (index of domestic prices, nominal effective exchange rates indices and index of world GDP). The main import of this is that it would be necessary to explore the influence of a deterministic trend in the cointegration tests, and possibly in the final VECM to be estimated.

Results of Cointegration Tests

Table 2 summarises the Johansen (1992, 1995a) based cointegration tests applied on variables in the economic model assuming each of the two candidate specifications of the deterministic components. This permits Pantula-based joint tests of the deterministic specification and rank of the cointegrating vectors.

Table 2: Results of the joint tests of deterministic specifications and cointegrating rank of agricultural export supply model for Nigeria

Hypothesized No. of CE(s)	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value
MODEL C: Allows intercept (No trend) in the CE and test VAR			
None **	99.45036	68.52	76.07
At most 1 *	53.98887	47.21	54.46
At most 2	27.74238	29.68	35.65
At most 3	12.60553	15.41	20.04
At most 4	0.953037	3.76	6.65
MODEL D: Allows intercept and trend in the CE no trend in the test VAR			
None **	118.4786	87.31	96.58
At most 1 **	72.82293	62.99	70.05
At most 2 *	46.00198	42.44	48.45
At most 3	22.34333	25.32	30.45
At most 4	7.219135	12.25	16.26

*(**) denotes rejection of the hypothesis at 5% (1%) level of significance

Examining the results in Table 2, it is apparent that the null hypothesis of no cointegrating equation (CE) is rejected at 1% level under both deterministic specifications, just as the null hypothesis of at most one CE is rejected at 5% level in both. However, while the null hypothesis of no more than two CE could not be rejected at 5% level in model C, this hypothesis is rejected in model D. Thus, application of the Pantula principle reveals that the study data supports the use of a vector error correction model (VECM) with intercept (no trend) in both the CE and VAR. By this specification, the Johansen (1992, 1995a) based likelihood ratio tests revealed that

two cointegrating equations exist among variables in the economic model.

VECM Results

Following the evidence from the cointegration tests, the statistical model (4) was estimated by VECM procedure in Eviews, with two cointegrating restrictions imposed. The normalisation adopted was in respect of the index of quantities and domestic prices of Nigeria's agricultural export commodities. Equation (5) presents the set of normalised cointegrating equations describing the long-run (equilibrium) relationships between the relevant trade variables in the VECM, while Table 3 present the short-run responses.

$$\ln Q = 39.4973 - \underset{(-2.85)}{0.6035}\ln E + \underset{(0.86)}{0.2477}\ln P^W - \underset{(-2.23)}{7.3199}\ln Y^W$$

$$\ln P^D = 17.9903 - \underset{(-5.48)}{1.2103}\ln E + \underset{(3.41)}{1.0240}\ln P^W - \underset{(-1.10)}{3.7798}\ln Y^W \quad \ldots\ldots\ldots\ldots\ldots\ldots\ 5$$

Note: Figures in parentheses are t-values of associated estimates

All the variables, except the index of world GDP, had long-run elasticities that are consistent with *a-priori* expectations. Coefficients associated with the index of nominal effective exchange rate were negative and significant in both the export quantities and domestic price equations. The results indicate that one per cent (1%) reduction in the nominal effective exchange rate index results in 0.6% increase in equilibrium export quantity index and 1.2% increase in the domestic price index. However, given that the equilibrium export quantity response is exchange rate - inelastic, policies/economic conditions that cause Naira to depreciate relative to other international currencies will lead to long run reduction in real value of Nigeria's agricultural exports, despite the fact that such exchange rate depreciation will raise producer prices and Naira value (nominal income) of Nigeria's agricultural exports. Thus, like every producer whose equilibrium quantity supply/demand is price inelastic, Nigeria's real agricultural export earnings would be enhance in the long-run, if she promotes policies that strengthen Naira as against devaluation.

Focusing on response to changes in the world prices, evidence in equation (5) shows that 1% increase in average world price of Nigeria's agricultural export tends to cause 0.25% increase in agricultural export quantities, while inducing almost equal (1.02%) proportionate increase in domestic prices of Nigeria's export. The inelastic agricultural export supply response to price changes is consistent with the fact that export crops are usually of long gestations making it almost impossible for farmers to respond immediately to price incentives.

Increase in the world's real GDP was found to be associated with significant long-run reduction in Nigeria's equilibrium agricultural export quantities and domestic prices, which goes against *a-priori* expectations. This suggests that Nigeria's agricultural export is treated, more or less, as inferior good by the outside world, which may not be unconnected with the fact that Nigeria' agricultural export commodities are largely exported raw, with little or no value addition.

Table 3: Estimates of short-run of components of Vector Error Correction Model of Nigeria's agricultural export supply response

Error Correction:	D(lnQ)	D(lnPD)	D(lnE)	D(lnPW)	D(lnYW)
CointEq1	-0.987554 (-5.91962)	0.851467 (1.10608)	-0.547347 (-0.97479)	-0.067161 (-0.21106)	-0.019758 (-1.17778)
CointEq2	0.920901 (6.34975)	-0.701492 (-1.04822)	0.177154 (0.36292)	-0.101954 (-0.36856)	0.008587 (0.58882)
D(lnQ(-1))	-0.145371 (-0.99048)	0.505424 (0.74629)	-0.584214 (-1.18265)	-0.008496 (-0.03035)	0.009162 (0.62080)
D(lnQ(-2))	-0.353542 (-2.65353)	0.267710 (0.43544)	0.124806 (0.27831)	0.276171 (1.08673)	-0.005195 (-0.38773)
$D(\ln P^D(-1))$	-0.923940 (-4.09950)	0.208339 (0.20033)	-0.038170 (-0.05032)	0.249514 (0.58042)	-0.018276 (-0.80638)
$D(\ln P^D(-2))$	-0.619747 (-3.21084)	0.518483 (0.58214)	-0.395939 (-0.60946)	-0.018316 (-0.04975)	-0.000637 (-0.03283)
D(lnE(-1))	-0.868203 (-3.65520)	0.080953 (0.07386)	0.118669 (0.14844)	0.448184 (0.98925)	-0.026017 (-1.08925)
D(lnE(-2))	-0.622890 (-2.78101)	0.771167 (0.74615)	-0.704494 (-0.93451)	-0.063280 (-0.14812)	0.000180 (0.00799)
$D(\ln P^W(-1))$	0.449732 (2.06483)	-0.344830 (-0.34310)	0.300870 (0.41042)	-0.350637 (-0.84401)	0.016393 (0.74846)
$D(\ln P^W(-2))$	0.252562 (1.27632)	-0.044123 (-0.04832)	-0.009828 (-0.01476)	-0.151708 (-0.40194)	0.014596 (0.73354)
$D(\ln Y^W(-1))$	-0.881750 (-0.39895)	-0.118665 (-0.01164)	1.106334 (0.14872)	3.943253 (0.93539)	0.291128 (1.30992)
$D(\ln Y^W(-2))$	3.756951 (1.80408)	-6.051296 (-0.62973)	-4.104718 (-0.58562)	-9.541230 (-2.40206)	-0.312271 (-1.49119)
C	-0.087300 (-1.07170)	0.473631 (1.26004)	-0.171314 (-0.62484)	0.242252 (1.55916)	0.028025 (3.42135)
Adj. R-squared	0.747142	-0.197562	-0.004227	-0.082625	0.087824
F-statistic	8.140757	0.601322	0.989829	0.815563	1.232675
Log likelihood	28.10113	-17.77430	-8.308578	8.729060	97.01171

Note: Figures in parentheses are t-values of associated estimates

Focusing on results of the short-run components of the VECM presented in Table 3, the only robust equation is the one involving short-run movements in the export quantities, given that all other equations had very low R^2 values. Besides, the adjustment coefficients were not significant in all these other equations, which imply that these variables do not exhibit significant adjustments to export quantity and price shocks, as to warrant their error correction modelling.

The regressors in the short-run export quantity equation accounted for as much as about 75% of the variations in the short-run export quantity supply responses. The two adjustment coefficients were also significant at one percent level. Almost all (i.e. 98.7%) of export quantity supply adjustment to any dis-equilibrium caused by export quantity shocks is corrected within the immediate year after the shock. Export quantity response to the Naira denominated Nigeria's export price shocks however occurs in the same direction with that of the cause of price shocks. This point to the need for domestic price stabilisation measures for meaningful long-run growth in agricultural exports quantities in Nigeria.

With respect to the short-term export quantity supply responses to short-run changes in its determinants, the VECM results suggest that the combined short-run elasticities of response to increases in domestic price of Nigeria's agricultural export, stronger Naira, average world price and the world's real GDP are -1.54, -1.49, 0.70 and 2.58 respectively. Thus, the short-term effect of 1% devaluation / depreciation of Naira is a more than the proportionate (1.54%) increase in export quantity supply, while 1% increase in domestic price of Nigeria's agricultural export results in a more than proportionate (1.49%) short-term reduction in agricultural export quantities. In the same vein, increases in global economic activities and higher world prices were indicated as stimulating increases in short-run export quantity supply.

Comparing the short-run and long-run export quantity response elasticities, results in this study shows that the long-run effects of exchange rate depreciation and export prices are generally smaller (and inelastic) than the short-run response, which is elastic. When this result is appraised against the background that the adjustment coefficients in the VECM are very close to unity, it becomes obvious that initial increases in export quantity supply that may arise from policy induced exchange rate depreciation tends to be short-lived. This is because Nigerians respond by raising domestic export prices, which in turn discourages foreign demand and lower agricultural export quantities. Given that long-run exchange rate effect is inelastic, policies aimed at causing depreciation of Naira may only stimulate increased export earnings in the short-run: on the long-run, they tend to worsen the nations real agricultural export earnings.

SUMMARY AND CONCLUSION

Against a background of the poor non-oil export response to trade reforms in Nigeria, and recent development in time series modelling that points to a need to review previous research efforts aimed at explaining the trade behaviour in Nigeria, this study adopted cointegration and vector error correction modelling framework in ana-

lysing agricultural export supply response in Nigeria. The main conclusions from the study and policy implications are as follows:

First, virtually all the time series commonly included in trade models were found to be non-stationary in their levels, a result which is consistent with macroeconomic literature (Nelson and Plosser, 1982). Thus, meaningful agricultural export supply modelling in Nigeria must take the non-stationarity of the series into consideration. Otherwise, application of least square would leads to spurious regression.

Second, while linear combinations of the series on Nigeria's agricultural exports quantities and its determinants (export prices, exchange rate, world prices, world real GDP, etc) were stationary, thus exhibiting long-run equilibrium relationships, the study found multiple cointegrating vectors in all variants of the VAR system specified. The main import of this is that agricultural exports modelling for Nigeria are better cast within the simultaneous equations frameworks, such as the VECM, as to appropriately incorporate the structural interdependence among the trade variables.

Third, while in the short-run, agricultural export quantities share positive relationship with the world's GDP and average export prices, and negative relationship with the nominal effective exchange rate and export prices in Nigeria, with elastic price/exchange rate effects; the response in the long-run were generally smaller and inelastic such that real export revenue in the long run, tends to decline with Naira depreciation. This partly explain the rather poor agricultural export response to trade reforms in Nigeria, which has been centred around market deregulation that tacitly support continuous depreciation of Naira against the major foreign currencies.

Fourth, adjustment coefficients associated with the error correction terms in the model were very close to an absolute value of one. Thus, agricultural export quantities adjust very quickly (taking about a year) to short-run shocks to the equilibrium export relations, such that while the observed elastic short-run response may results in some short-run income gains, such gains tend to be eroded within a year as the export relations returns to its in-elastic long-run equilibrium.

The fifth finding had to do with a negative long-run world income effect on Nigeria's agricultural export supply. This point strongly to the possibility that Nigeria's agricultural export commodities are largely treated as inferior commodities by the importing countries, such that as the world's income increases, less of Nigeria's agricultural exports are demanded.

In view of the above findings, the study recommends that governments policies aimed at enhancing real value of Nigeria's agricultural exports should promote (a) a stronger / stable Naira, (b) stable domestic price levels, and (c) improved product quality. Emphasis may also be shifted to increased value addition for Nigeria's agricultural exports.

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