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ON THE INTERACTION BETWEEN EXPORT PROMOTION AND AGRICULTURAL GROWTH IN POVERTY REDUCTION IN NIGERIA: EMPIRICAL EVIDENCE FOR THE PERIOD 1980-2016

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This paper examines the interactive effect of export promotion policies and agricultural output growth on the poverty level in Nigeria for the period 1980 to 2016 using the Autoregressive Distributed Lag Approach (ARDL) approach. Our results can be summarized as follows. First, the interaction of export promotion and agricultural output growth is associated with a lower poverty level in Nigeria in the long and short run. Second, agricultural output growth has a poverty-reducing effect in Nigeria in the long run. Three, export promotion policies aid poverty reduction in the long run. Finally, non-agricultural output growth, inflation, and population growth increase poverty in Nigeria. The findings from the study underlie the importance of integrating agricultural output growth and export promotion schemes in poverty-alleviation process in Nigeria.

Keywords: Agricultural Output, export promotion, poverty reduction ARDL, Nigeria
JEL Classification: Q18, F63, I32

1. INTRODUCTION

The United Nation's sustainable goals (SDGs) of 2015 outline a collection of seventeen global goals for 2030. The broad goals are interrelated though each has its targets to achieve. However, in general, all the seventeen goals aim to accelerate human development, climate change, and reduce poverty. To achieve these goals, governments in developing countries have initiated several economic measures in the various sectors of their economies. In Nigeria, the present government places particular focus on the agricultural sector. Governments have initiated several measures to develop the rural areas, modernize agriculture, and boost agricultural production. The emphasis on agriculture is anchored on the argument that the growth in agriculture is highly beneficial for poverty reduction.

Theoretically, several channels through which agricultural growth reduces poverty have been identified. First, agricultural growth could lead to higher incomes for farmers, including smallholders. Secondly, increased agrarian production helps in boosting the demand for farm labour due to either increased frequency of cropping and, or expansion in the cultivated land area. Thirdly, increased employment and income in the rural areas, allow not only for improved nutrition and health, but also increased investment in education. In general, improved welfare of the rural populace will positively impact rural labour productivity. Fourthly, increased agricultural growth can help to reduce prices of food and raw materials, raise rural wages of the urban poor, and promote increased savings and investment in both farm and non-farm sectors.

Empirically, some studies have confirmed the pro-poor bias of agricultural growth (Datt and Ravallion, 1996; Wodon, 1999; Coxhead and Warr, 1991; de Franco and Godoy, 1993; Irz et al., 2001). However, one could argue that for Nigeria, at least, agricultural growth effects have been limited over the years for some reasons. The incidence of poverty is high and rising in the rural sector of the economy where agriculture dominates. Two, the discovery and production of oil in large quantities have affected the classical intersectoral linkages making it difficult for agriculture to generate growth necessary for rapid poverty reduction. Third, the subsistence nature of agriculture in the rural areas, with emphasis on food crops production. This development perhaps explains government's focus on export promotion schemes to boost agricultural growth in the country.

Indeed, several export promotion schemes were initiated and implemented between 1980 and 2016. Some specific projects and policies implemented to transform the rural areas and boost agricultural production include the National accelerated food production programme (NAFPP), agricultural development projects (ADP), River Basin Development Authorities (RBDA). Other macroeconomic policies instituted to enhance efficiency and boost output in the agricultural sector include exchange rate depreciation, increased credit to the sector through such programmes as the agricultural credit guaranteed scheme and CBN Anchor Borrower Fund[1]. In addition to the promotion of increased foreign direct investment inflow in the agricultural sector, the government increased its level of capital expenditure in the sector by acquiring more farming equipment and by constructing more storage and irrigation facilities.

The literature is rich in studies analyzing the direct effects of agricultural growth and export promotion individually on poverty reduction (Gallup et al., 1997; Mellor, 1999; Suryahadi and Hadiwadjaja, 2011; Oni, 2014). However, none of the existing studies have analyzed the interactive effect of export promotion and agricultural growth on poverty to test the proposition that the poverty reduction effect of export promotion is better felt when agricultural output increases in the economy.

Moreover, most of the existing studies adopted narrow measurements of poverty and

[1] The CBN Anchor Borrower programme is designed by the Federal Government in collaboration with the Central Bank of Nigeria (CBN) to grant loans to rice farmers in the country to boost rice production and reduce the importation of rice.

export promotion schemes. Poverty is a multidimensional concept that encapsulates deprivation in several dimensions. Moreover, as contained in the literature, as many agricultural export promotion schemes are adopted simultaneously, a broader measure that combines few actions will most likely perform better. To overcome these gaps in the existing studies, we construct a multidimensional measure of poverty and export promotion in this study and explore their interactive effects on poverty in Nigeria over the period 1980-2016[2].

The contribution of this study is twofold. First, it constructs comprehensive measures of both poverty and export promotion schemes. These new measures are new broader, and more selective than those used in the past; they are wider because they combine several measures of the two phenomena. Second, the paper analyses the interaction effects of agricultural growth and export promotion on poverty reduction. This is an area that has not been addressed in the literature.

The paper is organized as follows: Section 2 provides a capsule summary of existing studies on nexus among export promotion, agricultural growth, and poverty. Section 3 presents the methodology and the description of the data. Section 4 discusses the main findings of the study. Section 5 contains the conclusion.

2. LITERATURE REVIEW

This section provides the theoretical and empirical literature on the nexus between agricultural growth, export promotion and poverty reduction. The section is divided into three sub sections. Subsection 2.1 looks at the effects of agricultural output growth on poverty reduction. Subsection 2.2 examines the effects of export promotion schemes on poverty reduction. The last subsection explores the interactive effects of agricultural output growth and export promotion on poverty reduction.

2.1. Agricultural Growth and Poverty Reduction

Several theoretical and empirical studies have investigated the effects of agricultural growth on poverty reduction. Agricultural growth has long been recognized a vital instrument for poverty reduction. Theoretically, some channels through which agricultural output growth could positively impact poverty levels have been identified in the literature. These include increased food production, food price reduction, employment generation, reduced malnutrition level, and increased real income (Chirwa et al., 2008). Agriculture is critical to poverty reduction for two main reasons. First, the incidence of poverty is disproportionately high in developing countries, which still rely heavily on agriculture for output and employment (Grewal et al., 2012). Second, the

[2] However, for comparison, we equally examine the impact of each of the identified export promotion policies on poverty in Nigeria.

poorest households with little or no assets typically rely more on agriculture for survival. Thus, by providing a more significant share in the employment of the poor and the unskilled workforce, agriculture plays a crucial role in making economic growth more pro-poor.

However, how agricultural growth helps reduce poverty depends on many factors. These factors include the extent to which the poor have access to farmland and productive lands; the extent to which output prices are sustained; the degree to which rural labour depends on farm labouring and the ability to link to expending employment opportunities in good jobs in both agriculture and the rural non-farm economy (Janvry and Sadoulet, 2010; Irz et al., 2001).

Evidence in the empirical literature consistently shows that agricultural growth is highly effective in reducing poverty (Gallup et al., 1997; Thirtle et al., 2001). Janvry and Sadoulet (2010) found that growth in agriculture is nearly three times more effective in reducing poverty than in manufacturing and nearly doubled that of growth in construction. They found that labour productivity gains in agriculture (measured by the value-added per worker) were substantial in East Asia during 1993-2002, while rural poverty rates also fell sharply. They also found that growth in agricultural productivity had a significant positive effect on poverty reduction in the developing countries of Sub-Saharan Africa and other parts of Asia, but not so in Latin America and the Caribbean.

Ravallion and Datt (1996), for example, found that growth in agriculture and the rural economy has been highly beneficial to reducing rural poverty in India. Warr (2002) suggested that, in addition to employing unskilled workers, the agriculture sector also contributed to poverty reduction by stimulating growth in the secondary and tertiary sub-sectors. Salis et al. (2006) explored how farm productivity affects poverty and how various factor market constraints affect farm productivity. They found that agricultural productivity directly affected household consumption and hence overall poverty and welfare.

Corral et al. (2017) examined the impact of agricultural policies on poverty reduction in developing countries using the three Water Basins in Cape Verde. The results showed that the agricultural policies implemented assisted to diversify and enhance agricultural production with a significant positive impact on poverty reduction. However, the paper recommends the need for the policies to work jointly and in harmony with other economic sectors.

Some other studies also argued that growth of agricultural output and productivity perform the role of creating employment opportunities and reducing poverty, especially in developing countries (Sharma and Kumar, 2011; Smith and Haddad, 2002; Hazell and Ramasamy, 1991; Mellor, 2001; Mendali and Gunter, 2013; Cervantes-Godoy and Dewbre, 2010). Habito (2009) contended that growth in agriculture accompanied by investment in infrastructure, education, and health, has a significant positive effect on poverty. Kolawole and Omobitan (2014) and Oni (2014) asserted that agriculture is a crucial driver of growth with a high potential of reducing poverty among Nigerians.

However, in few African countries like Tanzania and Malawi, growth of the agricultural sector has been seen to have no significant link with poverty reduction, using poverty headcount ratio and population in poverty (Chirwa et al., 2008; Mashindano et al., 2011; Suryahadi and Hadiwidjaja, 2011).

However, Hasan and Quibria (2004) have cautioned against what they call the misplaced 'agricultural fundamentalism', which argues that agricultural growth always leads to more rapid poverty reduction. According to them, agriculture was the most effective driver of poverty reduction in South Asia and Sub-Saharan Africa. However, in East Asia, poverty reduction was driven by the growth of the industry sector. Also, they found that the services sector had the most significant impact on poverty reduction in Latin America.

2.2. Export Promotion and Poverty Reduction

In recent times, efforts at alleviating poverty have focussed on export promotion. Hence, the promotion or implementation of several exports promotion policies in many developing countries. Theoretically, the argument in the literature is that economic growth critical to poverty alleviation in the long run. However, exports constitute a major source of economic growth, especially in the developed and industrialised economies. By implication, exports must be promoted to achieve improved economic growth and poverty alleviation. The argument is that economic growth assists in creating the resources to raise incomes. Even if trickle-down is insufficient to bring the benefits to the poor, governments are in a better position to implement more robust redistributive measures with high and rising income.

Indeed, several studies have shown that exports aid economic growth, and that the fastest-growing countries are those that have expanded their shares of global exports in goods (Sach and Warner, 1995; Rajan and Zingales, 2003; Chang et al., 2009; Kim, 2011; and Jouini, 2015). It is noted in the literature that exports and export promotion impact poverty-alleviation through income, expenditure and productivity channels.

In contrast, there is the argument that export promotion may not necessarily lead to economic growth and poverty reduction. In particular, where exports and export promotion are produced in enclaves that bring little or no new livelihoods to the people, income may not be positively affected. Moreover, export promotion policies designed to promote raw, unprocessed materials will not have a significant poverty-reduction effect in the country[3].

Empirically, there is no consensus on the impact of exports and export promotion/liberalisation on poverty. Some studies found that trade liberalisation and export promotion improved economic growth but led to falling standards of living in

[3] For a comprehensive theoretical discussion on the relationship between exports /export liberalisation on growth and poverty, see the works of Babatunde et al. (2012), Winters (2002), Rajan (2002) and Porto (2003).

economies that heavily regulated new entry or imposed high costs on exiting or downsizing firms (Bolaky and Freund, 2004). Babatunde et al. (2012) found that agricultural exports could reduce poverty working through the channels of employment and agricultural productivity. The study by Maertens and Swinnen (2009) found that exports decreased extreme poverty by 50 percentage points, while regional poverty declined by 12 percentage points in Senegal.

The study by Topolova (2004) found that export promotion through trade liberalisation affected poverty. He established that lack of geographical mobility coupled with a lack of inter-sectoral mobility as changes in relative output prices led to changes in the relative sector returns to specific factors, which adversely affected income and poverty level in India. Fauzel (2020) examined trade and poverty in Mauritius. He found that trade measured as the ratio of exports and imports to GDP reduced poverty in the long run than the short run. In sum, while many studies find that exports and export promotion have a beneficial effect on poverty reduction, it may not be the overriding factor.

2.3. Numerical Implementation

Not many known studies have analysed the interactive impact of export promotion and agricultural growth on poverty. Most existing studies either looked at the direct effect of export promotion on agricultural output growth or the direct effect of agricultural growth on poverty. The absence of literature on the interactive effect of export promotion and agriculture growth on poverty might not be unconnected with the assumption of a perfect positive correlation between them. However, this assumption has been contested on two main grounds. The first argument is that the poverty-reduction effect of export promotion schemes is more visible in an agricultural output growth environment. The second argument is that export promotion may aggravate poverty, particularly where such a programme leads to increased production costs in the sub-sector.

In the literature, several studies have provided empirical support to the view that export promotion has been a driver of aggregate agricultural growth. For example, Wang (2005) assessed two export promotion programs for rice, namely the foreign market development program (FMDP) and the market access program (MAP) for Mexico, Costa Rica, and Honduras. The results showed that export promotion schemes were effective in Mexico and Honduras but not in Costa Rica. Other studies that have reported a positive effect of some specific export promotion policies on agricultural growth include Caballero and Corbo (1990), Haque and Kermal (2007), Opara (2010), Fu and Gao (2007), Baltensparger and Herger (2009), Efobi and Osabuohien (2011).

However, few studies have contested the efficiency of export promotion policy in boosting agricultural production and export (Hogan, Keesing and Singer, 1991; Weil, 1978). Wail (1978) identified two main weaknesses of export promotion as: lack of information about what services are needed by specific groups and insufficient financial resources. These deficiencies result in inability to target export assistance efforts to potential users effectively.

Studies on the interactive effect of agricultural growth on export promotion are scarce. Indeed, no known research has focussed on the interactive impact of agricultural output growth and export promotion schemes on poverty in Nigeria.

Theoretically, if export promotion policies improve agricultural output growth, then poverty is likely to be reduced. This reflects the potential complementarity between export promotion policies and agricultural output growth in reducing the level of poverty in the country. However, where export promotion policy is weak in boosting agricultural output growth, their interaction may not have a significant positive effect on poverty reduction. The coefficient of the interactive term is likely to be insignificant. Essentially, how the interaction between export promotion policy and agricultural output growth affects poverty is an empirical issue. In a situation where export promotion policy complements agricultural output growth, poverty is likely to be reduced. If otherwise, the interaction might not affect the poverty level significantly.

3. METHODOLOGY

3.1. Model

This section presents a co-integration method to examine the direct and interactive effects of agricultural output growth and export promotion strategy on poverty in Nigeria over 1980-2016. Specifically, we apply the ARDL bounds testing approach developed by Pesaran et al. (2001). Several features of the ARDL procedure commend it for use in our study. First, it can be applied even if variables are I(0), I(1), or mutually exclusive (Pesaran and Shin, 1999). Second, the variables under consideration can take different optimal lag lengths. Third, it can be used even in the presence of endogenous explanatory variables in the estimated model. Fourth, short-run and long-run coefficients can be estimated concurrently. Fifth, it yields robust results for a small sample data size (Akcay, 2018; Tinoco-Zermeno, Veneges-Martinez and Torres-Preciado, 2014).

To investigate the primary objective of the study, we estimate Equation (1) given below:

$$POV_t = \alpha_0 + \beta_1 EXP_t + \beta_2 AGDP_t + \beta_3 DE_t + \beta_4 NAGDP_t + \beta_5 INFL_t + \beta_6 POP_t + \beta_6 (AGDP_t \times EXP_t)_t + \mu_t, \quad (1)$$

where POV is the poverty index; $AGDP$ is agricultural GDP measured as the share of agriculture in the national output. EXP is a measure of export promotion that assumes either of the following variables: XP aggregate export promotion index generated through Principal Component Analysis (PCA), agricultural Credit Guarantee Scheme Fund, exchange rate, foreign direct investment in agriculture, government recurrent expenditure on agriculture and total government investment on farm machinery and other equipment. Other variables are non-agricultural output growth ($NAGDP$), inflation rate ($INFL$), development expenditure (DE), population (POP), the interaction of agricultural output growth and export promotion ($AGDP \times EXP$), and the error term μ_t.

The coefficients of the three key variables, namely export promotion index, agricultural growth and interaction variable are expected to be negative. The three variables are expected to have negative coefficients because agricultural production and export promotion programmes are designed boost farm produce and encourage exports. Mainly, they are to reduce the cost of production and enhance efficiency and productivity in the agricultural sector. When export promotion improves efficiency and output, farmers' income will improve with a positive impact on the poverty level. However, where agriculture operates majorly at the subsistence level, response to incentives by the operators in the sector might be prolonged and weak. Hence, export promotion programmes, in particular, may not produce the expected outcomes, particularly in the short run. Hence, the coefficient of export promotion index β_1 may be negative.

The coefficient of government capital expenditure β_3 is expected to be negative. Non-agricultural output growth is expected to reduce the level of poverty. Accordingly, β_4 should be negative. Inflation can increase poverty in three ways. First, the inflation tax can reduce disposable income. Second, if nominal wages increase less than the price of goods consumed by wage earners, workers' real income will decline. Third, a high rate of inflation increases inputs' prices and, ultimately, the costs of production. Hence, β_5 is expected to be positive. Population growth can have either a positive or negative effect on poverty. The coefficient is indeterminate. Based on the bounds-testing approach proposed by Pesaran and Smith (1998) and Pesaran et al. (2001), the long-run relationship is expressed as:

$$\begin{aligned}\Delta POV_t = {} & \beta_0 + \sum_{i=1}^{q_1} \gamma_i \Delta POV_{t-i} + \sum_{i=0}^{q_1} \partial_i \Delta EXP_{t-i} + \sum_{i=0}^{q_2} \delta_i \Delta AGDP_{t-i} \\ & + \sum_{i=0}^{q_3} \rho_i \Delta DE_{t-i} + \sum_{i=0}^{q_4} \vartheta_i NAGDP_{t-i} + \sum_{i=0}^{q_5} \theta_i \Delta INFL_{t-i} \\ & + \sum_{i=0}^{q_6} \psi_i \Delta POP_{t-i} + \sum_{i=0}^{q_7} \Gamma_i \Delta AGDP_{t-i} \times EXP_{t-i} + \varphi_0 POV_{t-1} \\ & + \varphi_1 EXP_{t-1} + \varphi_2 AGDP_{t-1} + \varphi_3 DE_{t-1} + \varphi_4 NAGDP_{t-1} + \varphi_5 INFL_{t-1} \\ & + \varphi_6 POP_{t-1} + \varphi_7 AGDP_{t-i} \times EXP_{t-i} + \varepsilon_t, \qquad (2)\end{aligned}$$

where q is the optimal lag length, and Δ refers to the first difference of variables.

The hypothesis for testing the existence of any long-run co-integration among the variables in the model is given thus:

$$H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = \varphi_6 = \varphi_7 = 0,$$

$$H_1: \varphi_1 \neq 0, \varphi_2 \neq 0, \varphi_3 \neq 0, \varphi_4 \neq 0, \varphi_5 \neq 0, \varphi_6 \neq 0, \varphi_7 \neq 0.$$

Equation (3) states the joint null hypothesis of no cointegration against the existence of co-integration between poverty and the set of explanatory variables.

Given that there is co-integration, the short-run model is stated as:

$$\begin{aligned}\Delta POV_t = \beta_0 + \textstyle\sum_{i=1}^{q_1} \gamma_i \Delta POV_{t-i} + \sum_{i=0}^{q_1} \partial_i \Delta EXP_{t-i} + \sum_{i=0}^{q_2} \delta_i \Delta AGDP_{t-i} \\ + \textstyle\sum_{i=0}^{q_3} \rho_i \Delta DE_{t-i} + \sum_{i=0}^{q_4} \vartheta_i NAGDP_{t-i} + \sum_{i=0}^{q_5} \theta_i \Delta INFL_{t-i} \\ + \textstyle\sum_{i=0}^{q_6} \psi_i \Delta POP_{t-i} + \sum_{i=0}^{q_7} \Gamma_i \Delta AGDP_{t-i} * EXP_{t-i} + \lambda ECM_{t-1} + \mu_t, \qquad (3)\end{aligned}$$

where ECM_{t-1} is the error correction term, which is given as:

$$\begin{aligned}ECM_{t-1} = POV_{t-i} - (\varphi_1 EXP_{t-1} + \varphi_2 AGDP_{t-1} + \varphi_3 DE_{t-1} + \varphi_4 NAGDP_{t-1} \\ + \varphi_5 INFL_{t-1} + \varphi_6 POP_{t-1} + \varphi_7 AGDP_{t-i} * EXP_{t-i}). \qquad (4)\end{aligned}$$

The coefficients $\gamma_i, \partial_i, \delta_i, \rho_i, \vartheta_i, \theta_i, \psi_i$ and Γ_i denote the short-run dynamics of the variables, while the coefficient $\varphi_1 (i = 1, 2, 3, 4, 5, 6, 7)$ indicate the long-term dynamics. The term λ is the coefficient of correction in disequilibrium.

3.2. Data Sources and Measurement

This paper uses annual time series data ranging from 1980 to 2016. AGDP is the agricultural output share of gross domestic product comprising output from crop production, forestry, livestock, and fishery. NAGDP is non-agricultural GDP. INFL is the rate of inflation measured as the consumer price index. POP is the total population; DE is development expenditure measured as the sum of all items of expenditure on infrastructure proxied by the amount of capital spending in the economy. XP and POV are indices for export promotion and poverty, respectively, computed by principal component analysis.

Data were sourced from the World Bank, World Development Indicators, 2017 Edition, United Nations Conference on Trade and Development (UNCTAD) Statistics, database, Central Bank of Nigeria (CBN) Statistical Bulletin, 2017 edition. The data on Agricultural Credit Guarantee Scheme Fund, exchange rate, capital and recurrent expenditure in agriculture, total government capital expenditure in agriculture, and inflation were sourced from the Central Bank of Nigeria Statistical Bulletin 2017 edition.

3.2. Construction of Poverty and Export Promotion Indices

Many export promotion schemes were adopted in Nigeria over the study period. It is possible to assess the effects of these schemes simultaneously; however, this may not be plausible as some of them are often correlated. Hence, the need to construct a comprehensive measure of export promotion policies of the government. In this study, we used five different aspects of export promotion packages. The five components are, namely Agricultural Credit Guarantee Scheme Fund ($ACGSF$), the exchange rate (EXC), government capital expenditure in the agricultural sector ($AMACH$), government recurrent expenditure in the agricultural sector ($AEXP$), and foreign direct investment in the agricultural sector ($AFDI$). In the same way, to avoid the problem associated with the narrow definition of poverty, the study employs a multidimensional measure of poverty. We use a PCA to compute the poverty index from Human Development Indicators, namely, life expectancy at birth, rural development measured by agricultural value-added per worker, real per capita GDP, and consumption per capita.

Table 1. Construction of Export Promotion Index

Test for Factorability

Determinant of the matrix of correlation	0.002
Barlett's test for sphericity	215.584 (0.000)***
Kaiser-Meyer-Oklin measure	0.670

Principal Components/Correlation

Component	Eigenvalue	Difference	Proportion	Cumulative	
Comp1	3.834	3.120	0.766	0.766	Number of Obs = 37
Comp2	0.713	0.408	0.142	0.909	Number of comp. = 5
Comp3	0.305	0.192	0.061	0.971	Trace= 5
Comp4	0.113	0.078	0.022	0.993	Rotation: (unrotated = principal)
Comp5	0.034		0.007	1.000	Rho = 1.0000

Principal Components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Unexplained
$ACGSF$	0.492	0.096	0.252	0.556	-0.612	0
EXC	-0.322	0.901	0.253	0.107	0.084	0
$AFDI$	0.477	0.186	0.325	-0.778	-0.160	0
$AEXD$	0.425	0.377	-0.820	-0.004	0.058	0
$AMACH$	0.496	-0.012	0.304	0.270	0.766	0

Source: Authors' computation.

However, before proceeding with the PCA, we check the factorability of variables with Bartlett's test for sphericity and the Kaiser-Meyer-Oklin (KMO) coefficient. The Bartlett's test converts the calculated determinants of the matrix to a χ^2 statistic, which is then tested for significance (Tinoco-Zermeno et al., 2014). The null hypothesis of the test is that variables are non-collinear. The Kaiser-Meyer-Oklin (KMO) test, on the other hand, entails the comparison of the size of the variables' correlation coefficients with the size of the partial correlation coefficients. In the KMO test, a minimum value of 0.60 is necessary for an acceptable PCA. The results in table 1 show the results from Bartlett's and KMO tests and the PCA for export promotion scheme index. On the other hand, Table 2 provides the results from Bartlett's and KMO tests and the PCA for poverty index. The results in table 1 show that the five variables can be grouped into another set of factors using PCA. The same applies to the four variables used to generate the poverty index in Table 2. In both cases, the KMOs exceed the minimum value of 0.60, and the Barlett test significant. The values of the first PCA in both cases are used to calculate the weights for the export promotion scheme index and poverty index, respectively.

Table 2. Construction of poverty index

Test for Factorability	
Determinant of the matrix of correlation	0.013
Barlett's test for sphericity	146.307 (0.000)***
Kaiser-Meyer-Oklin measure	0.810

Principal Components/Correlation					
Component	Eigenvalue	Difference	Proportion	Cumulative	
Comp1	3.449	2.986	0.862	0.862	Number of Obs = 37 Number of comp. = 4 Trace= 4 Rotation: (unrotated = principal) Rho = 1.0000
Comp2	0.463	0.390	0.115	0.978	
Comp3	0.072	0.057	0.018	0.996	
Comp4	0.014	.	0.003	1.000	

Principal Components (eigenvectors)					
Variable	Comp1	Comp2	Comp3	Comp4	Unexplained
$CPER$	0.436	0.853	0.268	0.098	0
$LEXP$	0.519	-0.364	0.031	0.773	0
$GDPPC$	0.525	0.015	-0.790	-0.314	0
$AVAPC$	0.513	-0.373	0.550	-0.542	0

Source: Authors' computation.

Data were sourced from World Bank, World Development Indicators, 2017 Edition, United Nations Conference on Trade and Development (UNCTAD) Statistics, database, Central Bank of Nigeria (CBN) Statistical Bulletin, 2017 edition. Specifically, data on Agricultural Credit Guarantee Scheme Fund, exchange rate, capital and recurrent expenditure in agriculture, total government capital expenditure in agriculture, and inflation were sourced from Central Bank of Nigeria Statistical Bulletin 2017 edition.

Before examining the ARDL results, we present the descriptive statistics of all the variables used in the empirical model in Tables 3. Table 3 shows that for all variables except $AEXP$, the mean and median values are very close, which indicates symmetry. All variables are positively skewed except for $AFDI$, DE and the interaction term $AGDP \times AEXP$. From the kurtosis statistic, the table shows that the distribution of eight variables is flat relative to normal as their kurtosis is less than 3. These variables are $ACGSF$, $AFDI$, $AGDP \times ACGSF$, $AGDP \times AEXP$, POV, POP, DE and XP. The remaining variables namely; $AEXP$, $AGDP \times AFDI$, $AGDP \times AMACH$, $AGDP \times EXC$, EXC, $AGDP$, $NAGDP$, $INFL$ and $AGDP \times XP$ are peaked relative to the normal with kurtosis exceeding 3.

4. DATA ANALYSIS AND EMPIRICAL RESULTS

To check the stationarity properties of the variables, we use the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1981) and Phillip-Peron (PP) (Phillips and Perron, 1988) tests. Table 4 reports the unit root tests for all the variables employed in the study.

Table 3. Unit Root Test Results

Variables	Augmented Dickey-Fuller			Philip-Peron		
	Levels	1st Diff	Rmks	Levels	1st Diff	Rmks
$ACGSF$	-0.493	-5.702***	I(1)	-0.493	-5.695***	I(1)
$AEXP$	-2.794*		I(0)	-2.668*		I(0)
$AFDI$	-1.166	-2.245*	I(1)	-1.181	-5.863***	I(1)
$AGDP$	-2.041	-8.662***	I(1)	-2.192	-8.668***	I(1)
$AGDP * ACGSF$	-0.821	-7.891***	I(1)	-0.728	-9.108***	I(1)
$AGDP * AEXP$	-1.446	-8.398***	I(1)	-1.696	-11.225***	I(1)
$AGDP * AFDI$	-1.558	-8.418***	I(1)	-1.556	-8.418***	I(1)
$AGDP * AMACH$	-2.000	-8.822***	I(1)	0.795	-9.032***	I(1)
$AGDP * EXC$	-1.723	-6.940***	I(1)	-2.200	-6.890***	I(1)
$AGDP * XP$	4.458	1.187***	I(1)	-0.186	-5.950***	I(1)
$AMACH$	-7.213***		I(0)	-5.265***		I(0)
DE	-1.289	-5.915***	I(1)	-1.273	-5.962***	I(1)
EXC	-1.821	-4.090***	I(1)	-1.939	-4.065***	I(1)
$INFL$	-2.906*		I(0)	-2.820*		I(0)
$NAGDP$	-0.631	-6.872***	I(1)	-0.631	-6.872***	I(1)
POP	-0.502	-4.538***	I(1)	1.110	-2.331*	I(1)
POV	2.526	-4.604***	I(1)	2.389	-4.659***	I(1)
XP	-0.493	-5.702***	I(1)	-1.259	-5.695***	I(1)

Notes: ***,**, * indicates level of significance at 1%, 5% and 10% respectively. The unit root was conducted with intercept and no trend. All variables are as earlier defined.

The results in Table 3 show a mix of both I(1) and I(0) variables, which allows for the ARDL approach. The results of the Phillips–Perron and ADF unit root tests are similar in all respects. Three variables, namely $AEXP$, $AMACH$, and $INFL$ are stationary at level using both ADF and PP tests. The remaining variables apart from the three above are stationary and integrated at first difference.

Next, we test the presence of long-run relationships among the variables used. Table 4 reports the results of the ARDL bounds co-integration test. The Wald tests (F-test) for the joint null hypothesis that the coefficients of the lagged variables in the level form are zero (no co-integration between the variables), and the results of the calculated F-statistic and the value for both upper and lower bounds are shown in Table 4. In all the specifications (models 1- 13), the F-statistic ranging from 4.001 to 12.119 are higher than the upper critical bound, as shown in Table 4. This finding implies rejecting the null hypothesis of no co-integration for all the models at the 5% significance level. This result indicates that there is a unique, non-spurious, and stable long-run relationship among the variables.

Table 4. Testing for Long-run Co-integration; F statistic

Model 1: (Dependent variable: POV)			F-Statistic
F(AGDP, NAGDP, POP, INFL, DE)			4.52
	Critical Values (K=5; n=34)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.79	2.75
	5%	4.25	3.12
Model 2: (Dependent variable: POV)			F-Statistic
F(AGDP, ACGSF, NAGDP, POP, INFL, DE)			4.37
	Critical Values (K=6; n=34)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.23	2.12
	5%	3.61	2.45
Model 3: (Dependent variable: POV)			F-Statistic
F(AGDP, AEXP, NAGDP, POP, INFL, DE)			4.00
	Critical Values (K=6; n=34)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87
Model 4: (Dependent variable: POV)			F-Statistic
F(AGDP, AFDI, NAGDP, POP, INFL, DE)			4.76
	Critical Values (K=6; n=34)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87

Table 4. Testing for Long-run Co-integration; F statistic (con't)

Model 5: (Dependent variable: POV)			F-Statistic
F(AGDP, AMACH, NAGDP, POP, INFL, DE)			4.167
	Critical Values (K=6; n=34)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87
Model 6: (Dependent variable: POV)			F-Statistic
F(AGDP, EXC, NAGDP, POP, INFL, DE)			6.20
	Critical Values (K=6; n=34)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87
Model 7: (Dependent variable: POV)			F-Statistic
F(AGDP, AGDP×ACGSF, DE, INFL, NAGDP, POP)			4.29
	Critical Values (K=6; n=35)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.23	2.12
	5%	3.61	2.45
Model 8: (Dependent variable: POV)			F-Statistic
F(AGDP, AGDP×ACGSF, DE, INFL, NAGDP, POP)			8.54
	Critical Values (K=6; n=33)	Upper Bound I(1)	Lower Bound I(0)
	10%	2.87	1.75
	5%	3.24	2.04
Model 9: (Dependent variable: POV)			F-Statistic
F(AGDP, AGDP×AEXP, NAGDP, POP, INFL, DE)			4.83
	Critical Values (K=6; n=35)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87
Model 10: (Dependent variable: POV)			F-Statistic
F(AGDP, EXC, NAGDP, POP, INFL, DE)			4.76
	Critical Values (K=6; n=35)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87
Model 11: (Dependent variable: POV)			F-Statistic
F(AGDP, AGDP×AMACH, NAGDP, POP, INFL, DE)			12.12
	Critical Values (K=5; n=34)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.35	2.26
	5%	3.79	2.62

Table 4. Testing for Long-run Co-integration; F statistic (con't)

Model 12: (Dependent variable: POV)			F-Statistic
F(AGDP, AGDP×EXC, NAGDP, POP, INFL, DE)			5.52
	Critical Values (K=6; n=35)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87
Model 13: (Dependent variable: POV)			F-Statistic
F(AGDP, AGDP×XP, NAGDP, POP, INFL, DE)			5.51
	Critical Values (K=6; n=35)	Upper Bound I(1)	Lower Bound I(0)
	10%	3.59	2.53
	5%	4.00	2.87

Given co-integration, we obtained the long-run and short-run dynamic parameters for the variables.

4.1. Long Run Estimates

For the long-run dynamic, we estimate different versions of poverty equations, which are reported in Table 5 and Table 6. Table 5 contains long run estimations without interaction term (i.e., models 1-7). Table 6, on the other hand, shows the long-run estimates with interaction terms (i.e., models 8-13)[4].

In models 2, 4, and 7, the coefficients of export promotion schemes, namely ACGSF, AFDI, and composite export promotion index (XP), are negative and significant (i.e., models without interaction term). In models 3 and 4, export promotion policies, namely AEXP and EXC are positive but statistically significant only in model VI. The results obtained for models 2, 4, and 7 suggest that an increase in credit to the agricultural sector, foreign direct investment, and the combination of the export promotion policies leads to a reduction in the poverty level in the long run. For example, a 1 per cent increase in foreign direct investment flows to the agricultural sector will reduce the poverty by 3 percent. The corresponding percentages for government capital expenditure in the agricultural sector, a composite measure of export promotion, and agricultural credit guarantee scheme fund are 1.0, 0.277 and 0.058 per cent, respectively. However, the result obtained in model 6 shows that export promotion schemes, namely exchange rate liberalization, increases poverty in the long run. The depreciation of the local currency might have increased the prices of imported farm inputs and farmers' earnings.

[4] We have presented the results for multivariate models to avoid the problem omitted variable bias that is associated with bivariate analysis. This explains why the results for either of export promotion measures, agricultural output growth or interactive term alone have not been presented.

Table 5. Estimated Long- run Coefficients from the ARDL Models

Variable	1 (POV) ARDL(1,1,2,0,1,1)	2 (POV) ARDL(3,2,0,2,1,2,1)	3 (POV) ARDL(3,2,0,2,1,2,1)	4 (POV) ARDL(3,2,0,2,1,2,1)	5 (POV) ARDL(3,2,0,2,1,2,1)	6 (POV) ARDL(1,0,2,2,1,0,2)	7 (POV) ARDL(1,1,2,0,1,1,0)
ACGSF		-0.058*					
		(0.051)					
AEXP			0.002				
			(0.315)				
AFDI				-3.039***			
				(0.000)			
AGDP	-2.970***	-3.454***	-2.975***	-0.033	-2.574***	-0.303	-2.476***
	(0.000)	(0.000)	(0.000)	(0.797)	(0.000)	(0.636)	(0.003)
AMACH					-1.002		
					(0.263)		
DE	-0.177*	-0.073	-0.194**	-0.162	-0.209**	0.174***	-0.134
	(0.052)	(0.497)	(0.032)	(0.136)	(0.031)	(0.000)	(0.151)
EXC						0.001**	
						(0.011)	
INFL	0.002	0.002	0.002	0.002***	0.002	0.002***	0.0001
	(0.303)	(0.126)	(0.230)	(0.320)	(0.209)	(0.000)	(0.932)
NAGDP	2.285***	2.745***	2.283***	2.333***	1.954***	0.183	1.860***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.711)	(0.000)
POP	3.848	5.11**	-3.811**	-3.751*	5.253**	-4.105***	4.872***
	(0.041)	(0.049)	(0.034)	(0.057)	(0.029)	(0.005)	(0.001)
XP							-0.277*
							(0.084)

Notes: ***, **, * indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent level, respectively.

Table 6. Estimated Long-run Coefficients from the ARDL Models (Interaction Effects)

Variable	8 (POV) ARDL(4,1,2,3,1,1,1)	9 (POV) ARDL(1,1,1,2,0,1,1)	10 (POV) ARDL(1,1,0,2,0,1,1)	11 (POV) ARDL(1,2,2,2,0,1,1)	12 (POV) ARDL(1,2,2,2,0,1,1)	13 (POV) ARDL(2,2,2,1,2,2,1)
$AGDP$	-4.875***	-2.674	-2.645***	-4.244***	-2.426***	-2.714***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.004)	(0.000)
$AGDP \times ACGSF$	-0.368***					
	(0.001)					
$AGDP \times AEXP$		-0.087**				
		(0.011)				
$AGDP \times AFDI$			-0.154			
			(0.716)			
$AGDP \times AMACH$				-0.036**		
				(0.045)		
$AGDP \times EXC$					-0.008**	
					(0.045)	
$AGDP * XP$						-0.0006**
						(0.039)
DE	0.401***	-0.106	-0.069	0.247**	-0.095	0.06
	(0.000)	(0.221)	(0.565)	(0.037)	(0.312)	(0.260)
$INFL$	0.002	0.002	0.001	0.0003	0.002	0.002*
	(0.147)	(0.108)	(0.639)	(0.847)	(0.176)	(0.063)
$NAGDP$	3.669***	2.118***	2.058***	3.451***	1.932***	3.159
	(0.000)	(0.000)	(0.001)	(0.000)	(0.004)	(0.000)
POP	-0.766***	-3.932**	6.329***	3.195***	-2.937**	-2.741**
	(0.000)	(0.021)	(0.000)	(0.009)	(0.028)	(0.020)

Notes: ***, **, * indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent level, respectively.

The results reported in Tables 5 and 6 show that in almost all the models (with and without interaction term), the agricultural output growth variable is negative and statistically significant in the long run. It is only in models 4 and 6 that the coefficient of agricultural growth is not significant. Using model 1 as a lead, a 1 percent increase in agricultural output growth will reduce poverty by 2.97 per cent. The results suggest that an increase in agricultural output growth leads to a reduction in poverty in the long run.

The results of the interaction term reported in Table 6 (i.e., models 8-13) show that the interaction term is negative and statistically significant except in model 10, where the coefficient is insignificant. For example, a 1 per cent increase in the interaction of agricultural output growth and agricultural credit guarantee scheme fund leads to a 0.368 per cent reduction in poverty. The corresponding percentage for the interactive variable $(AGDP \times XP)$ is 0.0006. It shows that export promotion schemes and agricultural growth complement each other in reducing poverty in Nigeria, thus reflecting the rather impressive integration of export promotion policies into agricultural development initiatives in the economy.

Concerning development expenditure measured as government capital expenditure in the economy, the coefficient is negative in nine models, though significant only in models 1, 3, and 5. In contrast, the coefficient of development expenditure is positive and significant in models 6, 8, and 11. The finding of a positive effect of development expenditure is consistent with Fan, Hazell, and Thorat (1999).

The coefficient of inflation is positive in all the models (with and without interaction term) in the long run. However, the coefficient is only significant in models 6 and 13. This result suggests that inflation aggravates poverty in the country either through inflation tax that reduces disposable income or a reduction in real income engendered by an increase in prices of goods consumed by farmers and wage earners.

In all the models (with and without interaction term), the coefficient of non-agricultural output growth is positive and statistically significant. It is only in model 6 that the coefficient of non-agricultural output is not significant. This result suggests that poverty increases with an increase in non-agricultural production in the long run. This result is contrary to a priori expectation. However, the positive and significant long-run impact of non-agricultural production on poverty in Nigeria is understandable considering the enclave nature of the oil sector.

The result for population growth is mixed. The coefficient of the population is positive and significant in models 1, 2, 4, 7, 10 and 12, suggesting that increased population tends to exacerbate poverty in the long run. However, the coefficient of population shown in models 3, 4, 6, 8, 9, 12, and 13 is negative and significant. This result indicates that in the long run, population increase can help reduce the level of poverty using model 13 as the lead equation since our focus is on interactive term XP and $AGDP$.

4.2. Short Run Estimates

The short-run results for models with and without interaction terms are reported in tables 7 and 8, respectively. The short-run effects follow the same pattern as the long-run estimates. In all the models (without interaction terms), the coefficients of all the export promotion schemes and the composite export promotion index are negative but significant in model 2 (see Table 8). Using model 2 as a lead, a 1 per cent increase in the agricultural credit guarantee scheme fund leads to a 0.956 per cent reduction in poverty in the short run.

The results reported in Tables 8 and 9 show that the coefficient of agricultural output growth is negative and significant in seven models[5]. Using model 1 in table 8 as a lead, a 1 per cent increase in agricultural output growth leads to 0.498 per cent reduction in poverty in the short run. This result suggests that an increase in production leads to a decrease in poverty in the short run.

The short-run coefficient of the export promotion schemes that interacted with agricultural output growth is negative and significant in all the models except model 10. For example, a 1 per cent increase in the interaction in agricultural output growth and agricultural credit guarantee scheme fund ($AGDP \times ACGSF$) leads to a 0.155 per cent reduction in poverty in the short run. This result supports the finding in the long estimates.

In line with theoretical expectation, in almost all the models, the coefficient of development expenditure (DE) is negative and statistically significant in the short run. The result supports the position that increases government capital expenditure in the economy will help to reduce poverty in the short run. Inflation coefficient is positive in all the models (with and without interaction terms). This finding corroborates the evidence obtained in the long-run analysis. In the same way, the coefficient of non-agricultural output is positive in all the models (i.e., models 1-13). This result is consistent with the finding under the long-run model. The coefficient of population growth is positive and significant in all the models except model 5. This result shows that in the short run, population growth tends to aggravate poverty in Nigeria[6].

In all the estimated models, the coefficient of the error-correction term (ECM) is negative and statistically significant.

[5] The coefficient of agricultural output growth is not significant in models 3, 4, 5, 6 and 10 of tables 7 and 8.

[6] To verify whether the choice of poverty indicator used makes a difference in the outcomes, we found that results obtained with the one poverty indicator are more or less the same with that of composite index in signs. However, most of the coefficients are not significant compared with ones from composite measure of poverty. Asides, the CUSUMQ stability test for single indicator of poverty is unstable. Moreover, in terms of the magnitude of the coefficients, the results from the PCA generated index of poverty are higher. Hence, one can safely conclude that the PCA generated index of poverty is better than the single indicator of poverty.

Table 7. Estimated Short- run Coefficients from the ARDL Models

Variable	1 (POV) ARDL(1,1,2,0,1,1)	2 (POV) ARDL(3,2,0,2,1,2,1)	3 (POV) ARDL(3,2,0,2,1,2,1)	4 (POV) ARDL(3,2,0,2,1,2,1)	5 (POV) ARDL(3,2,0,2,1,2,1)	6 (POV) ARDL(1,0,2,2,1,0,2)	7 (POV) ARDL(1,1,2,0,1,1,0)
d($ACGSF$)		-0.956* (0.083)					
d($AEXP$)			-0.001 (0.329)				
d($AFDI$)				-0.019 (0.795)			
d($AGDP$)	-0.498** (0.021)	-0.039 (0.513)	-0.601 (0.149)	-0.512 (0.214)	-0.475 (0.232)	-0.213*** (0.004)	-0.216 (0.597)
d($AMACH$)					-0.609 (0.256)		
d(DE)	-0.124** (0.018)	-0.084 (0.163)	-0.139** (0.012)	-0.118** (0.045)	-0.106** (0.049)	-0.232*** (0.001)	-0.146** (0.012)
d(EXC)						0.00001 (0.973)	
d($INFL$)	0.001 (0.305)	0.002 (0.142)	0.001 (0.235)	0.001 (0.309)	0.001 (0.209)	0.003** (0.042)	0.0001 (0.933)
d($NAGDP$)	0.354 (0.244)	0.721* (0.093)	0.429 (0.174)	0.363 (0.246)	0.329 (0.276)	0.129 (0.716)	0.119 (0.700)
d(POP)	1.971*** (0.007)	3.181** (0.012)	1.955*** (0.007)	1.888** (0.014)	1.692*** (0.024)	-1.096 (0.328)	1.336* (0.089)
d(XP)							-0.161** (0.045)
ECM_{t-1}	-0.59*** (0.000)	-0.693*** (0.001)	-0.626*** (0.000)	-0.583*** (0.001)	-0.608*** (0.000)	-0.704*** (0.000)	-0.581*** (0.001)
Adj R-squared	0.995	0.994	0.995	0.994	0.995	0.997	0.994
DW-statistics	1.989	2.002	1.927	1.948	1.923	2.508	1.964
LM (χ^2) Version							
Serial Correlation	$\chi^2(2)$=6.79[.034]	$\chi^2(2)$=7.9[.019]	$\chi^2(2)$=25.05[.080]	$\chi^2(2)$= 6.47[.039]	$\chi^2(2)$= 7.072[.029]	$\chi^2(2)$= 4.293[.117]	$\chi^2(2)$= 5.99[.050]
Functional Form	$\chi^2(16)$= 1.43[.246]	$\chi^2(19)$=0.79[.435]	$\chi^2(20)$= 0.95[.353]	$\chi^2(20)$= 1.081[.292]	$\chi^2(20)$=0.097[.924]	$\chi^2(18)$=0.030[.976]	$\chi^2(21)$=0.379[.708]
Normality	$\chi^2(1)$= 23.85[.000]	$\chi^2(1)$= 20.1[.000]	$\chi^2(1)$= 17.89[.000]	$\chi^2(1)$= 23.25[.000]	$\chi^2(1)$= 14.97[.000]	$\chi^2(1)$= 1.130[.568]	$\chi^2(1)$= 25.17[.000]
Heterosked	$\chi^2(11)$=22.09[.024]	$\chi^2(13)$=24.48[.027]	$\chi^2(12)$=21.93[.038]	$\chi^2(12)$= 24.37[.018]	$\chi^2(16)$=25.61[.012]	$\chi^2(13)$=13.72[.394]	$\chi^2(11)$=24.57[.011]
F-Statistics							
Serial Correlation	F(2,15)=2.4[.116]	F(2,18)=2.63[.09]	F(2,19)=2.21[.137]	F(2,19)= 2.15[.142]	F(2,19)=7.58[.098]	F(2,17)=1.19[.329]	F(2,20)=2.07[.153]
Functional Form	F(1,7)=1.19[.246]	F(1,19)=0.64[.435]	F(1,20)=0.91[.353]	F(1,20)=1.17[.292]	F(1,20)=0.01[.923]	F(1,18)=0.001[.97]	F(1,21)=0.14[.708]
Normality	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Heterosked	F(11,23)=3.58[.01]	F(13,21)=3.7[.00]	F(12,22)=3.08[.01]	F(12,22)=4.20[.00]	F(12,22)=5.01[.00]	F(13,21)=1.04[.45]	F(11,23)=4.92[.00]

Notes: ***, **, * indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent level, respectively. The test for serial correlation is the LM test for autocorrelation, the test for functional form is Ramsey's RESET test, the test for normality is the test proposed by Bera and Jarque (1981), the test for heteroskedasticity is the LM test. Lag length is based on SBC.

Table 8. Estimated Short-run Coefficients from the ARDL Models (Interaction Effects)

Variable	8 (POV) ARDL(4,1,2,3,1,1,1)	9 (POV) ARDL(1,1,1,2,0,1,1)	10 (POV) ARDL(1,1,0,2,0,1,1)	11 (POV) ARDL(1,2,2,2,0,1,1)	12 (POV) ARDL(1,2,2,2,0,1,1)	13 (POV) ARDL(2,2,2,1,2,2,1)
$\mathrm{d}(AGDP)$	-1.467***	-0.518	-0.160	-4.349**	-0.176**	-1.370**
	(0.007)	(0.173)	(0.712)	(0.023)	(0.016)	(0.049)
$\mathrm{d}(AGDP \times ACGSF)$	-0.155**					
	(0.018)					
$\mathrm{d}(AGDP \times AEXP)$		-0.0006**				
		(0.046)				
$\mathrm{d}(AGDP \times AFDI)$			-0.083			
			(0.292)			
$\mathrm{d}(AGDP \times AMACH)$				-2.435*		
				(0.654)		
$\mathrm{d}(AGDP \times EXC)$					-0.030*	
					(0.052)	
$\mathrm{d}(AGDP \times XP)$						-0.0001**
						(0.028)
$\mathrm{d}(DE)$	0.080	-0.143**	-0.108*	0.071	-0.204***	-0.067
	(0.158)	(0.012)	(0.099)	(0.486)	(0.005)	(0.332)
$\mathrm{d}(INFL)$						
$\mathrm{d}(NAGDP)$	0.004**	0.002	0.0006	0.003	0.002	0.0009
	(0.002)	(0.107)	(0.636)	(0.151)	(0.211)	(0.496)
$\mathrm{d}(POP)$	0.004**	0.363	0.127	1.459**	0.465	1.298*
	(0.011)	(0.207)	(0.340)	(0.047)	(0.290)	(0.050)
ECM_{t-1}	2.601**	1.964***	1.482*	0.733***	3.117***	0.715***
	(0.023)	(0.005)	(0.086)	(0.007)	(0.003)	(0.000)
Adj R-squared	0.762	0.996	0.403	0.995	0.996	0.996
DW-statistics	2.643	1.903	1.854	2.199	2.554	2.336
LM (χ^2) Version						
Serial Correlation	$\chi^2(2)$= 9.185[.010]	$\chi^2(2)$= 2.809[.245]	$\chi^2(2)$= 4.169[.124]	$\chi^2(2)$= 3.113[.211]	$\chi^2(2)$= 5.654[.059]	$\chi^2(2)$= 2.004[.234]
Functional Form	$\chi^2(13)$= 0.495[.629]	$\chi^2(19)$= 0.512[.615]	$\chi^2(21)$= 1.37[.185]	$\chi^2(14)$= 2.557[.023]	$\chi^2(17)$=1.010[.327]	$\chi^2(14)$= 0.105[.918]
Normality	$\chi^2(1)$= 0.382[.826]	$\chi^2(1)$= 5.159[.076]	$\chi^2(1)$= 31.94[.000]	$\chi^2(1)$= 3.809[.149]	$\chi^2(1)$= 1.133[.567]	$\chi^2(1)$= 0.962[.618]
Heterosked	$\chi^2(20)$= 18.110[.448]	$\chi^2(13)$= 20.155[.091]	$\chi^2(11)$= 21.50[.029]	$\chi^2(17)$= 20.531[.248]	$\chi^2(15)$= 21.579[.119]	$\chi^2(17)$=27.246[.075]
F-Statistics						
Serial Correlation	F(2,12)=2.314[.141]	F(2,18)=0.785[.471]	F(2,20)=1.352[.281]	F(2,13)=0.635[.546]	F(2,16)= 1.541[.244]	F(2,13)= 0.589[.569]
Functional Form	F(1,13)= 245[.629]	F(1,19)= 0.262[.615]	F(1,21)= 1.877[.185]	F(1,14)= 6.536[.023]	F(1,17)= 1.021[.327]	F(1,27)= 0.011[.918]
Normality	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Heterosked	F(20,13)=0.946[.552]	F(13,21)=2.193[.052]	F(11,23)=3.331[.007]	F(17,17)=1.419[.239]	F(15,19)=2.037[.072]	F(18,16)=3.123[.013]

Notes: ***, **, * indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent level, respectively. The test for serial correlation is the LM test for autocorrelation, the test for functional form is Ramsey's RESET test, the test for normality is the test proposed by Bera and Jarque (1981), the test for heteroskedasticity is the LM test. Lag length is based on SBC.

The magnitude of the estimate of the error-correction term suggests a very high speed of adjustment from short-run disequilibrium. Indeed, as shown in model 13 of Table 7, the error coefficient term is -1.497, which implies that instead of monotonically converging to equilibrium path directly, the error-correction fluctuates around the long-run value in a dampening manner. However, once the process is complete, convergence to the equilibrium path is rapid. The estimated models passed all the diagnostic tests. There is much evidence in support of Ramsey's RESET test, which suggests that the estimated models are well specified. On the stability of the estimated coefficients, the results of the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMQ) for the estimated models indicate that the parameters of the models are highly stable over the sample period. The plots of the CUSUM and CUSUMQ statistic fall within the critical bounds at 5% confidence interval of the parameter[7].

5. CONCLUSION

The paper explores the interactive effects of export promotion schemes and agricultural output growth on poverty in Nigeria from the period 1980-2016. Using the ARDL bound testing approach to co-integration; the results confirm long-run relationship between agricultural output growth, export promotion policies and poverty reduction. The results show that agricultural output growth and export promotion individually has a positive impact on poverty reduction. Moreover, the interaction of the export promotion policies and agricultural output growth helps in reducing poverty. This simply means that the policies of export promotion and agricultural output growth are complements in poverty reduction in the country.

In addition, the results show that increased foreign investment inflows into the agricultural sector coupled with increased credit through the agricultural credit guarantee scheme fund would help to reduce poverty in the country. Massive exchange rate depreciation leads to increased poverty, especially in the long run. Finally, non-agricultural output growth, inflation, and population increase poverty level both in the short and long run. This finding supports the tenets that the export promotion poverty-reduction effect is more visible in an agricultural output growth environment.

What policy inferences can we draw from these results? First, the policies of export promotion and agricultural output growth, if properly integrated and pursue together, will assist in poverty in Nigeria. Second, policymakers should enhance the value of the domestic currency through improved productivity growth in the agricultural and non-agricultural sectors. Third, government should ensure that more foreign direct investments flow to agricultural sector. More foreign direct investments into agricultural sector will lead to increased income and productivity, with a possible positive effect on

[7] The graphs of the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMQ) for the models are not reported here to conserve space.

poverty. Finally, policymakers should formulate and implement policies to reduce the rate of inflation and ensure that government capital investment in the agricultural sector is correctly managed with corruption appropriately tackled.

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